Information Management and Business Review (ISSN 2220-3796)
Vol. 16, No. 3(S), pp. 551-561, Sep 2024

Revisiting Okun's Law: Evidence from Malaysia

Syahira Nasir, *Salwaty Jamaludin, Sharul Shahida Shakrein Safian, Nazurah Abdul Malek, Muhammad Ridzuan Abdul Aziz
Faculty of Business and Management, UiTM Cawangan Selangor, Kampus Puncak Alam, Selangor, Malaysia
syahiranasir123@gmail.com, *salwatyjamaludin@uitm.edu.my, sharulshahida@uitm.edu.my, nazurah.malek@uitm.edu.my, ridzuandba@uitm.edu.my
Corresponding Author: Salwaty Jamaludin

Abstract: Okun's Law explains an inverse relationship between unemployment and GDP. To re-examine the validity of Okun's Law to the Malaysian economy through the period of 1988 until 2021, this paper employed the Ordinary Least Squares (OLS) approach with several diagnostic tests. The findings indicate that there is a significant relationship between GDP and unemployment. The control variables - population, inflation rate, and FDI also significantly affect unemployment. While the country's GDP and inflation rate have a negative relationship with unemployment, population and FDI have a positive relationship with unemployment in Malaysia. Therefore, Okun's Law is valid in the case of Malaysia.

Keywords: *Okun's Law, unemployment, gross domestic products, inflation, population, FDI*

1. Introduction and Background

In Malaysia, the unemployment rate was around 3.3% for the last decade, however, due to the pandemic Covid-19, it surged to 5.3% in May 2020 coinciding with the government's imposition of restriction orders, and then plateaued at 4.6% for the subsequent months. This uptick in unemployment was attributed to employers' struggles to sustain their businesses. Tan Sri Noh Omar, the former Minister of Entrepreneur Development and Cooperatives, noted that with the introduction of Movement Control Order 3.0 (MCO 3.0) in May 2021, around 37,415 enterprises shut down (as reported by the New Straits Times, 2021). The unemployment rate saw a significant rise due to layoffs and the inability of individuals to access the formal job market amid the pandemic. The continued high unemployment, especially for graduates and youth unemployment in Malaysia has given rise to a discussion of the reasons for this persistence of unemployment over the years. According to Department of Statistics Malaysia data, the percentage of unemployed graduates in 2000 was less than 10% of the total unemployment rate. This ratio increased to over 40% in just 20 years. In addition, in the same year, the youth unemployment rate was as high as 10%. The COVID-19 pandemic has made things worse for young people who are looking for work because they now must compete with people who have lost their jobs to get back into the formal job market which led to a higher unemployment rate.

From the supply side, there are several reasons why they are unable to enter the formal labor market. One of the factors is the assertion made by job seekers that there are no suitable positions available in the market. (Jamaludin et al, 2021). However, in the market, there are millions of job vacancies available. Table 1 shows the distribution of job vacancies based on occupation in the recent years, 2000-2021. Elementary Occupations, categorized as low-skilled jobs, constitute 25% of all job openings, while Clerical support workers, Service & sales workers, Skilled agricultural, forestry, livestock & fisheries workers, Craft & related trades workers, and Plant & machine operators and assemblers which categorized as middle-skilled jobs make up 40-44% of the total job openings. The unbalanced distribution of job vacancies might contribute to the issue of unemployment, which sends signals of a mismatch in the labor market in Malaysia (Said et al., 2021).

Unemployment or mismatch is a problem that shouldn't be disregarded as it may inhibit long-term economic development and productivity. One way to explain this would be through resource allocation, as resource allocation may be a factor in why some nations are more productive than others (Bartelsman, Haltiwanger, & Scarpetta, 2013; Hsieh & Klenow, 2009). The buildup of human and physical capital is negatively impacted by resource misallocation when the labor market is unable to absorb workers and offer employment opportunities (Zulkiply, 2017). The underutilization of the country's human resources and the potential for low labor productivity are caused by these situations (Mukoyama & Sahin, 2009).

Table 1: Job vacancies by group of occupation 2020 and 2021

Types of skills	Group of occupation	2020	2021
High-skilled	Managers	35964	97700
	Professionals	110175	457153
	Technicians & associate professionals	89954	298578
Middle-skilled	Clerical support workers	55985	180164
	Service & sales workers	135058	395450
	Skilled agricultural, forestry, livestock & fisheries workers	3846	8270
	Craft & related trades workers	49426	176050
	Plant & machine operators and assemblers	81418	220626
Low-skilled	Elementary occupations	183478	646586
Total		745304	2480577

Source: Social Security Organization (SOCSO) & Ministry of Human Resource Malaysia (MOHR)

Specifically, it can be explained in terms of Okun's Law. Okun's Law is an economic concept that describes the inverse relationship between changes in Gross Domestic Product (GDP) growth and changes in unemployment. The law was first proposed by economist Arthur Melvin Okun in 1962. The theory emphasizes the economic concept that if unemployment falls by 1%, GDP rises by 3% (Okun, 1962). When the economy is growing and hiring more people, unemployment tends to decline when it is at or over its potential. On the other hand, the output gap grows during recessions and downturns in the economy, which raises unemployment rates.

Thus, the primary focus of this study is to revisit Okun's Law or the correlation between unemployment and GDP in Malaysia. To broaden the inquiry, other macroeconomic variables including inflation, population, and foreign direct investment will be examined for the regression.

2. Literature Review

Theoretical Review

Okun's Law

A notion in economics known as Okun's Law states that changes in unemployment and changes in GDP growth have an inverse connection. Economist Arthur Melvin Okun first proposed the law in 1962. When the economy is growing and hiring more people, unemployment tends to decline when it is at or over its potential. On the other hand, the output gap grows during recessions and downturns in the economy, which raises unemployment rates. Although the precise strength of this relationship may vary between economies and historical periods, economists have generally observed a consistent association over time between changes in the unemployment rate and changes in real GDP growth.

Okun's Law states that a 1% increase in the unemployment rate is usually correlated with a 2-3% decline in GDP (Okun, 1962). Recent data indicates that to lower the unemployment rate by 1% over a given year, the real GDP must grow by 2% more than the potential real GDP. The unemployment rate will drop by 1%, for instance, if the real GDP growth rate is 4% and the potential GDP growth rate is 2% (Md Kamrul I, 2021; Louail, 2021; Dunsch, 2016). The law has been thoroughly examined, and although it is true in most situations, there are several exceptions to the rule. For instance, the 2008 financial crisis demonstrated that the law was untrue. Despite clarifying the relationship between unemployment and economic growth, Okun's Law has several drawbacks. First of all, as a general rule, it is untrustworthy since the relationship it portrays isn't always stable.

Second, there are different versions of the Law, and choosing the correct one can have a big impact on how accurate it is. Unanticipated factors like labor hours and capacity utilization can skew the results. Important ideas like the natural unemployment rate and potential GDP are also difficult to quantify, which makes them difficult to understand and use. Finally, the accuracy of its depiction of the employment-productivity link has been questioned by certain economists. These drawbacks emphasize the necessity of exercising caution when applying Okun's Law and underscore the significance of taking other variables into account for thorough

economic research. Notwithstanding its shortcomings, Okun's Law is nevertheless a helpful resource for companies and policymakers to comprehend the connection between unemployment and economic growth. Using the law has allowed for the development of successful plans to combat unemployment and foster economic expansion.

Philips Curve

Philips Curve which was founded by A. W. Phillips represents a theory on an inverse relationship between unemployment and inflation rate in the economy. Labor demand and supply is a notion that helps explain the fundamental theoretical underpinnings of the Phillips Curve. A surplus of labor demand can drive up wage rates, leading to high inflation in the nation. The unemployment rate would stay low in this scenario, and it would be simple for people to obtain employment. On the other hand, if there is a labor supply excess over demand, wages would decline, and the nation's inflation rate would decrease. At the same time, workers would find it difficult to find jobs due to the oversupply of labor, and unemployment would be quite high (Furuoka and Munir, 2014). However, Friedman (1977) criticized the theory and claimed that there is no trade-off between unemployment and inflation. In response to Friedman's contention, Greenwood and Huffman (1988) carried out research by building a stochastic general equilibrium model to investigate the covariance characteristics between unemployment and inflation depending on the conditional and unconditional state of exogenous real and monetary factors. The outcome validates the Phillips Curve theory, which holds that there is a negative correlation between unemployment and inflation.

Empirical Review

Unemployment and GDP

Economic theory and empirical study have proven a strong correlation between GDP and unemployment. In general, unemployment falls when GDP rises, and vice versa. Chand (2017) did a study in India to quantify the country's unemployment situation and discovered a strong negative correlation between the jobless rate and economic growth. Using information from secondary sources like the World Bank, researchers have used regression and correlation analysis to look at the kind and degree of effects that economic growth has on the unemployment rate.

Ellen and Abeti's (2019) recent study looked at the relationship between unemployment and economic development in the Chinese economy from 1991 to 2018. After applying the ARDL limits test to cointegration, the empirical results demonstrated that the relationship between unemployment and economic growth was negative in both the short and long terms. The Granger causality data indicated that the two components had no causal relationship. Bal-Domańska (2022) studied the impact of macroeconomics on unemployment on gender and confirmed the inverse relationship between GDP and unemployment in 28 European Union (EU) countries. Kalinová and Kroutlová (2023) provide evidence for this inverse relationship, which verifies the direct correlation between GDP and the overall unemployment rate in the Moravian-Silesian Region of the Czech Republic. Meanwhile, another study by Rhee (2018) and Jo et al. (2023) found that GDP growth has a significant negative effect on unemployment in Korea, confirming Okun's Law.

Some research has been done to test the validity of Okun's Law during Covid-19. An et al. (2022) stated that according to official statistics, Covid-19 caused a break in Okun's law in every region of Spain. With the help of the temporary layoff procedures (ERTE), many employees were able to keep their employment. From a productive perspective, the law persisted in the affected regions, demonstrating a robust correlation between untapped labor resources and economic activity. Al-kasasbeh (2022) demonstrates the presence of Okun's law in the Jordanian economy, showing that a 1% decline in GDP is associated with a 0.276% rise in the unemployment rate. Based on these empirical findings, several policy suggestions are developed to attract more foreign direct investment (FDI), which is necessary to reduce the high unemployment rate in the nation.

In a study in Malaysia Liyana and Masih (2018) confirmed that GDP is comparatively more endogenous or lagging while the unemployment variable is comparatively more exogenous or leading. These findings have obvious policy ramifications in that the Government's proactive policy to lower the jobless rate, at least in Malaysia, can help promote economic growth to achieve a sustained increase in living standards. Numerous studies have been carried out on the relationship between unemployment and economic growth, but their

findings have produced mixed results, leading some experts to attribute their findings to unrelated factors. Thus, to understand the effect that unemployment has on the expansion of the contemporary Malaysian economy and to contribute to the corpus of literature, a study of this nature must be carried out.

Unemployment and inflation

The inflation rate contributes to unemployment through the inverse relationship described by the Phillips Curve, which suggests that a lower unemployment rate can be maintained indefinitely if a higher inflation rate can be tolerated (Freund & Rendahl, 2020). However, the relationship between inflation and unemployment is more complex than it appears at first glance, and it has broken down on several occasions over the past 50 years. Study in the USA, Qin (2020) reported the existence of unidirectional Granger causality from unemployment to inflation, which demonstrates that the regulation of unemployment contributes to the control of inflation. In a study published in the same year, Korkmaz and Abdullazade (2020) examined the correlation between the unemployment rate and the inflation rate in nine G6 nations—Australia, Brazil, Canada, France, Germany, Italy, the Russian Federation, Turkey, and the United Kingdom—and discovered a unidirectional Granger causal relationship between the two variables.

Furuoka and Munir (2014), who carried out a study in Malaysia, verified the relationship. They supported the validity of the Phillips Curve relationship by using the Error Correction Model to find an equilibrium relationship between Malaysia's inflation and unemployment rates. Recently, Naqibullah (2020) found statistics significantly verified the long-term inverse causative association, running from unemployment to inflation. However, the study revealed no association between unemployment and inflation in the short term. The response of fiscal and monetary policy to shocks and imbalances in the economy can also affect the short-term link between inflation and unemployment. In addition, Michael and Geetha (2020) in their recent research show that there is a negative correlation between youth unemployment with GDP and inflation. In the meantime, FDI and youth unemployment have a favorable correlation. A thriving economy may encourage entrepreneurship and creativity by giving young people the chance to launch their own companies or take part in creative endeavors that employ both themselves and others.

Unemployment and population

The population can affect unemployment rates through variations in terms of education and demography. For instance, a European study from Dvouletý et al., (2020) that examined the impacts of demographic and educational changes on unemployment rates discovered that shifts in the population's age distribution and educational attainment have a major influence on unemployment rates. Another study conducted by Doon (2021) found that defining unemployment in developing countries requires a focus on individual labor market behavior and demographic characteristics. Both studies have significance in comprehending the connection between unemployment rates and population.

In a study in Malaysia, Ramli (2018) confirmed that population was a significant factor in unemployment. This finding has been agreed by the study of Pillay and En (2021) who also found a significant relationship between population growth and unemployment in Malaysia. Indeed, Baba and Ali (2021) revealed the presence of short-run and long-run causality among the unemployment and population. Growing populations can put pressure on the labor market because they can't be employed at the rate the economy can produce. Rapid population expansion is also contributing to Malaysia's present mismatch problem.

Unemployment and FDI

Foreign Direct Investment (FDI) can have both positive and negative effects on unemployment rates, depending on the type of investment and the economic conditions of the host country. Alalawneh and Nessa (2020) found that FDI can lead to job creation and lower unemployment rates. This finding is also consistent with Kokotovic & Kurecic (2022) who examined the impact of FDI on foreign capital flows. The impact of FDI on unemployment rates is complex and can be influenced by various factors, including the type of investment, the economic conditions of the host country, and the labor market regulations. Understanding the relationship between FDI and unemployment is crucial for policymakers and businesses to develop effective strategies to address unemployment and promote economic growth. Recently, Ishchenko et al., (2023) conducted a study in Europe and found that only efficiency-oriented FDI of industries and services can result in net unemployment in investing economies.

In the meantime, a 2016 study conducted in Malaysia by Muhd Irpan discovered that foreign direct investment significantly affects the country's unemployment rate. Their research focuses on the impact of FDI on Malaysia's employment rate while controlling for other variables. They employed yearly data spanning from 1980 until 2012. The autoregressive distributed lag (ARDL) model is used to determine the long-term relationship between the variables. It is significant how foreign direct investment (FDI) affects unemployment in Malaysia. This emphasizes how important it is to foster long-term investment inflows, support workforce participation and skill development, and implement inclusive growth strategies to fully realize the potential of FDI to drive economic growth and reduce unemployment rates in the country.

3. Research Methodology

Sources of Data

This study aims to examine the relationship between macroeconomic parameters in Malaysia, including unemployment, GDP, inflation, population, and FDI by employing secondary data from the Department of Statistics Malaysia (DOSM) and the World Bank Data for the long period from 1988 to 2021.

The variables of this study were determined by following the research done by Mohd Azhar (2021) and Chen (2017). The first variable is unemployment (UR), proxy by the total number of people in the labor market who are actively looking for work but are having difficulty finding positions that suit them in Malaysia. The entire labor force is used as the unit of measurement (million). GDP, or gross domestic product, is a proxy by proportion of GDP per capita. It is a monetary representation of the entire amount of goods and services produced inside a nation's boundaries over a given time frame, usually a quarter or a year.

This study has also included the inflation rate (IR) that is proxied by the Consumer Price Index (CPI) which is a measure of the percentage change in the average level of prices for goods and services in an economy over a given time frame. Next is population (POP) which is the total number of people living in a specified geographic area, such as a nation, region, city, or community, either at a given time or over a predetermined period. All people who are counted inside the area's defined limits, regardless of their age, gender, ethnicity, or socioeconomic status, are included. It is expressed in terms of the total number of Malaysian residents (million). Foreign Direct Investment (FDI) is another variable, proxy by percentage of net inflows. It describes the financial commitment that a corporation or individual from one nation makes to support ventures in another.

Model specification

The econometric model is as follows. The ordinary least squares (OLS) were used to regress the model to capture the relationship between the independent variable towards the dependent variables. By employing the OLS, it offers an accurate linearly biased estimator.

$$UMP = \beta_0 + \beta_1 GDP + \beta_2 INF + \beta_3 POP + \beta_4 FDI + \mu$$

Where;

UMP	= Unemployment (million)
GDP	= Gross Domestic Product per capita (%)
INF	= Inflation rate (%)
POP	= Population (million)
FDI	= Foreign Direct Investment (million)
$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$	= Coefficient
μ	= Error term

Diagnostic test:

Diagnostic tests are techniques used to assess the validity and reliability of a regression model and identify any potential problems or unmet assumptions. These tests help to verify that the regression model is appropriate for the provided data and that the results' interpretation may be relied upon. By performing these diagnostic tests, researchers can assess the robustness of their regression model and identify any potential issues that need to be addressed, such as data translation, changes to the model specification, or the elimination of notable

outliers. This improves the reliability and validity of the results of the regression analysis. Among the tests are normality test, autocorrelation test, serial correlation test, heteroscedasticity test, and multicollinearity test.

4. Results

Based on the results of data regression using the OLS results obtained all the independent variables have a substantial effect on Malaysia's unemployment rate. Referring to the regression result, an R^2 value of 0.962, or 96.2%, indicates that the independent variables in the regression model are significant in explaining the dependent variable. It also reflects a strong relationship between the independent and dependent variables in the regression model.

Dependent Variable: UMP Method: Least Squares Date: 02/17/24 Time: 15:49
Sample: 1988 2021
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30.24399	12.75443	2.371253	0.0246
POP	1.387150	0.558119	2.485399	0.0190
GDP	-0.586382	0.215127	-2.725745	0.0108
INF	-6.830431	2.708168	-2.522159	0.0174
FDI	1.229900	0.050416	24.39498	0.0000

R-squared	0.961739	Mean dependent var	1.381715
Adjusted R-squared	0.956461	S.D. dependent var	0.861343
S.E. of regression	0.179728	Akaike info criterion	-0.459695
Sum squared resid	0.936759	Schwarz criterion	-0.235230
Log-likelihood	12.81481	Hannan-Quinn criteria.	-0.383146
F-statistic	182.2356	Durbin-Watson stat	1.631518
Prob(F-statistic)	0.000000		

The result of regression is as follows:

UMP = 30.24 + – 0.58GDP – 6.83INF + 1.39POP+1.23FDI

All the variables significantly affect unemployment. In terms of GDP, there is an inverse relationship between unemployment and GDP, which is consistent with Okun's Law. As shown by the regression analysis, an increase in GDP per capita of 1% corresponds to a 0.58 million drop in unemployment in Malaysia. This relationship is also consistent with Liyana and Masih (2018) and Baba & Abang Ali (2021). A rising GDP frequently corresponds with higher consumer confidence and expenditure, which stimulate the economy and generate employment chances. Increased consumer expenditure may result in higher output and, therefore, a demand for additional labor. Apart from that, fiscal and monetary policies, as well as other government initiatives that promote economic growth, can have a favorable effect on GDP and help reduce unemployment. Fiscal measures like tax relief or infrastructure spending, for instance, can stimulate the economy and create jobs. The dynamics of the labor market may also be the reason for the inverse association. In times of economic optimism, firms may increase the number of employees to accommodate increased demand for their products and services. Consequently, hiring chances typically increase in sectors of the economy that are growing, which lowers unemployment rates.

The relationship between unemployment and inflation is also consistent with the Philip Curve theory and other studies (Furuoka and Munir, 2014; Daniel et al., 2021). A 1% increase in inflation will result in a 6.83 million reduction in Malaysia's overall unemployment. Cost-push inflation or a spike in production costs resulting from factors such as rising salaries or raw material prices could cause firms to pass those costs on to consumers in the form of higher prices for goods and services. Businesses may reduce employment and production if costs rise, which would raise unemployment. The COVID-19 epidemic also had a significant impact on inflation and unemployment in Malaysia. Since the start of the outbreak, there has been a sharp decline in demand for goods

and services because of widespread lockdowns, transportation limitations, and economic hardships, which have also significantly reduced employment losses in several industries.

In terms of population, regression analysis reveals that population has a major and positive impact on unemployment. An increase of 1 million of population will increase 1.39 million of unemployment in Malaysia. This result is aligned with the previous study done by Ali (2021), Afolabi and Olayinka Bobola (2020), and Ramli et al. (2018). All these academics concurred that rising rates of unemployment follow population increases. Rapid population expansion can outstrip the rate at which jobs are created in developing nations. Higher unemployment rates could be the outcome of the economy's inability to produce enough job opportunities to accommodate the growing number of individuals joining the labor market. Innovations in technology and automation have the potential to create or destroy jobs.

However, the percentage of the population 65 years and older (old age) increased from 7.2% in 2022 to 7.4% in 2023, encompassing 2.5 million individuals, according to the most recent projections from DOSM. This suggests that Malaysia is witnessing a population aging process. The aging population in Malaysia will affect unemployment. For instance, when older people depart from the workforce, an aging population usually results in a fall in the labor force participation rate. It can lead to a declining workforce and possible labor shortages in some industries if the decline in older workers' engagement in the labor force is not compensated by an increase in younger workers' participation. Furthermore, older workers may find it difficult to keep up with technological advancements and acquire the new skills that changing industries require, which could result in structural unemployment in some age groups.

Next, in terms of FDI, the findings showed a positive correlation between FDI and unemployment, with an increase in FDI of 1 million corresponding to a rise in unemployment overall in Malaysia of 1.23 million. This result is consistent with Muhd Irpan et al. (2016), however contradicts Karimov (2020) and Alkofahi (2020). They noted in their study that FDI can lower unemployment. The country's current economic circumstances may be the cause of the discrepancy in the results. In the case of Malaysia, the introduction of automation and cutting-edge technologies by foreign investors may result in the replacement of physical labor. Machines or automated processes may replace jobs that were formerly performed by many workers, which could cause those workers to lose their jobs (Tan, 2022).

Diagnostic test

Below are the diagnostic tests that have been performed which are normality, autocorrelation, serial correlation and heteroscedasticity:

Table 2: Diagnostic test

Test	Result	Remark
Normality	0.3915	P value > 0.05. Passed.
Autocorrelation	1.6315	P value is between 2 to 4 which indicates that this model has negative autocorrelation. Passed.
Serial correlation	0.1964	P value > 0.05. Passed.
Heteroscedasticity	0.1754	P value > 0.05. Passed.

We discovered that the model passed every test once it was put through its paces. This improves the validity of the model and regression coefficients by demonstrating that the residuals are regularly distributed. We also observed that the temporal dependencies in the data were well-represented by the model.

5. Conclusion and Recommendations

To wrap up, this paper examines the intricate nexus between macroeconomic factors including GDP, Inflation, Population, and FDI and how this affects unemployment in Malaysia. The findings indicate that all factors significantly affect unemployment. Both GDP and inflation had a negative correlation with unemployment, which confirms Okun's Law and Philips Curve theory. Population and FDI, on the other hand, both had a positive correlation with unemployment. To create policies that can effectively reduce unemployment and promote

economic resilience, it is essential to recognize the dynamic nature of the relationships between population dynamics, inflation, GDP per capita, FDI, and unemployment.

Governments may focus on infrastructure projects priority to boost both employment and the economy, such as infrastructure investments related to energy, transportation, and technology. They can encourage investments in less developed regions to create jobs and decrease migration to urban centres, as well as balanced regional development to lessen the concentration of economic activity in particular places. For instance, job seekers in the four states of Pahang, Kelantan, Terengganu, and Selangor may find it easier to use the East Coast Rail Project (ECRL). Additionally, this can help the local economy and tourism industry. It will also, inadvertently, create job possibilities for locals. Since there are a large number of East Coasters who move to Kuala Lumpur and Selangor to find employment, thus such investments can lessen the concentration of economic activity in particular regions. Future studies could be improved by incorporating additional control factors, such as technology and R&D, and examining how they affect unemployment through the use of alternative economic methods, like ARDL and others.

References

An, Z., Bluedorn, J., & Ciminelli, G. (2022). Okun's law, development, and demographics: Differences in the cyclical sensitivities of unemployment across economy and worker groups. *Applied Economics*, *54*(36), 4227-4239.

Afolabi, B., and Olayinka Bobola, A. (2020). Population growth and unemployment in Nigeria. *Journal of Economics and Sustainable Development, 11*(2020), 2, 98-106.

Al-kasasbeh, O. (2022). The relationship between unemployment and economic growth: is Okun's Law valid for the Jordan case? *International Journal of Economics Development Research (IJEDR), 3*(3), 217-226.

Alalawneh, M., & Nessa, A. (2020). The impact of foreign direct investment on unemployment: Panel data approach.

Ali, O., Omar, M., and Yusuf, S. (2021). Population growth and unemployment in Zanzibar. *International Journal of Sciences: Basic and Applied Research, 59*(2), 36-47.

Baba, J. F., & Abang Ali, D. H. (2021). Economic Determinants of Unemployment in Malaysia: Short–and Long–Run Causality. *Journal of Public Administration and Governance, 11*(1), 251 - 272.

Bal-Domańska, B. (2022). The impact of macroeconomic and structural factors on the unemployment of young women and men. *Economic Change and Restructuring, 55*(2), 1141-1172.

Bartelsman, E., Haltiwanger, J., & Scarpetta, S. (2013). Cross-country differences in productivity: The role of allocation and selection. *American Economic Review, 103*(1), 305-34.

Chand, A., 2017. MG316: Comparative Employment and Industrial Relations: Coursebook. Suva: The University of the South Pacific

Chen, L. X., Chew, Y. B., Lim, R. L. H., Tan, W. Y., & Twe, K. Y. (2017). *Macroeconomic factors affecting the unemployment rate in China* (Doctoral dissertation, UTAR).

Daniel, S.U., Israel, V.C., Chidubem, C.B., and Quansah, J. (2021). Relationship between inflation and unemployment: Testing Philips curve hypotheses and investigating the causes of inflation and unemployment in Nigeria. *Path of Science, 7*(9), 1013-1027.

Doon, R. (2021). Overeducation in Trinidad and Tobago's Labor Market: A Quantile Regression Approach (No. 822). GLO Discussion Paper.

Dvouletý, O., Lukeš, M., & Vancea, M. (2020). Individual-level and family background determinants of young adults' unemployment in Europe. *Empirica, 47*(2), 389-409.

Dunsch Sophie (2016), Okun's Law and Youth Unemployment in Germany and Poland. *International Journal of Management and Economics*, 34–57.

Ellen, K. A., & Abeti, W. (2019). The impact of unemployment on economic growth in China. MPRA Paper, 96100, University Library of Munich, Germany, Available at: https://mpra.ub.uni-muenchen.de/96100/

Friedman, M. (1977). Nobel lecture: inflation and unemployment. *Journal of Political Economy, 85(*3). 451-472.

Freund, L., & Rendahl, P. (2020). Unexpected effects: uncertainty, unemployment, and inflation.

Furuoka, F. and Munir, Q. (2014). Unemployment and inflation in Malaysia: Evidence from error correction model. *Malaysian Journal of Business and Economics, 1*(1), 35-45.

Hsieh, C. T., & Klenow, P. J. (2009). Misallocation and manufacturing of TFP in China and India. *The Quarterly journal of economics, 124*(4), 1403-1448.

Greenwood, J., & Huffman, G. W. (1988). On modelling the natural rate of unemployment with indivisible labor. *Canadian Journal of Economics*, 587-609.

Ishchenko, M., Adamovska, V., & Porosla, P. (2023). Management and evaluation of investments as a component of the economic security of the state with the use of accounting and analytical support, statistical methods and marketing research. *Economics, Finance and Management Review,* (1), 115-142.

Jamaludin, S.; Said, R.; Ismail, N.W.; Nor, N.M. (2021). Are Jobs Available in the Market? A Perspective from the Supply Side. *Sustainability, 13*, 1973, 1-17. https://doi.org/10.3390/su13041973

Jo, C., Kim, D. H., & Lee, J. W. (2023). Forecasting unemployment and employment: A system dynamics approach. *Technological Forecasting and Social Change*, 194, 122715.

Kalinová, E., & Kroutlová, K. (2023). The relationship between unemployment and macroeconomic indicators. *In SHS Web of Conferences (Vol. 160).* EDP Sciences.

Karimov, M., Parádi-Dolgos, A., & Koroseczne Pavlin, R. (2020), An Empirical Analysis of the Relationship between Foreign Direct Investment and Unemployment Rate: Evidence from Turkey. *European Research Studies Journal, 23*(1), 453-464.

Kokotovic, F., & Kurecic, P. (2022). Examining The Impact of Foreign Capital Flows on Different Types of Unemployment in Small Open Economies: A Regression Analysis Of Croatia And The Czech Republic. *Economic And Social Development: Book of Proceedings*, 9-19.

Korkmaz, S. and Abdullazade, M. (2020). The causal relationship between unemployment and inflation in G6 countries. *Advances in Economics and Business, 8*(5), 303-309. DOI:10.13189/aeb.2020.080505

Liyana, A. and Masih, M. (2018), Does the unemployment rate lead to GDP growth or the other way around? Malaysia's case, INCEIF, Malaysia, Business School, Universiti of Kuala Lumpur.

Louail, B. (2021), Relationship between Economic Growth and Unemployment Rates in the Algerian Economy: Application of Okun's Law during 1991–2019. *Organizations and Markets in Emerging Economics, 12*, 1(23), 71–85.

Md Kamrul, I. (2021), Relationship between Economic Growth and Unemployment; Measuring Okun‟s Coefficient for Bangladesh. *International Journal of Research and Innovation in Social Science (IJRISS), 5*(8), 628-635.

Michael, E., & Geetha, C. (2020). Macroeconomic factors that affect youth unemployment in Malaysia. *Malaysian Journal of Business and Economics (MJBE), 7*(2), 181-181.

Mohd Azhar, A. A. and Ibrahim, N. A. (2021), Factors Affecting Unemployment Rate in Malaysia. *E-Prosiding Seminar Antarabangsa Islam dan Sains*, 670 – 679.

Muhd Irpan, H., Mat Saad, R., Md Nor, A. H. S., Md Noor, A. H., and Ibrahim, N. (2016), Impact of Foreign Direct Investment on The Unemployment Rate In Malaysia. *Journal of Physics: Conference Series 710*.

Mukoyama, T., & Şahin, A. (2009). Why did the average duration of unemployment become so much longer? *Journal of Monetary Economics, 56*(2), 200-209.

Naqibullah, H., Rahmatullah, P., Zmarai, M., Safiullah, S., and Ahad, Z.A. (2020). The long-run determinant of inflation in Malaysia: A Philips curve review. *European Journal of Molecular & Clinical Medicine, 7*(11), 4549-4563.

New Straits Times. (2021). 37,415 MSMEs closed during MCO 3.0. https://www.nst.com.my/news/nation/2021/09/731825/37415-msmes-closed-during-mco-30#google_vignette.

Okun, A. (1962). Potential GNP: its measurement and significance. In: *Proceedings of the business and economics statistics*. American Statistical Association, Washington, DC, pp 98-104.

Pillay, K.G. and En, T.B. (2021). prediction of the unemployment rate in Malaysia based on macroeconomic factors. *Enhanced Knowledge in Sciences and Technology, 1*(2), 30-39.

Qin, Y. (2020). The relationship between unemployment and inflation - evidence from U.S. economy. *Advances in Economics, Business and Management Research, 59*, 157162.

Ramli, S.F., Firdaus, M., Uzair, H., Khairi, M., and Zharif, A. (2018). Prediction of the unemployment rate in Malaysia. *International Journal of Modern Trends in Social Sciences, 1*(4), 38-44.

Rhee, H.J. (2018). Economic growth and unemployment in Korea implemented by Okun's Law: an application of differenced and modified models. *Asia Pac. J Multimed. Serv. Converg. Art Humanit. Sociol., 8*(5), 63-74. 10.21742/AJMAHS.2018.05.42

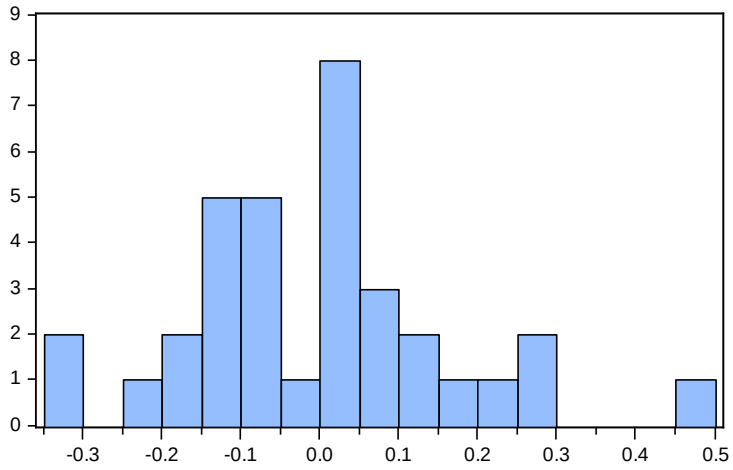
Said, R., Jamaludin, S., Ismail, N. W., Nor, N. M.& Yong, C. C. (2021). Measuring mismatch unemployment in the Malaysia labor market. *International Journal of Economic Policy in Emerging Economies, 14*(3), 227-247.

Tan, Z. G., Deborah, C. Y. K., Vaisnavi, M. R., Renato, L. (2022). Industry 4.0 Technology Adoption in Malaysian Manufacturing: Strategies for Enhancing Competitiveness, *ASB Working Paper Series 11/2022 Center of Technology, Strategy and Sustainability*, 1 -50.

Zulkiply, O. (2017). Malaysian Institute of Economic Research (MIER). Pertumbuhan ekonomi negara dan keperluan buruh asing. Retrieved from https://www.mier.org.my/old/newsarticles/archives/pdf/DrZul11_07_2017.pdf

Appendices

Normality test



Series: Residuals	
Sample 1988 2021	
Observations 34	
Mean	1.01e-14
Median	0.018140
Maximum	0.472778
Minimum	-0.335659
Std. Dev.	0.168483
Skewness	0.486837
Kurtosis	3.613028
Jarque-Bera	1.875446
Probability	0.391518

Autocorrelation test

Dependent Variable: UMP
Method: Least Squares
Date: 12/11/23 Time: 22:24
Sample: 1988 2021
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30.24399	12.75443	2.371253	0.0246
POP	1.387150	0.558119	2.485399	0.0190
GDP	-0.586382	0.215127	-2.725745	0.0108
IR	-6.830431	2.708168	-2.522159	0.0174
FDI	1.229900	0.050416	24.39498	0.0000

R-squared	0.961739	Mean dependent var	1.381715
Adjusted R-squared	0.956461	S.D. dependent var	0.861343
S.E. of regression	0.179728	Akaike info criterion	-0.459695
Sum squared resid	0.936759	Schwarz criterion	-0.235230
Log likelihood	12.81481	Hannan-Quinn criter.	-0.383146
F-statistic	182.2356	Durbin-Watson stat	1.631518
Prob(F-statistic)	0.000000		

Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.429194	Prob. F(2,27)	0.2570
Obs*R-squared	3.254871	Prob. Chi-Square(2)	0.1964

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/02/24 Time: 22:17
Sample: 1988 2021
Included observations: 34
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.541371	13.17989	-0.192822	0.8485
POP	-0.157871	0.627565	-0.251562	0.8033
GDP	0.070015	0.242505	0.288715	0.7750
IR	0.525098	2.803295	0.187315	0.8528
FDI	0.003473	0.049731	0.069838	0.9448
RESID(-1)	0.224984	0.195624	1.150081	0.2602
RESID(-2)	-0.280969	0.212330	-1.323263	0.1968

R-squared	0.095732	Mean dependent var	1.01E-14
Adjusted R-squared	-0.105217	S.D. dependent var	0.168483
S.E. of regression	0.177125	Akaike info criterion	-0.442677
Sum squared resid	0.847082	Schwarz criterion	-0.128426
Log likelihood	14.52550	Hannan-Quinn criter.	-0.335508
F-statistic	0.476398	Durbin-Watson stat	1.869645
Prob(F-statistic)	0.819818		

Heteroscedasticity test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.660796	Prob. F(4,29)	0.1860
Obs*R-squared	6.336928	Prob. Chi-Square(4)	0.1754
Scaled explained SS	6.023251	Prob. Chi-Square(4)	0.1974

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/02/24 Time: 22:18
Sample: 1988 2021
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.028371	3.086871	1.305001	0.2022
POP	-0.102155	0.135078	-0.756268	0.4556
GDP	-0.001657	0.052066	-0.031820	0.9748
IR	-0.778806	0.655440	-1.188218	0.2444
FDI	-0.019043	0.012202	-1.560644	0.1295

R-squared	0.186380	Mean dependent var	0.027552
Adjusted R-squared	0.074157	S.D. dependent var	0.045207
S.E. of regression	0.043498	Akaike info criterion	-3.297137
Sum squared resid	0.054871	Schwarz criterion	-3.072672
Log likelihood	61.05133	Hannan-Quinn criter.	-3.220588
F-statistic	1.660796	Durbin-Watson stat	1.841578
Prob(F-statistic)	0.186041		