UMT PRESS
Journal of Mathematical Sciences and Informatics
Journal Homepage: https://journal.umt.edu.my/index.php/jmsi
eISSN: 2948-3697
DOI: http://doi.org/10.46754/jmsi.2026.06.005

STATISTICAL ANALYSIS ON UNEMPLOYMENT RATE IN MALAYSIA

NUR SYAMILA AQILA ZAININUDIN AND SYERRINA ZAKARIA*

Faculty of Computer Science and Mathematics, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia.

**Corresponding author: syerrina@umt.edu.my*

ARTICLE INFO

Article History:
Received: 28 July 2025
Revised: 27 January 2026
Accepted: 13 April 2026
Published: 15 June 2026

Keywords:
Unemployment, correlation, multiple linear regression, Gross Domestic Product (GDP), Consumer Price Index (CPI).

ABSTRACT

Unemployment is a critical socio-economic issue affecting individual livelihoods and national economic performance. In Malaysia, the unemployment rate has fluctuated over the past decade, influenced by various social, economic, macroeconomic, demographic factors, and any other factors. The objectives of this research are to investigate the patterns and trends of the unemployment rate and to identify the significant factors that contribute to the joblessness in Malaysia. Several factors were considered such as the Gross Domestic Product (GDP), inflation, population growth, the COVID-19 pandemic, and Consumer Price Index (CPI). A correlation coefficient and multiple regression model were used to achieve the objective. Monthly data comprising 168 observations is collected from various sources such as the Department of Statistics Malaysia (DOSM) and the Central Bank of Malaysia. The dataset is categorised into two distinct periods, 2010-2019, representing the pre-pandemic era, and 2020-2023, which represents the COVID-19 pandemic era. The findings show that the CPI for food was both a consistent and significant predictor of unemployment across both periods under review, while the GDP was only significant before the pandemic, while the CPI for housing became a significant factor over the pandemic period. The remaining variables, such as inflation, the COVID-19 rate of infection, and population growth were not significant. In conclusion, the study showed that, while the GDP and CPI for food and housing have a significant effect on Malaysia's unemployment rate, their impact changes between periods, which illustrates the shifting nature of economic determinants both before and after the COVID-19 pandemic.

2020 Mathematics Subject Classification:

Introduction

Unemployment is influenced by various factors arising from both the supply side, which relates to workers, and the demand side, which involves employers. On the demand side, economic conditions such as the financial crises, global recessions, and high interest rates can reduce the demand for labour. Meanwhile, factors such as frictional unemployment and structural

unemployment play an important role on the supply side of the labour market. Macroeconomic indicators including the Gross Domestic Product (GDP), inflation, population growth, and more recently the COVID-19 pandemic are also closely associated with the unemployment rate and may influence overall economic growth.

Gross Domestic Product (GDP) measures the total value of goods and services produced in a year, excluding production costs [1]. During periods of economic expansion, job opportunities tend to increase, whereas during economic downturns, the unemployment rate generally rises. Inflation affects purchasing power, business operating costs, and hiring decisions, while persistent inflation or deflation may create uncertainty that further exacerbates unemployment. The COVID-19 pandemic severely affected the global economy, causing job losses due to lockdowns, remote working arrangements, and contractions in sectors like tourism and retail. Although governments introduced various economic support measures, recovery has been uneven across different sectors and regions.

Population growth also influencers unemployment; as Malaysia continues to experience annual growth rate increases, the labour force expands rapidly, and unemployment may increase, if job demand does not keep pace with labour market demand. According to [2], the Consumer Price Index (CPI), which measures the prices of household goods and services like food, housing, and fuel, reflects inflationary trends that may indirectly influence the employment opportunities in consumer-driven industries.

Unemployment refers to a condition in which individuals who are actively seeking employment are unable to obtain work [3]. According to the International Labour Organisation (ILO), the unemployment rate is defined as the proportion of unemployed individuals within the labour force. Mathematically, it is calculated by dividing the total number of unemployed persons by the total labour force, which consists of both employed and unemployed individuals within a given country or population group. The unemployment rate is widely used as an indicator of economic health; a higher unemployment rate generally reflects weaker labour-market conditions and may indicate broader economic challenges.

Malaysia's unemployment rate is relatively low and stable at around 3%. According to the World Bank Open Data report, the unemployment rate in Malaysia in 1999 was at 3.43% and then fluctuated considerably from year to year. Since then, the unemployment rate has gradually declined, reaching its lowest level of 2.7% in 2014. In 2015, the unemployment rate started to fluctuate again at 3.1%. Thereafter, the unemployment rate rose and peaked at 4.54% during 2020, due to the impact of the COVID-19 pandemic. The figure then showed a decrease to 3.93% by 2022.

Numerous studies have investigated the determinants of the unemployment rate across different economic contexts. Macroeconomic indicators such as inflation and the Gross Domestic Product (GDP) are frequently identified as key drivers of unemployment dynamics. For instance, previous research employing linear regression found that inflation exerted the strongest influence on unemployment in the United States, while GDP, unemployment insurance, and stock-market performance were negatively associated with unemployment levels [4]. Similarly, studies focusing on developing countries using econometric approaches such as the Augmented Dickey–Fuller (ADF) test and the Generalised Method of Moments (GMM) reported that higher GDP, remittances, favourable exchange rates, and increased

education expenditure contribute to reducing unemployment, whereas population growth and external debt tend to increase unemployment levels [5].

In the context of South Asia, the Vector Error Correction Model (VECM) has shown that institutional and technological factors, including good governance, internet access, and human-capital development, play significant roles in lowering unemployment rates. Conversely, financial expansion particularly in terms of credit activity and population growth have been found to increase unemployment in the long run [6]. In addition to examining determinants, several studies have also focused on forecasting unemployment trends. For example, the Autoregressive Integrated Moving Average (ARIMA)model has been applied to forecast global unemployment trends, suggesting that unemployment levels are likely to remain elevated in the coming years [7]. Furthermore, country-specific analyses, such as those conducted in Slovakia, highlight the influence of economic shocks and policy-related variables, including inflation, government expenditure, exports, and the COVID-19 pandemic, on unemployment fluctuations [8].

Despite these contributions, previous studies have primarily focused on individual countries or specific regions and employ different econometric techniques, resulting in varying findings regarding the determinants of unemployment. Moreover, limited studies have simultaneously integrated multiple macroeconomic indicators simultaneously to examine their combined effects on unemployment dynamics within a unified analytical framework. Therefore, further research is required to provide a more comprehensive analysis of the factors influencing unemployment and to offer more robust empirical evidence for policymakers.

Several studies have investigated factors influencing unemployment in Malaysia. [9,10] found that inflation and population growth significantly affect unemployment using forecasting techniques like ARIMA and Holt's Exponential Smoothing. Meanwhile, [11] showed that inflation exerted the strongest influence on unemployment between Association of Southeast Asian Nations (ASEAN)member states, while other factors like wages and education were less significant. [12] found that GDP is positively associated with unemployment in the short term but reduces it in the long run, while foreign direct investment (FDI) increases it.

During the COVID-19 pandemic, [13] used ARIMA models to study unemployment trends, suggesting the importance of understanding unemployment during crises. Inflation and GDP were found to reduce youth unemployment, while FDI, migration, and exchange rates increase it, as found by [14,15]. Education and population growth also play important roles where [16] confirmed that higher education enrolment lowers unemployment, and [17] noted migration and birth rates as major factors.

According to [18] there is a positive association between youth unemployment and economic growth, however this relationship is not statistically significant in Malaysia. Meanwhile, [19] reported that there is a weak correlation between unemployment and inflation in Malaysia. Conversely, [20] who investigated the relationship between unemployment and inflation in Malaysia found evidence of an equilibrium relationship between the inflation rate and the unemployment rate in Malaysia. Investigations into the roles of economic growth, inflation, and foreign direct investment (FDI) by [21] and [22] underscored both short-term causality and long-term dynamics, with GDP and inflation exhibiting negative effects on unemployment and FDI exhibiting a positive correlation. In addition, [23] showed energy consumption has varying long-term effects on unemployment, and [24] identified exchange

rates as significant factors influencing the unemployment rate. Furthermore, [25] found population and FDI reduce unemployment, but GDP and inflation had no effect and [26] linked unemployment to industrial patterns and productivity growth.

In conclusion, unemployment in Malaysia is influenced by inflation, GDP, FDI, population growth, and education. Inflation shows the most consistent positive link to unemployment, while GDP and education help reduce it. FDI and population growth show mixed effects. Balanced policies that promote economic growth, manage inflation, and invest in education are essential. Future research should consider sector-specific labour trends to guide effective policymaking.

Unemployment is a serious issue that directly affects both individual livelihoods and national economic performance. Over the past decade, Malaysia's unemployment rate has fluctuated due to a combination of gross domestic product (GDP) growth, inflation, COVID-19 pandemic, population growth and consumer price index (CPI) as some of the significant factors. However, the specific relationship between these characteristics and unemployment in Malaysia have received relatively limited attention, especially during periods of economic instability such as COVID-19 pandemic era. This paper aims to fill this gap by assessing Malaysia's unemployment patterns, focusing on the role of GDP, inflation, the COVID-19 outbreak, population growth, CPI, to provide evidence-based recommendations to address labour market difficulties using some statistical methods.

Data and Method

In this research, secondary data were collected from various sources such as the Department of Statistics Malaysia and Central Bank of Malaysia. The data set used in this research is monthly data from 2010-2023 consisting of a total of 168 observations. The data is categorised into two distinct periods, 2010-2019 representing the pre-pandemic era, and 2020-2023, representing the COVID-19 pandemic. The unemployment rate was treated as the dependent variable and the gross domestic products, inflation, COVID-19 cases, population growth, and consumer price index were the independent variables.

As the sample sizes were sufficiently large ($n = 120$ & 48) A formal normality test was not conducted in this study. This is because the sample size used in the analysis is sufficiently large, allowing the assumption of normality to be addressed through the Central Limit Theorem (CLT), which states that the distribution of sample means approximates a normal distribution (a bell curve) as the sample size becomes larger, regardless of the population's original distribution shape.

T-Test

A t-test is an inferential statistic used to determine if there is a statistically significant difference between the means of two populations. The hypothesis test for comparing the difference between two means is:

Null hypothesis (H_0): $\mu_1 = \mu_2$

Alternative hypothesis (H_1): $\mu_1 \neq \mu_2$

where:

μ_1 = the average of unemployment rate during the pre-pandemic era (2010-2019)
μ_2 = the average of unemployment rate during the COVID-19 pandemic (2020-2023)

The decision to reject or fail to reject the null hypothesis is based on the *p*-value obtained from the test. If the *p*-value is less than 0.05, the null hypothesis is rejected. If the *p*-value is greater than 0.05, the null hypothesis is not rejected [27]. The formula of the test statistic is (assuming equal variances):

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \text{ with } s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}} \quad (1)$$

where:
$\bar{x}_1, \bar{x}_2$ = mean for Group 1 and 2, respectively
μ_1, μ_2 = unknown population mean for Group 1 and 2, respectively
s_1, s_2 = standard deviation for Group 1 and 2, respectively
s_p = pooled sample standard deviation
n_1, n_2 = sample size for Group 1 and 2, respectively
Group 1 = unemployment rate during the pre-pandemic era (2010-2019)
Group 2 = unemployment rate during the COVID-19 pandemic period (2020-2023)

Correlation Coefficient Method

Correlation Analysis is statistical method that is used to discover if there is a relationship between two variables [28]. It is a common tool for describing simple relationships without making a statement about cause and effect. If the data is normally distributed, Pearson correlation coefficient is the most common method to measure linear correlation between two continuous variables. The formula for the Pearson correlation coefficients as follows:

$$r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum(X - \bar{X})^2}\sqrt{(Y - \bar{Y})^2}} \quad (2)$$

where:
$\bar{X}$ = mean of *X* variable (independent variable)
$\bar{Y}$ = mean of *Y* variable (dependent variable)

Pearson can be used when both variables must be quantitative. If one of the variables is qualitative, a different statistical method should be applied. The variables should also be normally distributed. Histograms can be generated for each variable to assess whether the distributions are approximately normal. Slight deviations from normality are generally acceptable. The data should also be free from outliers, which are observations that significantly differ from the overall pattern of the data. A scatterplot can be used to identify potential outliers by locating points that are distant from the others. Furthermore, the relationship between the two variables should be linear. A linear relationship indicates that a straight line can adequately represent the association between the variables. This can also be evaluated using a scatterplot [29].

Multiple Regression Model

According to [30] regression analysis is a statistical method for analysing a relationship between two or more variables in such a manner that one of the variables can be predicted or explained by the information on the other variables. This regression method would easily help researcher to decide which factors is matter the most and which factors that can be overlooked. It also helps to identify those factors affect each other. Regression analysis includes several variations, such as linear, multiple linear, and non-linear. The most common models are simple linear and multiple linear. Simple linear regression is a model that assesses the relationship between a dependent variable and an independent variable. The simple linear model is expressed as:

$$y = a + bX + \epsilon \quad (3)$$

where:
y = dependent variable
X = independent variable
a = intercept
b = slope
ϵ = residual (error)

Multiple linear regression is a statistical technique used to predict the outcomes. It is also known as multiple regression and the model of this method has more than one independent variable. The mathematical representation of multiple linear regression is:

$$y = \alpha + \beta X_{1i} + \gamma X_{2i} + \cdots + \theta X_{ui} + \varepsilon_i \quad (4)$$

where:
y = dependent variable
X_{1i}, X_{2i}, X_{3i} = independent variables
$\alpha, \beta, \gamma, \theta$ = regression coefficient
ϵ = residual (error)

In this research, multiple linear regression is used to test the dependent and independent variables. The following are the research hypothesis statement of influential factors. Some hypotheses were tested and the hypothesis statement as follows:

Hypothesis 1(H_0): GDP has no significant relationship with unemployment rate.
Hypothesis 2 (H_0): Inflation has no significant relationship with unemployment rate.
Hypothesis 3 (H_0): COVID-19 rate has no significant relationship with unemployment rate.
Hypothesis 4 (H_0): Population growth has no significant relationship with unemployment rate.
Hypothesis 5 (H_0): CPI has no significant relationship with unemployment rate.

Result and Discussion

Table 1 shows the descriptive statistics of Variables for 2010-2019. The total observations were 120 months, which the data is from 1 January 2010 to 1 December 2019.

Table 1: Descriptive statistics of variables (2010-2019)

Variable	Mean	Standard Deviation	Minimum	Maximum
Unemployment	3.20417	0.22357	2.60000	3.60000
GDP	5.31500	1.24081	3.60000	10.30000
Inflation	0.17500	0.35177	-1.20000	1.30000
CPI for food	119.86917	9.45199	102.60000	133.90000
CPI for house	110.17833	7.18671	99.40000	122.20000

The mean value of unemployment rate is 3.20, which shows that on an average sample. The maximum and minimum of 3.6 and 2.6, respectively, show that unemployment rate swung between 2.6% to 3.6%. The mean value of GDP is 5.32 with the volatility swung between 3.6 to 10.3. The inflation recorded a mean value of 0.18 show that the inflation swung between -1.2 to 1.3. Finally, Malaysia's CPI for food recorded an average of 119.87 and Malaysia's CPI for house recorded an average of 110.18 based on the mean value. Hence, CPI for food fluctuated between 102.6 to 133.9 and CPI for house fluctuated between 99.4 to 122.2.
Table 2 shows the descriptive statistics data for 2020-2023. The total observations were 48 months, which the data is from 1 January 2020 to 1 December 2023.

Table 2: Descriptive statistics of variables (2020-2023)

Variable	Mean	Standard Deviation	Minimum	Maximum
Unemployment	4.07917	0.60176	3.20000	5.30000
GDP	2.72500	7.59136	-16.90000	16.30000
Inflation	0.14792	0.54616	-2.70000	1.20000
COVID-19 rate	2.08333	3.33724	0.00009	15.15067
Population growth	0.80625	0.69233	0.20000	2.10000
CPI for food	142.22917	7.08333	133.90000	153.00000
CPI for house	122.16250	2.63153	117.90000	126.00000

The mean value of unemployment rate is 4.08, which shows that on an average sample. The maximum and minimum of 5.3 and 3.2, respectively, show that unemployment rate swung between 3.2% to 5.3%. The mean value of GDP is 2.73 with the volatility swung between -16.9 to 16.3. The inflation recorded a mean value of 0.148 show that the inflation swung between -2.7 to 1.2. Also, the average of COVID-19 rate are 2.08 with a standard deviation 7.08. The minimum of COVID-19 rate is 0 and the maximum is 15.15. Next, the mean of population growth is 0.81, with a maximum of 2.1% and a minimum of 0.2%. Finally, Malaysia's CPI for food recorded an average of 142.23 and Malaysia's CPI for house recorded an average of 122.16 based on the mean value. Hence, CPI for food fluctuated between 133.9 to 153 and CPI for house fluctuated between 117.9 to 126.

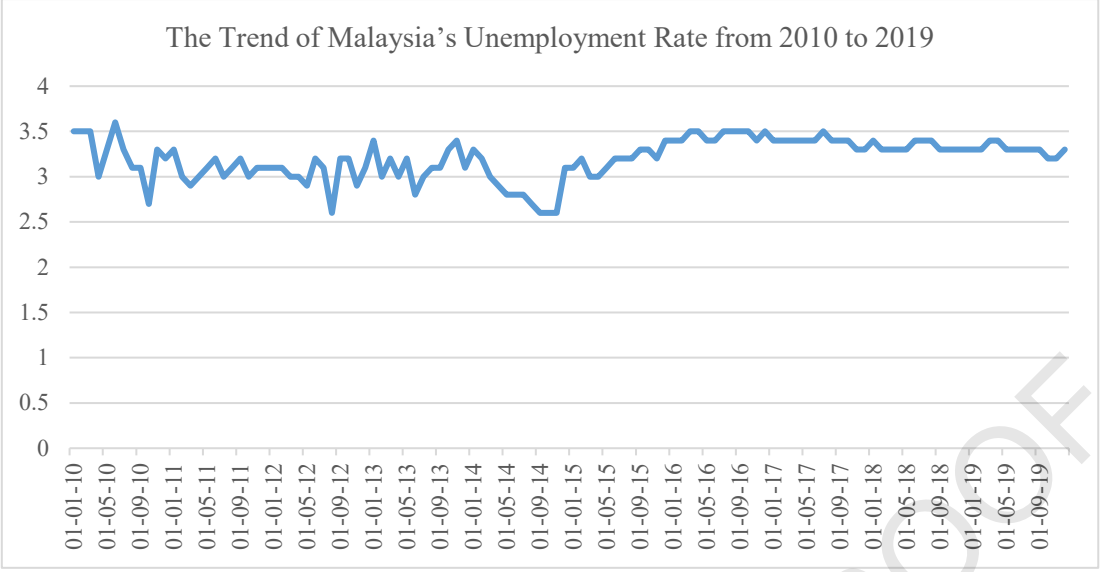

Figure 1: The trend of Malaysia's unemployment rate from 2010-2019

Figure 1 shows the trend of Malaysia's unemployment rate from January 2010 to December 2019. Overall, the unemployment rate fluctuated moderately between 2.6% and 3.6% throughout the period. There was a slight downward movement around 2014, reaching the lowest point at 2.6%, followed by a gradual increase beginning in 2015. From 2016 onwards, the rate remained relatively stable, hovering around 3.3% to 3.4%, indicating a relatively steady labour market condition before the COVID-19 pandemic.

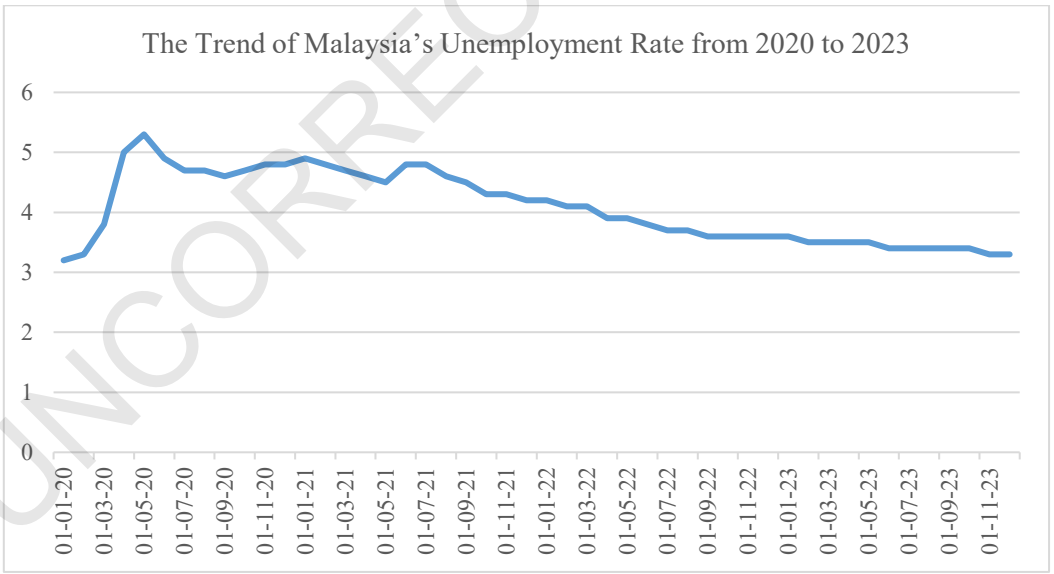

Figure 2: The trend of Malaysia's unemployment rate from 2020-2023

Figure 2 illustrates the trend of Malaysia's unemployment rate from January 2020 to December 2023. At the beginning of 2020, the unemployment rate increased sharply from around 3.3% to a peak of 5.1% in May 2020, coinciding with the onset of the COVID-19 pandemic and nationwide lockdowns. After the peak, the rate showed a slow but steady decline over the following years, indicating a gradual recovery in the labour market. By the end of 2023, the unemployment rate had stabilised at approximately 3.3%, returning close to pre-pandemic levels.

T-Test

Table 3 show the results of descriptive statistics and independent t-test (equal variance) between two distinct periods. Group 1 represents the unemployment rate during pre-pandemic era (2010-2019), while Group 2 represents the unemployment rate during the COVID-19 pandemic (2020-2023).

Table 3: Independent t-test result of unemployment rate

Group	N	Mean	Std. Dev.	Std. Error	Min.	Max.
1	120	3.2042	0.2236	0.0204	2.600	3.600
2	48	4.0792	0.6018	0.0869	3.200	5.300
T-Test Result						
DF		**t-Value**			**p-value**	
52.27		-9.81			<0.0001	

The null hypothesis (H_0) stated that there is no significant difference between Group 1 and Group 2, while the alternative hypothesis (H_1) stated that there is a significant difference between Group 1 and Group 2. From the result above, it shows a t-value of -9.81 with 52.27 degrees of freedom and a *p*-value less than 0.0001. This indicating *p*-value is below the 0.05 significance level, so the null hypothesis is rejected. These findings suggest a statistically significant difference in the mean of the unemployment rate between two groups. Moreover, the mean score of Group 2 is 4.0792 has higher than Group 1's 3.2042, indicating that unemployment rate values are generally greater in Group 2. This increase may be due to the economic impact of the COVID-19 pandemic, which led to lower GDP, higher inflation, and greater labour market uncertainty. Rising food and housing expenses may have made it more difficult for people to find and hold jobs, adding to the increased unemployment rate during this period.

Correlation Coefficient

Table 4 presents the Pearson correlation results for two distinct periods, 2010-2019 (pre-pandemic era) and 2020-2023 (COVID-19 pandemic).

Table 4: Correlation analysis results

Variables	2010-2019	2020-2023
	Unemployment	**Unemployment**
GDP	0.02431	-0.47058
	(0.7921)	(0.0007) *
Inflation	-0.08949	-0.04545
	(0.3310)	(0.7590)
COVID-19 rate	-	0.20272
		(0.1670)
Population growth	-	-0.74071
		(<0.0001) *
CPI for food	0.55461	-0.80007
	(<0.0001) *	(<0.0001) *
CPI for house	0.42239	-0.88232
	(<0.0001) *	(<0.0001) *

Note: () = *p*-value; * = significant.

In the earlier period, GDP showed a weak positive correlation of 0.024 with *p*-value 0.7921, but not significant. However, this shifted to a moderate negative correlation, -0.47, with *p*-value 0.0007 during the COVID-19 pandemic. This shows that GDP became more associated with lower unemployment rate during the pandemic. The correlation between unemployment and inflation remained insignificant weak during two periods, with -0.089 with *p*-value 0.3310 during pre-pandemic and -0.045 with *p*-value 0.7590 during the COVID-19 pandemic. This suggests that inflation minimally affected unemployment. COVID-19, where it occurred in 2020, showed an insignificant weak positive, 0.20, with *p*-value 0.1670 while population growth had a strong negative relationship between unemployment, -0.74, with *p*-value less than 0.0001. Both CPI for food and house exhibited a significant moderate positive correlation with unemployment, 0.55 and 0.42 with both *p*-values less than 0.0001. During the pandemic period, both CPI shifted to a strong negative correlation, -0.80 and -0.88, with both *p*-values less than 0.0001 suggesting that during that period, rising prices were linked to reduced unemployment.

The findings indicate that GDP, population growth, and both CPI for food and housing were strongly connected with unemployment during the COVID-19 pandemic, although inflation and the COVID-19 rate variable were not statistically significant. Notably, the relationships between unemployment, GDP, and CPI are changed considerably during the pre-pandemic and pandemic periods. This shows a structural change in the economy's dynamics during the pandemic, with established economic linkages shifting, possibly due to emergency economic policies, supply chain interruptions, or changes in consumer behaviour. This shows how the crisis forced governments to adopt emergency policies and shifts in consumer behaviour, leading to a different set of factors driving unemployment compared to the pre-pandemic period.

Multiple Linear Regression

Table 5 shows the result for multiple linear regression analysis from year 2010-2019.

Table 5: Multiple linear regression result (2010-2019)

Variables	Coefficients	Standard Error	t-statistics	Probability	VIF
Intercept	1.66337	0.34771	4.78	< 0.001	0
GDP	0.00479	0.01770	0.27	0.7870	1.61011
Inflation	-0.02035	0.04959	-0.41	0.6822	1.01578
CPI for food	0.01385	0.00360	3.85	0.0002	3.86351
CPI for house	-0.00128	0.00514	-0.25	0.8040	4.55838
Adjusted R^2	0.2869				

The table forms an Equation (5) derived from the multiple linear regression analysis for the period 2010-2019 as follows:

$$y = 1.66337 + 0.00479GDP - 0.02035\ Inflation + 0.01385\ CPI\ for\ food - 0.00128\ CPI\ for\ house \quad (5)$$

This equation models the unemployment rate (y) as a function of GDP, inflation, CPI for food and CPI for house, with an intercept, $\beta_0 = 1.66$. This means that when all factors equal to zero, the unemployment rate is 1.66. The coefficient for GDP is near to zero, $\beta_1 = 0.0048$ with *p*-value 0.7870. This shows that when GDP increases by one, the unemployment rate will increase by 0.0048. GDP do not give significant effect to unemployment rate. Inflation has a negative coefficient, $\beta_2 = -0.02$ with *p*-value 0.6822, suggesting that a one unit increase in inflation is associated with a 0.02 unit decrease in the unemployment rate, assuming other variables remain constant. But inflation does not have a significant effect to the unemployment rate. The coefficient for CPI for food is $\beta_3 = 0.014$ with *p*-value 0.0002, meaning a one unit increase in food prices is associated with a 0.014 increase in unemployment rate and it gives a significant effect to the unemployment rate. Finally, the CPI for house, $\beta_4 = -0.0013$ with *p*-value 0.8040 shows no meaningful impact on unemployment and do not give significant effect to unemployment rate.

Among the variable's tests, only CPI for food is statistically significant, $p = 0.0002$. Other variables, including GDP, inflation, and CPI for house are not statistically significant. The adjusted r-squared is 0.2869, indicating that approximately 28.7% of the variation in unemployment rate is explained by the model. The results of variance inflation factor (VIF) for all factors are below 10. Therefore, the regression model does not have serious multicollinearity between each independent variable. Table 6 shows the result of regression analysis between unemployment and CPI for food.

Table 6: Regression analysis of unemployment with CPI for Food (2010-2019)

Variable	Coefficients	Standard Error	t Value	Probability	VIF
Intercept	1.63170	0.21786	7.49	< 0.0001	0
CPI for food	0.01312	0.00181	7.24	< 0.0001	1
Adjusted $\boldsymbol{R^2}$	0.3017				

Thus, the final regression model obtained was:

$$y = 1.63170 + 0.01312\ CPI\ for\ food \quad (6)$$

This indicates that when CPI for food equal to zero, the unemployment rate is 1.63, with adjusted R^2 is 0.3017. The model was statistically significant and have positive relationship between unemployment rate and CPI for food.

The results show that while the model explains a modest portion of the variation in unemployment, most of the independent variables do not show statistically significant effects. Among the factors analysed, only the CPI for food has a significant relationship with unemployment rates. This indicates the potential importance of food price stability in addressing unemployment, whereas GDP, inflation, and housing costs appear to have minimal or statistically insignificant impact within the examined period. Table 7 shows the result for multiple linear regression from 2020-2023.

Table 7: Multiple linear regression result (2020-2023)

Variables	Coefficients	Standard Error	T-statistics	Probability	VIF
Intercept	24.48329	4.54844	5.38	< 0.0001	0
GDP	-0.00244	0.00887	-0.28	0.7845	2.51516
Inflation	0.04871	0.08219	0.59	0.5567	1.11685
COVID-19 rate	-0.00037	0.01559	-0.02	0.9809	1.49990
Population growth	-0.18686	0.18300	-1.02	0.3132	8.89837
CPI for food	0.00310	0.01848	0.17	0.8677	9.50305
CPI for house	-0.16940	0.04017	-4.22	0.0001	6.19387
Adjusted R^2	0.7658				

The table forms an Equation (7) derived from the multiple linear regression analysis for the period 2020-2023 as follows:

$$\begin{aligned} y = {} & 24.48329 - 0.0024\ \text{GDP} + 0.04871\ \text{Inflation} \\ & - 0.00037\ \text{COVID19 rate} - 0.18686\ \text{Population growth} \\ & + 0.0031\ \text{CPI for food} - 0.16940\ \text{CPI for house} \end{aligned} \quad (7)$$

This equation models the unemployment rate (y) as a function of GDP, inflation, CPI for food and CPI for house. The coefficient for GDP has a small negative coefficient, β_1 = -0.0024 with *p*-value 0.7845. This shows that when GDP increases by one, the unemployment rate will reduce by 0.0024. GDP do not give significant effect to unemployment rate. Inflation has a positive coefficient, β_2 = 0.049 with *p*-value 0.5567, suggesting that one unit increase in inflation is associated with a 0.0049 unit increase in the unemployment rate and do not have

significant effect to unemployment rate. The coefficient for COVID-19 rate is β_3=-0.00037 with *p*-value 0.9808, meaning a one unit increase in COVID-19 rate is associated with a 0.014 decrease in unemployment rate. This factor does not give significant effect to unemployment rate. Next, population growth has a negative coefficient, β_4=-0.19 with *p*-value 0.3132, implying a slight reduction in unemployment with higher population growth but it's do not give significant effect to unemployment rate.

The CPI for food, $\beta_5 = 0.0031$ with *p*-value 0.8677, has a positive coefficient and does not have significant effect to unemployment rate. Finally, the CPI for house, $\beta_6 = -0.17$ with *p*-value 0.0001. This shows that when CPI for house increases by one, the unemployment rate will reduce by 0.17. Among the variable's testes, only CPI for house is statistically significant, $p = 0.0001$. Other variables, including GDP, inflation, COVID-19 rate, population growth and CPI for food are not statistically significant. The adjusted r-squared is 0.7658, indicating that approximately 76.6% of the variation in unemployment rate is explained by the model. Maybe some other factors give significant effect to unemployment rate does not consider in this study. The results of Variance Inflation Factor (VIF) for all factors are below 10.

Therefore, the regression model does have moderate multicollinearity between each independent variable. Because of these two factors not significantly give effect to unemployment rate, we just report the result and do no further our study on how to solve this multicollinearity problem. Final model can refer to Table 8 below. Table 8 shows the result of regression analysis between unemployment and CPI for house.

Table 8: Regression analysis of unemployment with CPI for housing (2020-2023)

Variable	Coefficients	Standard Error	t Value	Probability	VIF
Intercept	28.72674	1.93899	14.82	< 0.0001	0
CPI for house	-0.20176	0.01587	-12.71	< 0.0001	1
Adjusted $\boldsymbol{R^2}$	0.7737				

Thus, the final regression model obtained was:

$$y = 28.73 - 0.20176\ CPI\ for\ housing \quad (8)$$

This indicates that when CPI for food equal to zero, the unemployment rate is 24.73, with adjusted R^2 is 0.7737. The model was statistically significant and have negative relationship between unemployment rate and CPI for housing.

The results show that while the model explains a great portion of the variation in unemployment. However, among all the variables, only the CPI for housing has a significant effect on unemployment rate. This suggesting that rising housing costs may be associated with lower unemployment, possibly due to broader economic activity in the housing sector. Other variables such as GDP, inflation, COVID-19 rate, population growth and CPI for food do not exhibit statistically significant impact on unemployment rate. These findings highlight the importance of housing-related economic conditions in shaping labour market outcomes within the studied period.

The negative relationship between CPI and unemployment rate during the pandemic may reflect the effects of expansionary government policies implemented throughout the crisis

period. In Malaysia, economic stimulus packages, wage-subsidy programmes, and financial-assistance schemes were introduced to support businesses and maintain employment levels. These interventions enabled firms to retain workers and sustain economic activity. Increased government expenditure and financial support also stimulated consumer demand, which may have led to rising prices while simultaneously stabilising employment levels. The results highlight how extraordinary economic shocks can alter traditional macroeconomic relationships, resulting in temporary deviations from conventional expectations regarding inflation and unemployment dynamics.

Conclusions

This study examined the patterns and determinants of unemployment in Malaysia from 2010 to 2023, focusing on key macroeconomic and demographic factors such as GDP, inflation, population growth, the COVID-19 pandemic, and the Consumer Price Index (CPI). The research employed quantitative methods, including descriptive statistics, correlation analysis, and multiple linear regression, to evaluate the relationships between these variables and unemployment rates. The findings provide valuable insights into how these factors influence unemployment trends, particularly during periods of economic instability, such as the COVID-19 pandemic.

The results revealed that the CPI for food was a significant predictor of unemployment in the pre-pandemic period (2010–2019), while CPI for housing exhibited strong correlations during the pandemic (2020-2023). However, some factors, such as GDP, inflation and population growth, did not demonstrate statistically significant impacts, suggesting the need for further investigation.

Despite providing useful insights into the determinants of unemployment in Malaysia from 2010 to 2023, several limitations should be acknowledged. First, the study relied on secondary macroeconomic data at the national level, which may not fully capture regional variations in unemployment patterns across different states or sectors in Malaysia. As a result, the findings may not reflect localised labour market dynamics. Second, the study considered only a limited number of macroeconomic indicators, namely GDP, inflation, population growth, and selected components of the Consumer Price Index (CPI). Other potentially relevant factors, such as educational attainment, labour market policies, technological advancements, industrial structures, and foreign investments, were not included due to data constraints. The omission of these variables may limit the comprehensiveness of the model in explaining unemployment trends. Third, the analysis employed descriptive statistics, correlation analysis, and multiple linear regression. While these methods are useful for identifying relationships between variables, they may not fully capture complex dynamic interactions or long-term causal relationships among macroeconomic variables. More advanced econometric techniques, such as time-series models or panel-data analysis, could provide deeper insights into these relationships.

To enhance the robustness of future research, expanding the dataset to include additional variables such as foreign direct investment (FDI), education levels, and sector-specific employment trends could provide deeper insights. Employing advanced econometric models, such as Vector Error Correction Models (VECM) or machine-learning techniques, may

improve predictive accuracy. Additionally, qualitative approaches, such as surveys or interviews with industry experts or affected individuals, could complement quantitative findings by offering practical perspectives on unemployment mitigation strategies.

Authors' Contributions

All authors read and approved the final manuscript. Conceptualisation: Nur Syamila Aqila Zaininudin and Syerrina Zakaria; Methodology: Syerrina Zakaria; Formal analysis and investigation: Nur Syamila Aqila Zaininudin; Writing: Both authors; Review and editing: Nur Syamila Aqila Zaininudin; Validation and visualisation: Syerrina Zakaria; Supervision: Syerrina Zakaria.

Acknowledgements

The authors would like to express their appreciation to Universiti Malaysia Terengganu for facilitating the successful completion of this research.

Conflict of Interest Statement

The authors declare no conflict of interest.

References

[1] Aljileedi, M. R. A., & Heri, Y. (2020). Factors influencing unemployment rate: A comparison among five ASEAN countries. *Journal of Economic Education*, *9*(1), 37–45. https://www.researchgate.net/publication/343581428_Factors_Influencing_Unemployment_Rate_A_Comparison_Among_Five_Asean_Countries

[2] Baba, J. F., & Abang Ali, D. H. B. (2021). Economic determinants of unemployment in Malaysia: Short- and long-run causality. *Journal of Public Administration and Governance*, *11*(1). https://doi.org/10.5296/jpag.v11i1.17794

[3] Beers, B. (2024, July 31). *What is regression? Definition, calculation, and example*. Investopedia. https://www.investopedia.com/terms/r/regression.asp

[4] Borhan, H., Ridzuan, A. R., Razak, M. I. M., & Mohamed, R. N. (2023). The dynamic relationship between energy consumption and level of unemployment rates in Malaysia: A time series analysis based on ARDL estimation. *International Journal of Energy Economics and Policy*, *13*(2), 207–214. https://doi.org/10.32479/ijeep.13893

[5] Chai, Y. H. (2021). *The connection between unemployment and inflation: A case of Malaysia* [Unpublished thesis]. Universiti Utara Malaysia.

[6] Davis, C., & Hashimoto, K. (2022). Productivity growth, industry location patterns and labour market frictions. *Regional Science and Urban Economics*, *97*. https://doi.org/10.1016/j.regsciurbeco.2022.103817

[7] Department of Statistics Malaysia. (2023). *Consumer prices*. OpenDOSM. https://open.dosm.gov.my/dashboard/consumer-prices

[8] Evanezza, M., & Caroline, G. (2020). Macroeconomic factors affecting youth unemployment in Malaysia. *Malaysian Journal of Business and Economics*, *7*(2), Article 181. https://doi.org/10.51200/mjbe.vi.2890

[9] Ewe, W. X., & Bee Wah, T. A. N. (2023). *Exploring the relationship between macroeconomic factors and unemployment in Malaysia*. Annual ECOFI Symposium (AES 2023).

[10] Fernando, J. (2024). *Gross domestic product (GDP): Formula and how to use it*. Investopedia. https://www.investopedia.com/terms/g/gdp.asp

[11] Fung, Y. V., & Nga, L. H. J. (2023). Economic growth and youth unemployment in Malaysia. *International Journal of Academic Research in Economics and Management Sciences*, *12*(2), 497–513. https://doi.org/10.6007/ijarems/v12-i2/17494

[12] Furuoka, F., & Qaiser, M. (2014). Unemployment and inflation in Malaysia: Evidence from error correction model. *Malaysian Journal of Business and Economics*, *1*(1), 35–45.

[13] Gopal Pillay, K., & Bi En, T. (2021). Prediction of unemployment rate in Malaysia based on macroeconomic factors. *Enhanced Knowledge in Sciences and Technology*, *1*(2), 30–39. https://penerbit.uthm.edu.my/periodicals/index.php/ekst/article/view/2092

[14] Green, A., Nasim, A., Radadia, J., Kallam, D. M., Kalyanam, V., Owenga, S., & Ashqar, H. I. (2024). *Identifying economic factors affecting unemployment rates in the United States*. arXiv. https://arxiv.org/abs/2411.02374

[15] Hayes, A. (2022, December 8). *What is unemployment?* Investopedia. https://www.investopedia.com/terms/u/unemployment.asp

[16] Hayes, A. (2024, October 4). *T-test: What it is with multiple formulas and when to use them*. Investopedia. https://www.investopedia.com/terms/t/t-test.asp

[17] Ismail, N. A., Ramzi, N. A., & Mah, P. J. W. (2022). Forecasting the unemployment rate in Malaysia during COVID-19 pandemic using ARIMA and ARIMA models. *Malaysian Journal of Computing*, *7*(1), 982–994.

[18] James, E. (2021). *What is correlation analysis? Definition and exploration*. FlexMR. https://blog.flexmr.net/correlation-analysis-definition-exploration

[19] Mahdali, A. (2024). The impact of population growth rate, minimum wage, and education on the unemployment rate in 2022. *Jambura Equilibrium Journal*, *6*(1), 48–59. https://doi.org/10.37479/jej.v6i1.23513

[20] Ma'in, M., Othman, S. M., Mat Isa, S. S., & Junos, S. (2021). Unemployment and macroeconomic indicators in Malaysia. *Global Business & Management Research*, *13*(4), 38.

[21] Mohd Azhar, A. A., & Ibrahim, N. A. (2021, September). *Factors affecting unemployment rate in Malaysia*. E-Prosiding Seminar Antarabangsa Islam dan Sains 2021.

[22] Senci, M., Svabova, L., & Kliestik, T. (2024). The anatomy of unemployment: Determinants during and after the COVID-19 crisis. *Management Dynamics in the Knowledge Economy*, *12*(1), 86–100.

[23] Shabbir, A., Kousar, S., & Zubair Alam, M. (2021). Factors affecting level of unemployment in South Asia. *Journal of Economic and Administrative Sciences*, *37*(1), 1–25.

[24] Siddiqa, A. (2021). Determinants of unemployment in selected developing countries: A panel data analysis. *Journal of Economic Impact*, *3*(1), 19–26.

[25] Sun, F. (2023). World unemployment problem and the unemployment rate forecasting with ARIMA model. *Theoretical and Natural Science*, *26*(1), 113–118. https://doi.org/10.54254/2753-8818/26/20241031

[26] Suraya Fadilah, R., Muhammad, F., Hazmi, U., & Amirul Zharif, Z. (2018). Prediction of the unemployment rate in Malaysia. *International Journal of Modern Trends in Social Sciences*, *1*(4). https://gaexcellence.com/ijmtss/article/view/648

[27] Turney, S. (2022). *Pearson correlation coefficient (r): Guide and examples*. Scribbr. https://www.scribbr.com/statistics/pearson-correlation-coefficient/

[28] Vizie, T., & Kamarudin, A. (2024). Factors affecting unemployment rate and the forecasting trend. *Proceeding of Science and Mathematics*, *22*, 174–184. https://science.utm.my/procscimath/wp-content/uploads/sites/605/2024/08/174-184-TAY-VIZIE.pdf

[29] Wen, L. L., Misiran, M., Sapiri, H., Supadi, S. S., & Yusof, Z. M. (2022). Quantitative assessment of unemployment among youths in Malaysia. *Malaysian Journal of Fundamental and Applied Sciences*, *18*(5). https://doi.org/10.11113/mjfas.v18n5.2436

[30] Yong, N. K., Abu, A., Sufian, A., Shamsuddin, S., & Zainal, Z. (2023). Analysing unemployment determinants in Malaysia using the VECM methodology. *Malaysian Journal of Business and Economics*, *10*(2). https://doi.org/10.51200/mjbe.v10i2.4818