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Article

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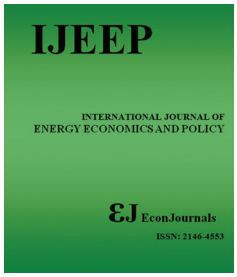

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The Dynamic Relationship between Energy Consumption and Level of Unemployment Rates in Malaysia: A Time Series Analysis Based on ARDL Estimation

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ABSTRACT

Unemployment is a critical issue that affects the wellbeing of citizens and requires attention in many countries, including Malaysia. However, the impact of macroeconomic factors on unemployment rates, such as energy consumption, has not been thoroughly studied. In this paper, we aim to investigate the impact of various macroeconomic variables, including foreign and domestic investment, trade liberalization, inflation, urbanization, economic growth, corruption, and energy consumption on unemployment rates in Malaysia. Using annual data from 1984 to 2020, we utilized the ARDL estimation to analyze the data. The results show a mixed expected impact between the independent and dependent variables in the long run. Although energy consumption has a negative impact on unemployment rates in the short term, this is not the case in the long run. The paper concludes with a list of policy recommendations.

Keywords: Energy consumption, Unemployment, Malaysia, ARDL
JEL Classifications: E00, Q43, J21, J64

1. INTRODUCTION

The issue of unemployment is a significant macroeconomic challenge faced by many developing countries. The latest data released by the Department of Statistics of Malaysia (DoSM) indicates a rise in the unemployment rate from 5% in April 2020 to 5.3% in May 2020, with 826,100 citizens being unemployed, an increase of 47,300 (DoSM, 2021). This trend can be attributed to the implementation of the Movement Control Order (MCO) nationwide. The problem of unemployment is particularly acute among young people in Malaysia, as highlighted by Abd Rahman et al. (2020a), who have difficulty finding jobs that match their qualifications (Abd Rahman et al. 2020b). Unemployment has far-reaching implications, including economic and social

instability in society, reduced purchasing power, and a slowdown in economic growth. It also adversely impacts the standard of living of individuals, as it affects their monthly income (Michael and Geetha, 2020).

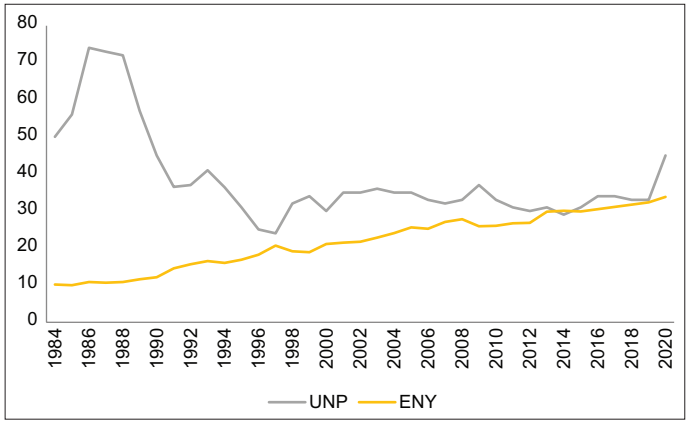
In summary, the rise in unemployment rate in Malaysia due to the MCO is a worrying trend, especially among young people. The economic and social implications of this problem are significant, and it is crucial to address it to prevent further deterioration of the country's economy and society.

According to Figure 1, Malaysia's unemployment trend from 1984 to 2020 has been consistently below 8%, indicating stable control. Notably, the country's lowest unemployment rate occurred in 2014 at 2.85%, attributable to sustainable economic growth and diverse employment opportunities that have made Malaysia an attractive destination for neighboring countries in Southeast Asia. However, energy consumption in Malaysia has increased over the years, largely derived from the burning of fossil fuels and coal due to its lower cost. Unfortunately, this has resulted in higher carbon emissions that contribute to global warming, as evidenced by studies conducted by Voumik et al. (2023), Pujiati et al. (2023), Shaari et al. (2022), Ridzuan et al. (2022), and Ridzuan et al. (2020).

As Malaysia transitions from an agricultural-based economy to an industrialized one, more energy supply is required by factories to accommodate expanded economic activities, as reflected by higher gross domestic product (GDP) each year between 1984 and 2020. The surge in energy consumption has coincided with the unemployment rate trend, raising the question of whether the two indicators are related. Industrial employment opportunities account for 30% of employment in Malaysia, while the service sector contributes to 50% of the country's GDP. Although Malaysia's GDP growth trend is promising, sustainable initiatives are necessary to overcome unemployment challenges in various economic sectors.

It is crucial to identify the key factors causing unemployment in Malaysia to ensure sustainable economic growth, as unemployment could lead to economic crises such as those experienced by the country in 1997 and 2008. Therefore, this study aims to examine the short- and long-term relationship between selected macroeconomic variables and unemployment in Malaysia. By identifying the underlying causes of unemployment, policymakers can develop sustainable initiatives to address the issue and maintain stable economic growth.

Figure 1: Unemployment rate (*10) and energy consumption (/100) in Malaysia (1984-2020)



The following section focuses on the literature review. Next, Section 3 explains the methodology of this study, followed by analysis and discussion in Section 4. The last section highlights the conclusion and policy recommendations.

2. LITERATURE REVIEW

Numerous studies have been conducted to investigate the determinant of the unemployment rate. This section focuses on the summary of selected past studies on this topic. Through this section, we could identify several macroeconomic variables commonly used as potential determinants for the unemployment model.

Johnny et al. (2018) investigated the impact of FDI on Nigeria's unemployment rate from 1980 to 2015. According to the study, there is a negative and significant relationship between FDI and unemployment and a positive and significant relationship between capital formation and unemployment. According to the findings, the government should implement policies to improve the investment climate in Nigeria and ensure that all resources for productive activities are fully utilised before engaging in any form of savings. Irpan et al. (2018) investigated the impact of FDI on Malaysia's employment rate. Other factors, such as the number of foreign workers, GDP, and exchange rate (EXCR), were also considered in the study. The study relied on annual data spanning the years 1980-2012. The long-run relationship between the variables was determined using the autoregressive distributed lag (ARDL) model. The study discovered that FDI and GDP significantly influence and significantly influence other economists, such as Grahovac and Softi (2017), who take a more passive approach to the effect of foreign direct investment on the host country's unemployment rate. They investigated the relationship between global unemployment rates and FDI flows in Western Balkan countries and presented a comparative analysis with selected countries from 2000 to 2014. The analysis revealed that there had been a significant reduction in net investments since 2009, which is more visible in the case of FDI due to lower domestic and external demand as a result of the global economic crisis, which has resulted in a decrease in the number of employees and rising unemployment. The findings also revealed the absence of a positive impact of FDI on employment, which was present in most CEE countries during the transition period, as demonstrated by numerous empirical studies.

Bulavskaya and Reynès (2017) examined the impact of renewable energy on job creation in Netherlands using a neo-Keynesian CGEM Three-ME model. The authors concluded that the transition to renewable energy may create close to 50,000 jobs by 2030 thus contributing 1% to GDP. Khodeir (2016) established an inverse correlation between renewable electricity generation and unemployment rate in Egypt over the period 1989 and 2013 using

the ARDL approach. The study aimed to detect the effects in the short and long run during the study period, however, it has been found that the hypothesis was achieved in the long run only.

Bekmez and Ağpak (2016) investigated the relationship between non-hydro renewable energy and employment for a panel of 80 countries and concluded that there is unidirectional causality from employment to non-hydro renewable energy consumption for low to middle income countries and no causality for high income countries. The results therefore provide no support for the notion that renewable energy has a positive impact on unemployment.

Apergis and Salim (2015) investigated 80 countries from the period 1990-2013 using the advanced generation of unit root, cointegration and nonlinear Granger causality methodological approach in panel data. They obtained mixed results regarding the impact of renewable energy consumption on unemployment. However, total findings found that renewable energy consumption has a positive impact on unemployment, disaggregated data across specific regions, such as Asia and Latin America.

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Using the ARDL approach, Khodeir (2016) discovered an inverse relationship between renewable electricity generation and Egypt's unemployment rate between 1989 and 2013. During the study period, the study aimed to detect effects in both the short and long run; however, it was discovered that the hypothesis was only achieved in the long run. Bekmez and Apak (2016) investigated the relationship between non-hydro-renewable energy and employment for a panel of 80 countries. They found unidirectional causality from employment to non-hydro-renewable energy consumption in low to middle-income countries but no causality in high-income countries. As a result, the findings do not support the notion that renewable energy reduces unemployment. Apergis and Salim (2015) used an advanced generation of unit root, cointegration, and nonlinear Granger causality methodological approach in panel data to investigate 80 countries from 1990 to 2013. They got mixed results regarding the effect of renewable energy consumption on unemployment. However, overall findings revealed that renewable energy consumption positively impacted unemployment when data from specific regions, such as Asia and Latin America, were disaggregated.

Thayaparan (2014) investigated the impact of inflation and economic growth on unemployment in Sri Lanka. The study used annual time series data from the Central Bank of Sri Lanka (CBSL) annual reports from 1990 to 2012. The Augmented Dickey-Fuller (ADF) Test was used in this study to determine whether the series was stationary. The Granger Causality Test was used to determine the causal relationship between the variables. According to the unit root test results, only GDP is stationary on level, while unemployment and inflation are stationary at their first difference. The overall findings of this study concluded that inflation has a significant negative impact on unemployment in Sri Lanka, whereas GDP has a positive but insignificant impact on unemployment. Abdul-Khaliq et al. (2014) conducted an empirical study of the relationship between unemployment and GDP growth in nine Arab countries between 1994 and 2010. The pooled panel unit root tests were used in this study to test the stationery of the variables. The Pooled EGLS (Crosssection SUR) estimation methods were used to test the relationship between the variables. According to the study, economic growth significantly negatively impacts the unemployment rate. Existing literature explains the relationship between trade openness and the unemployment rate empirically. Mohler et al. (2018) investigated the link between international trade and Swiss unemployment. The study covered 1991 to 2008 and involved approximately 33,000 manufacturing workers. Using the panel regression technique, the study found an insignificant relationship between international trade and unemployment. Martes (2018) investigated the link between trade openness and unemployment rates in 28 OECD (Organization for Economic Cooperation and Development) countries. The panel regression estimation technique was used in the study, which spanned the years 2000 to 2016. The study's findings revealed that trade openness had a significant and negative impact on the unemployment rate in both the long and short run. Awad-Warrad (2018) investigated the impact of trade openness and economic growth on reducing unemployment in the Arab region. The research covered seven Arab countries (Algeria, Bahrain, Egypt, Jordan, Oman, Saudi Arabia, and Tunisia) from 1990 to 2015. The study found that trade openness and economic growth significantly reduced unemployment in the Arab region using the panel-weighted least square estimation technique.

According to Hala et al. (2021), the effect of the urban population on the unemployment rate is positive and significant; a 1% increase in the urban population results in a 4.06% increase in the unemployment rate. People in cities are limited to

working in industries, service providers, and government jobs, among other things. In contrast, people in villages have the opportunity to farm on various scales while their cost of living is lower.

Bouzid (2016) used youth unemployment to investigate the relationship between corruption and unemployment empirically. According to his research, corruption by government officials when hiring employees raises unemployment rates for workers and the youth. It leads to more corruption because those looking for work tend to pay bribes to officials to secure employment.

Chella and Phiri (2017) investigated the relationship between FDI, domestic investment and unemployment in South Africa. The (ARDL) model was applied to quarterly data between 1970 and 2014. The findings indicate that domestic investments have a negative impact on unemployment levels, whereas foreign direct investment appears to have little impact on unemployment levels. The summary of the literate review in this section is presented in Table 1 below.

3. METHODOLOGY

In this section, we introduce our econometric model and describe the ARDL form of the model. We proposed an unemployment model based on selected macroeconomic determinants based on past studies, and the equation can be shown in equation 1 below

$$UNP_t = f(GDP_t, FDI_t, ENY_t, DI_t, COR_t, INF_t, TO_t, URB_t) \quad (1)$$

where
UNP_t represents unemployment rates,
GDP_t represents economic growth,
FDI_t represents foreign direct investment,
ENY_t represent energy consumption,
DI_t represents domestic investment,
COR_t represents corruption,
INF_t represent inflation,
TO_t represents trade openness,
URB_t represents urbanization

The variables in equation 2 were transformed into log-linear forms (LN). The log version of the variables indicates the short-run and long-run elasticity. According to Shahbaz et al. (2012), the log version of the tested variables can produce a consistent and reliable estimation. The log version of the model derived from Equation 1.0 can be seen as follows:

$$\begin{aligned} LNUNP_t &= \delta_0 + \alpha_1 LNGDP_t + \alpha_2 LNFDI_t \\ &+ \alpha_3 LNENY_t + \alpha_4 LNDI_t + \alpha_7 LNCOR_t + \alpha_8 LNINF_t \\ &+ \alpha_9 LNTO_t + \alpha_{10} LNURB_t + \mu_t \end{aligned} \quad (2)$$

The ARDL model based on the Unrestricted Error Correction Model (UECM) is stated below:

$$\begin{aligned} \Delta LNUNP_t &= \beta_1 + \theta_0 LNGDP_{t-1} + \theta_1 LNFDI_{t-1} + \theta_2 LNENY_{t-1} \\ &+ \theta_3 LNDI_{t-1} + \theta_4 LNCOR_{t-1} + \theta_5 LNINF_{t-1} + \theta_5 LNTO_{t-1} \\ &+ \theta_6 LNURB_{t-1} + \sum_{i=1}^{a} \beta_i \Delta LNUNP_{t-i} + \sum_{i=0}^{b} \gamma_i \Delta LNGDP_{t-i} \\ &+ \sum_{i=0}^{c} \delta_i \Delta LNFDI_{t-i} + \sum_{i=0}^{d} \lambda_i \Delta LNENY_{t-i} + \sum_{i=0}^{e} \vartheta_i \Delta LNDI_{t-i} \\ &+ \sum_{i=0}^{f} \psi_i \Delta LNCOR_{t-i} + \sum_{i=0}^{g} \varpi_i \Delta LINF_{t-i} \\ &+ \sum_{i=0}^{h} \varsigma_i \Delta LNTOR_{t-i} + \sum_{i=0}^{i} \rho_i \Delta LNURB_{t-i} + \upsilon_t \end{aligned} \quad (3)$$

Where Δ is the first difference operator, and u_t is the white-noise disturbance term. Residuals for the UECM should be serially uncorrelated, and the model should be stable. This validation can be addressed with a series of diagnostic tests shown in the analysis section. The final version of the model represented in Equation (4.0) above can also be viewed as an ARDL of order (a b c d e f g h i). The expected sign for each independent variable towards the dependent variable is mixed. The model indicates that unemployment rates (LNUNP) can be influenced and explained by their past values. Hence, it involves other disturbances or shocks. From the estimation of UECM, the long-run elasticity is the coefficient of the one-lagged explanatory variable (multiplied by a negative sign) divided by the coefficient of the one-lagged dependent variable.

The coefficients of the first differenced variables capture the short-run effects. The null of no co-integration in the long-run relationship is defined by:

H_0: $\theta_0=\theta_1=\theta_2=\theta_3=\theta_4=\theta_5=\theta_6=\theta_{7=}\theta_{8=}0$ (there is no long-run relationship), is tested against the alternative of H_1: $\theta_0\neq\theta_1\neq\theta_2\neq\theta_3\neq\theta_4\neq\theta_5\neq\theta_6\neq\theta_7\neq\theta_8=0$ (there is a long-run relationship exists), employing the familiar F-test. The null hypothesis of no co-integration is rejected when the F statistic is larger than the upper bound value. After confirming the presence of long-run Bound cointegration, we can proceed with the short-run and long-run estimation.

This study uses annual data ranging from 1984 up to 2020 (36 years) as a sample period. A summary of the data and its sources is shown in Table 2.

4. RESULTS AND DISCUSSION

The analysis begins with testing the existence of a unit root for each variable. e used Augmented Dickey-Fuller (ADF) and Philip Perron Test (PP) for this purpose. Based on Table 3, we found mixed evidence of stationarity for both the ADF and PP tests. At level, LNFDI and LN TO are found to be stationary at 1% and 10% significant levels, respectively. Meanwhile, at first different, all variables are stationary except for LNURB if based on the ADF

Table 1: Summary of literature review

Authors	Findings
Johnny et al. (2018)	There is a negative and significant relationship between FDI and unemployment and a positive and significant relationship between capital formation and unemployment
Irpan et al. (2018)	The study discovered that FDI and GDP significantly influence and reduce Malaysia's unemployment rate
Grahovac and Softi (2017)	The analysis revealed that there has been a significant reduction in net investments since 2009
Khodeir (2016)	Discovered an inverse relationship between renewable electricity generation and Egypt's unemployment rate between 1989 and 2013. During the study period, the study aimed to detect effects in both the short and long run; however, it was discovered that the hypothesis was only achieved in the long run
Bekmez and Apak (2016)	Found unidirectional causality from employment to nonhydro renewable energy consumption in low to middle-income countries but no causality in high-income countries. As a result, the findings do not support the notion that renewable energy reduces unemployment
Apergis and Salim (2015) Apergis and Salim (2015)	They got mixed results regarding the effect of renewable energy consumption on unemployment. However, overall findings revealed that renewable energy consumption positively impacted unemployment when data from specific regions, such as Asia and Latin America, were disaggregated
Thayaparan (2014)	The overall findings of this study concluded that inflation has a significant negative impact on unemployment in Sri Lanka, whereas GDP has a positive but insignificant impact on unemployment
Abdul-Khaliq et al. (2014)	Economic growth has a significant negative impact on the unemployment rate
Mohler, Weder, and Wyss (2018)	Using the panel regression technique, the study found an insignificant relationship between international trade and unemployment
Martes (2018)	The study's findings revealed that trade openness had a significant and negative impact on the unemployment rate in both the long and short run
Awad-Warrad (2018)	The study found that trade openness and economic growth significantly reduced unemployment in the Arab region using the panel-weighted least square estimation technique
Hala, Mehdi, and Huseyin (2021)	The effect of the urban population on the unemployment rate is positive and significant
Bouzid (2016)	Corruption by government officials when hiring employees raises unemployment rates, workers and the youth, and it leads to more corruption because those looking for work tend to pay bribes to officials to secure employment
Chella and Phiri (2017)	The findings indicate that domestic investments have a negative impact on unemployment levels, whereas foreign direct investment appears to have little impact on unemployment levels

Table 2: Sources of data

Variables	Description	Sources
LNUNP	Unemployment rates (percentage)	WDI
LNGDP	GDP per capita (constant 2015 US$)	WDI
LNFDI	Foreign direct investment, net inflows (percentage of GDP)	WDI
LNENG	Energy use (kg of oil equivalent per capita)	WDI
LNDI	Gross fixed capital formation (percentage of GDP)	WDI
LNCOR	Corruption Perception Index	ICRG
LNINF	Inflation, consumer prices (annual percentage)	WDI
LNTO	Trade (% of GDP)	WDI
LNURB	Urban population growth (annual percentage)	WDI

WDI: World Development Indicator (2022); ICRG stands for International Country Risk Guide (2022)

unit root test. The mixed stationarity of these outcomes fulfils the conditions of ARDL estimation.

Next, to confirm the existence of long-run cointegrating in the purposed model, we need to check whether the F statistics of the model score higher than any upper bound values of 1, 5 or 10 % significant level. Based on Table 4, the F statistic recorded is 5.051, which is greater than 4.1, thus confirming the long-run presence of this model at a 1% significant level.

A series of diagnostic tests are performed to ensure reliability. Based on Table 5, all the probability values recorded are higher than the 10% significant level. Thus, it is confirmed that the model has no serial correlation problem, is well-functioned, and has no normality and heteroscedasticity issues. Besides, the stability of the model is also confirmed through CUSUM and CUSUMSQ tests where the blue dotted lines lie within the 2 dotted red lines.

The main outcomes are revealed in Table 6. Based on the short-run and long-run elasticities, a decrease in LNGDP at present lag could increase the unemployment rate by 1.84%. When economic growth is low, economic activities are slower, less profit for the business, and thus, not much job creation occurs. Thus, there is an increase in unemployment rates. This relationship, however, does not prolong in the long run, given that it is not significant at any level. LNFDI also exhibit a negative relationship with unemployment rates based on the previous 1-year lag. Statistically, a 1% increase in LNFDI reduces the unemployment rate by 0.03%. Higher FDI inflows will lead to more foreign companies opening, thus, more local workers are getting hired. In the long run, LNFDI indicate a positive and significant relationship with the level of unemployment rates. A 1% increase in LNFDI increases LNUNP by 0.08%. Next, we found that energy consumption, LNENG have a negative and significant relationship with LNUNP at 1% level. Statistically, a 1% increase in energy consumption will reduce the unemployment rate by 0.832%. This variable, however, fails to have any significant relationship with LNUNP in the long run. Low energy consumption means lower productivity in industries, thus decreasing productivity. As a result, companies cannot gain more income and limit their capabilities to hire new workers. Next, we found out that an increase in domestic investment could help reduce unemployment rates in both the short and long run. The magnitude of the impact seems to be greater in the short run compared to the long run. Specifically, a 1% increase in LNDI reduces the LNUNP by 0.312% and 0.40%, respectively. When the government increases their domestic investment, more government projects, such as fixing the road and buildings, will be available to the local contractor, creating more job opportunities for the people.

Table 3: Testing Augmented Dickey-Fuller and PP unit root

Level I (0)	ADF unit root		PP unit root	
	Intercept	Intercept and trend	Intercept	Intercept and trend
LNUNP	−2.299 (1)	−1.810 (1)	−1.712 (1)	−1.242 (2)
LNGDP	−0.977 (0)	−1.442 (0)	−0.957 (1)	−1.680 (2)
LNFDI	−5.022 (0)***	−5.084 (0)***	−5.022 (0)***	−5.082 (1)***
LNENC	−1.826 (2)	−1.576 (0)	−2.419 (12)	−1.357 (4)
LNDI	−1.312 (0)	−1.744 (0)	−1.312 (0)	−1.744 (0)
LNCOR	−1.813 (0)	−1.471 (0)	−1.800 (3)	−1.631 (3)
LNINF	−1.530 (0)	−1.663 (0)	−1.687 (4)	−1.655 (2)
LNTO	−2.760 (9)*	−0.912 (0)	−1.380 (3)	−0.797 (17)
LNURB	0.387 (1)	−2.406 (1)	0.708 (2)	−2.476 (0)
First difference I (1)	**ADF unit root**		**PP unit root**	
	Intercept	Intercept and trend	Intercept	Intercept and trend
LNUNP	−3.855 (3)***	−4.961 (4)***	−3.516**	−4.129**
LNGDP	−4.507 (0)***	−4.566 (0)***	−4.479 (1)***	−4.513 (1)***
LNFDI	−6.743 (1)***	−6.690 (1)***	−21.227 (26)***	−27.458 (34)***
LNENC	−4.781 (1)***	−5.116 (1)***	−6.225 (5)***	−13.498 (31)***
LNDI	−4.177 (0)***	−4.132 (0)**	−4.026 (4)***	−3.940 (5)**
LNCOR	−5.924 (0)***	−6.200 (0)***	−5.948 (3)***	−6.194 (3)***
LNINF	−3.903 (0)***	−4.528 (0)***	−3.978 (3)***	−4.530 (3)***
LNTO	−3.451 (0)**	−4.887 (0)***	−3.448 (4)**	−6.709 (34)***
LNURB	−1.768 (9)	−0.576 (0)	−4.279 (0)***	−4.544 (1)***

**and *5% and 10% of significant levels, respectively. The optimal lag length is selected automatically using the SIC for the ADF test, and the bandwidth was selected using the Newey–West method for PP. SCI: Schwarz info criteria, ADF: Augmented Dickey-Fuller

Table 4: Detecting the presence of long-run cointegration based on F stat

Model	Lag order	F statistics
LNUNP=f (LNGDP, LNFDI, LNENG, LNDI, LNCOR, LNINF, LNTO, LNURB)	1, 1, 2, 2, 0, 2, 2, 2, 2	5.051***
Critical values for F stat	**Lower I (0)**	**Upper (1)**
10 (%)	1.96	3.06
5 (%)	2.22	3.39
1 (%)	2.79	4.1

The critical values are based on Pesaran *et al*. (2001), Case III: unrestricted intercept and no trend. k is a number of variables equivalent to 8. **, *** represent 5% and 1% significance, respectively. Estimation is based on SC

Table 5: Diagnostic tests

A	B	C	D
Serial correlation (P)	Functional form (P)	Normality (P)	Heteroscedasticity (P)
1.082 (0.375)	1.541 (0.240)	0.033 (0.983)	1.072 (0.466)

The diagnostic test performed as follows Lagrange multiplier test for residual serial correlation; Ramsey's RESET test using the square of the fitted values; Based on a test of skewness kurtosis of residuals; Based on the regression of squared fitted values

Table 6: Short run and long run elasticities

Short run elasticities		Long run elasticities	
Variables	Coefficient	Variables	Coefficient
ΔLNGDP	−1.838***	LNGDP	−0.523
ΔLNFDI	0.003	LNFDI	0.082*
$\Delta LNFDI_{(-1)}$	−0.027**	LNENG	0.466
ΔLNENG	0.360	LNDI	−0.398***
$\Delta LNENG_{(-1)}$	−0.832***	LNCOR	−1.678***
ΔLNDI	−0.318**	LNINF	1.761**
ΔLNCOR	−0.520	LNTO	−3.172***
$\Delta LNCOR_{(-1)}$	0.396**	LNURB	1.803***
ΔLNINF	0.132	C	13.709***
$\Delta LNINF_{(-1)}$	−0.913**		
ΔLNTO	−1.147***		
$\Delta LNTO_{(-1)}$	0.737**		
ΔLNURB	0.715**		
$\Delta LNURB_{(-1)}$	−0.298		
$ECT_{(-1)}$	−0.799***		

***, **and *1%, 5% and 10% of significant levels, respectively

The level of corruption, LNCOR displayed a positive relationship with LNUNP in the short run. A 1% increase in LNCOR increases the LNUNP by 0.40%, based on the lag of 1 year before. Higher corruption rates contributed to higher unemployment rates in the country, indicating that some people with social status misused their power to recruit someone close to them. This is an unfair practice that should be avoided. The long-run elasticities, however, exhibit a contradicted expected sign, indicating a higher corruption level able to reduce unemployment rates. Whether the sign is positive or negative, both give a wrong message to the country, and it should be avoided as corruption triggers other economic problems. Statistically, a 1% increase in LNCOP led to a 0.40% increase in LNUNP in the short run and 1.68% in the long run.

Next, the level of inflation based on the previous one-year lag, LNINF, negatively correlates with LNUNP at a 5% significant level in the short run. However, in the long run, the expected sign changed to a negative, which indicates higher inflation led to lower unemployment rates. Despite the relationship between these two variables being quite unusual, it still provides some meaningful insight. Based on long-run elasticities, higher inflation increases the unemployment rates by 1.761%, thus indicating that as the cost of production and cost of living rises, the purchasing power of the people will be affected. This will reduce the market activities and thus increase the unemployment rates. The level of trade openness, LNTO at current lag incurred negative relationship in both the short and long run towards LNUNP. Statistically, a 1% increase in trade openness decreases unemployment by 1.15% and 3.17%, respectively. If the country managed to be more active in

international trading activities, this would facilitate more economic activities, thus creating more jobs and reducing unemployment rates. Lastly, we found that a higher level of urbanisation, LNURB, leads to a higher unemployment rate in the country. Statistically, a 1% increase in LNURB increases the LNUNP by 0.72% and 1.80%, respectively. Urbanisation has increased the migration of people from rural areas to main cities, especially among young people. This scenario led to an excessive supply of labour, thus increasing the level of unemployment rates. The negative and positive signs of error correction sign, ECT indicated that all the tested variables would be converged in the long run. This is important that the policy suggested in this paper is practical and reliable.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The purpose of this study is to investigate the relationship between energy consumption and the level of unemployment rates in Malaysia. The study utilizes both Augmented Dickey-Fuller (ADF) and Philip Perron Test (PP) methods to test for stationarity, and the results indicate that both methods have the same unit root that is stationary at 1% and 10%. The study further tests for long-run relationships between the variables through a co-integration test, which confirms the existence of such relationships. The cumulative sum chart is also used to monitor the trend throughout the process.

Based on the results of the study, it can be concluded that all variables significantly affect the level of unemployment rates in the short run, with different lag values and expected signs. Specifically, it is found that foreign direct investment (FDI) and inflation (INF) have a positive impact on unemployment rates, while domestic investment (DI), trade openness (TO), and corruption (COR) have a negative relationship in the long run.

The study offers several policy recommendations. Firstly, the government should ensure that foreign investors who set up operations in the country recruit local talent to work in their companies. This will support the government's policies on job creation from foreign direct investments. Secondly, the government should monitor the country's inflation level to prevent it from rising too much, which could negatively affect the citizen's wellbeing. Contractionary fiscal and monetary policies should be implemented, with special attention given to the level of unemployment rates.

Thirdly, policymakers should not overlook the development of economic sectors in rural areas, despite higher urbanization leading to lower unemployment rates. People are migrating from rural to urban areas to find better jobs and better pay, but job opportunities also need to be available for those who stay in rural areas.

Finally, higher domestic investment and trade openness facilitate economic activities and lead to more job opportunities. The government can stimulate the economy by spending more on improving infrastructure and providing subsidies to local entrepreneurs actively involved in international trade activities, leading to a multiplier effect on job creation and reducing unemployment rates. With regard to corruption, the government must impose severe punishment and practice fairness when offering job opportunities in the government sector. The use of influence, such as family members or connections, is not allowed, as it sends the wrong signal to society.

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