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The Effects of Oil Price Changes And Exchange Rate Volatility On Unemployment: Evidence From Malaysia

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Abstract

The study aims to examine the effects of oil price and exchange rate on unemployment in Malaysia. The empirical analysis commence by analyzing the time series property of data. The Johansen VAR-based co-integration technique was applied to examine the long run relationship between exchange rate, oil price and unemployment and found the long run relationship does exist. The vector error correction model was performed to check the short run dynamics and found that the short run dynamics are influenced by the estimated long run equilibrium. Granger causality was done and found that oil price does not affect unemployment but exchange rate has an influence on unemployment. Therefore, putting the exchange rate under control should be implemented to control unemployment.

Keywords: Oil Price; Exchange Rate; Unemployment

1. Introduction

Unemployment is a serious problem all over the world. Many problems occur because of high unemployment rates such as poverty. Unemployment is also one of the reasons behind the inexorable increase in crime rate in Malaysia (Tang, 2009). Policy makers should understand that the trend of unemployment differs depending on the status of the country. Unemployment in developing countries is higher than developed countries (Dogrul & Soytas, 2010). The unemployment rate is also higher in rural areas than in urban ones.

According to Dunaev (2005), unemployment is determined by real wage, labor utilization rate, money supply, and money velocity. Frenkel and Ros (2006) found that the exchange rate is a determinant of unemployment. Dogrul and Soytas (2010) stated that oil price is another factor that determines unemployment.

Oil price and exchange rate exhibit fluctuations in Malaysia. Past studies have addressed the effect of oil price and exchange rate on unemployment separately. However, no study exists regarding the simultaneous effect of these two fluctuating variables on unemployment. Several papers studied the effects of oil price and exchange rate on inflation

(Aliyu, 2009; Shaari, et al., 2012). This study aims to investigate the relationship between these two fluctuating variables (oil price and exchange rate) and unemployment in Malaysia

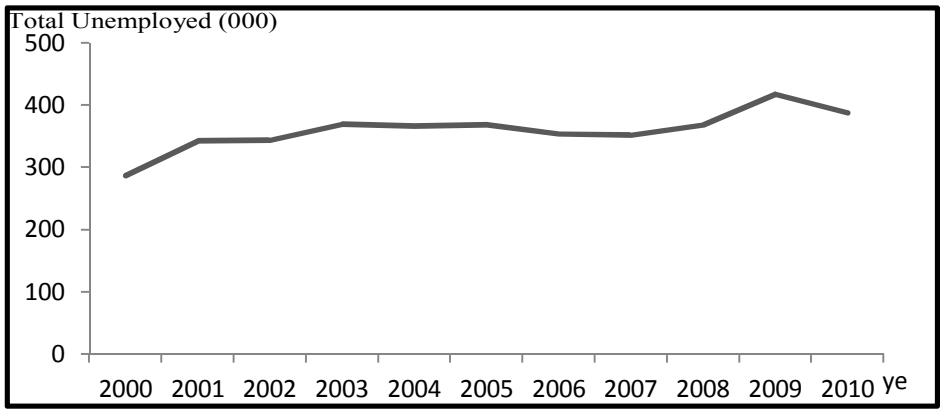
The increase in the price of oil in 2008 attracted many economists and policy makers to study the effect of oil prices on economies. Oil price plays a very important role in determining the economy of every country. Oil is the main commodity that generates growth in an economy. An increase in the price of oil should be taken seriously by governments. Oil price fluctuations cause many problems in an economy, such as high inflation, unemployment (Shaari, et al, 2012), and decline in GDP (Ling & Jones, 2011). Most studies agreed that oil price shocks contribute to higher unemployment rates (Dogrul & Soytas, 2010, Andreopoulos, 2006; Yau, 2010; Loschela & Oberdorferb, 2009; Jalles, 2009). Oil price increase can also contribute to an increase in the cost of production, which affects the number of employees. Industries are dependent on oil; thus, an increase in the price of oil will have major effects on production (Mellquist & Femermo, 2007). A higher cost of production because of a surge in the price of oil can cause people's rate of consumption to decrease. Employment is also dependent on aggregate demand or people consumption. A reduction in demand also contributes to higher unemployment (Andreopoulos, 2006).

Unemployment is also very sensitive to volatilities in the exchange rate. Volatilities are caused by the flexibility of the exchange rate market system. Duttagupta et al. (2005) believed that allowing some flexibility in the exchange rate can stimulate economic activities. However, Ragan (2008) argued that a fixed exchange rate would reduce economic volatilities. This statement is supported by Stone et al. (2008). The volatility of exchange rates causes unemployment to increase via lower investments in physical capital. High volatility can prompt a reduction in investment. High volatilities in the exchange rate usually cause uncertainty, thus reducing investment (Feldmann, 2011). Belke and Gros (2001) stated that an increase in the exchange rate can cause firms to delay job creation because of uncertainty in future earnings.

2. Trends of total unemployment, oil price, and exchange rate in Malaysia

Figure 1 shows the trend of total unemployment in Malaysia from 2000 to 2010. The highest unemployment recorded was in 2009 with 418, 000 people unemployed. This number increased by 45, 000 from that in 2008 because of the financial crisis and fuel crisis. In 2010, total unemployment decreased to 387, 900. This proved that the economy recovered from the crises because of policies implemented by the government. In 2000, total unemployment was very low with only 286, 900 unemployed. The number of unemployed started increasing in 2006.

Figure 1: Total Unemployment in Malaysia.

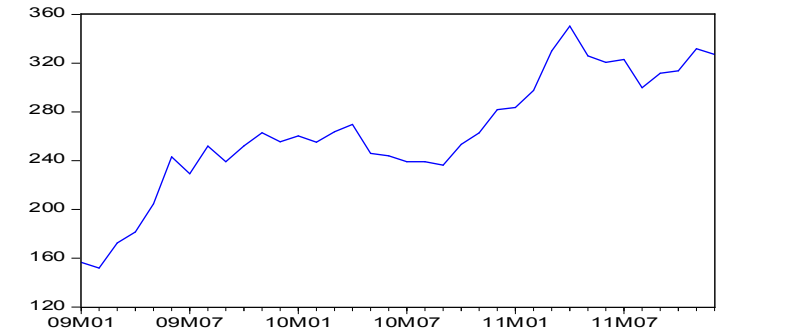


Source: Malaysian Economic Statistic

A large increase in the price of oil in 2008 exerted pressure on the Malaysian economy even though Malaysia is an oil producing country. The largest increase (41%) occurred in June 2008 and had a detrimental effect on the Malaysian economy. The issue of oil price has not been resolved. The opposition party used the issue on oil to win votes from the people. During this time, government subsidies to maintain the price of oil became unfeasible. Fluctuations in global crude oil prices in 2010 caused domestic oil price to increase in tandem. The issue of oil price is still being debated among politicians and economists to this day.

Figure 2 shows the trend of oil price in Malaysia from January 2009 to December 2011. This figure indicates that Malaysia faced oil price fluctuations during this period. The highest oil price was recorded in April 2011. During this period, oil price hit RM350.44 per barrel. The lowest price in that period was recorded in February 2009 at RM151.95 per barrel.

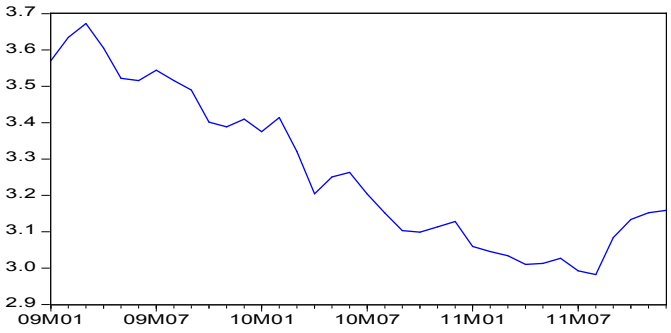
Figure 2: Oil Price in Malaysia From january, 2009 to December, 2011



Source: Index Mundi

Asian countries slid into recession in 1998 with exchange rates reaching all-time lows. The Malaysian government was forced to fix exchange rates to mitigate the effect. The recession caused many workers to be laid off. The effect of exchange rate fluctuations to the economy was very fatal. High exchange rates can also cause higher unemployment. An increase in the value of currency can reduce exports. Low exports correspond to high unemployment rates.

Figure 3: Real Exhange Rate in Malaysia from January, 2009 to December, 2011



Source: Index Mundi

Figure 3 shows the real exchange rate of Malaysia from January 2009 to December 2011. This figure reveals that the exchange rate steadily increased during this period. The highest exchange rate was recorded in March 2009 at USD 3.67, which is much higher compared with August 2011 at USD 2.99. In 2011, the real exchange rate steadily increased from January to December.

3. Literature review on methodology

Most previous studies employed vector autoregression (VAR) to examine the relationships between related variables (Berument et al., 2008; Loschel & Oberdorfer, 2009; Jalles, 2009; Aliyu, 2009; Shaari et al., 2012). Loschel and Oberdorfer (2009) analyzed the effects of oil price on unemployment in Germany from 1973 to 2008 using VAR The findings show that an increase in the price of oil increases the unemployment rate in the labor market.

Jalles (2009) evaluated the influence and effect of oil price fluctuations and shocks on aggregate economic performance, industrial production index, and inflation rate. The multivariate VAR approach was employed. The results show that variations on the price of oil have significant effects on inflation for the second time interval and unemployment rate. The magnitude of the coefficients became smaller in the subsample, implying that macroeconomic aggregates are gradually less reactive to oil price fluctuations and shocks. The result from the Granger causality test show that a causal relationship exists between oil price, inflation rate, unemployment rate, and industrial production index.

Johansen co-integration was used by Aliyu (2009) to examine the effect of oil price shocks and real exchange rate volatilities on the real economic growth of Nigeria using quarterly data from 1986 to 2007. The Johansen VAR-based co-integration method was employed. The results show that all coefficients are correctly signed, thus implying a positive relationship between the variables. Short-run vector error-correction model (VECM) was also used. This model confirmed that real GDP has an automatic adjustment mechanism and that the economy responds to deviations from the equilibrium in a balanced manner. Granger causality results explain that oil price and exchange rate affect GDP. Shaari (2012) employed the same approaches in an economic study of Malaysia to examine the effects of oil price shocks and real exchange rate volatilities on inflation. VARbased co-integration and VECM tests reveal the same results;however, Granger causality tests show that inflation is not affected by exchange rate but byoil price.

Berument et al. (2008) investigated the effects of macroeconomic policy shocks on total unemployment in Turkey and measured the differential responses of unemployment in economic sectors from January 1988 to April 2004. The study employed a VAR model with recursive order. The findings show that a relationship exists between income shock and unemployment in all economic activity groups during the initial periods, except for unemployment in the sectors of mining, manufacturing, construction, wholesale/retail trade, transportation, finance, and insurance. Price shock is positively correlated with unemployment in the long term except for mining and community services. Interest rate shocks do not show any significant relationship with unemployment.

Tunah (2010) used Johansen co-integration and Granger causality to examine the cause of unemployment in Turkey. The results reveal that a relationship exists between GDP, inflation, exchange rate, and unemployment for the long term. In the short term, only real GDP and inflation Granger caused unemployment. Dogrul and Soytas (2010) applied the Toda–Yamamoto causality test to investigate the causality between unemployment, crude oil price, and real interest rate in Turkey. The results show that real prices and interest rates can improve unemployment forecasts.

According to Andreopoulos (2006), real interest rates do not affect US unemployment dynamics in the long term, whereas real oil prices influence US unemployment in the long and short term. Thus, real oil price is an important factor of recession. The study applied a Markov switching VAR method by using data from 1970 to 2005

Yau (2010) examined the dynamic relationship between capital stock, GDP, employment, and oil price by using structural VECM impulse response and variance decomposition analysis. The study found that oil price has adverse effects on capital stock, GDP, and employment. Unemployment, GDP, domestic investment, and capital stock reached their lowest value before recovering in 2010. However, oil price was found to have a detrimental effect on price level and a negative effect on money supply, thus exacerbating unemployment.

Industrial countries are highly dependent on oil; thus, an increase in oil price exerts pressure on the economy of these countries. Mellquist and Femermo (2007) examined how the price of oil affects the unemployment rate in Sweden. Quarterly data from 1980 to 2004 were used and the study employed linear regression analysis with current changes in the variables and Granger causality tests. The linear regression analysis with current changes in the variables found a positive relationship between oil price and unemployment. Some of the coefficient estimates are positive and some are negative in the Granger causality regressions. Therefore, whether an increase in the price of oil has a positive or negative effect on unemployment cannot be determined.

Fluctuations in the exchange rate are also a problem in Asian countries. Some Asian countries were hit by the financial crisis even when their exchange rate was floated. Chimnani et al. (2012) investigated the effect of exchange rates on unemployment rates in Asia by using an unbalanced panel of data from ten countries, namely, Pakistan, India, China, Japan, Bangladesh, Argentina, Algeria, Brazil, Colombia, and Sri Lanka from 1995 to 2005. The study employed the ordinary least squares model and ascertained that real exchange rate has a positive effect on unemployment rates in Asian countries. The authors suggested that the exchange rate should be controlled to control unemployment

Feldmann (2011) studied the effect of exchange rate volatility on unemployment in all major industrial countries. Data from 1982 to 2003 were collected. The study used a generalized autoregressive conditional measure of conditional volatility as a proxy for uncertainty. The results explain that the coefficient of exchange rate volatility is significant, thus indicating that higher volatility corresponds to unemployment. The possibility of reverse causality was also examined. Four regressions were performed with the unemployment rate as the explanatory variable and the exchange rate as the dependent variable. The results show that causality from unemployment to exchange rate is nonexistent. However, exchange rate volatility adversely affects unemployment.

4. Methodology

This study conducted an empirical analysis on three variables, namely, oil price, exchange rate, and unemployment. Monthly data from 2009 to 2011 were collected to determine the relationship between oil price, exchange rate, and unemployment. Equation 3.1 expresses the estimating equation used in this study:

$$U_t = \beta_0 + \beta_1 OIL_t + \beta_2 EX_t + \varepsilon_t \qquad (3.1)$$

Where U_t is unemployment, OIL_t is oil price, and EX is exchange rate. To obtain the best results, the equation must show all variables to determine the percentage of change in the dependent variable when the independent variable changes approximately by one percent.

$$\ln U_t = \beta_0 + \beta_1 \ln OIL_t + \beta_2 \ln EX_t + \varepsilon_t \qquad (3.1)$$

Unit root test, Johansen co-integration test, VECM, and Granger causality were applied. Unit root test was employed to determine the stationary series in the level and in the first difference test using the augmented Dickey–Fuller (ADF) test. The variable series is stationary and does not have a unit root test; thus, the null hypothesis is rejected and an alternative hypothesis is accepted. If the stationary test is not statistically significant, meaning that the variable series is non-stationary, the variables have a unit root test (null hypothesis will be accepted). The hypothesis in this test is presented as follows:

$H_0 : \delta = 0$ (unit root test / not stationary)
$H_1 : \delta \neq 0$ (no unit root test / stationary)

If the value of the t-statistic is greater than the critical value of the ADF, the null hypothesis is not rejected (unit root test exists). However, if the t-statistic is less than the critical value of the ADF, the unit root test does not exist (the null hypothesis is rejected). First, the unit root test was performed in level (unit root test in level with constant and unit root test in level with constant and trend). Thereafter, the unit root test was conducted in the first difference (unit root test in first difference with constant and unit root test in first difference with constant and trend). Equations 3.2, 3.3, and 3.4 express the equations in level without constant and trend, in level with constant only, and with constant and trend, respectively.

Without constant and trend

$$\Delta Yt = \delta Yt - 1 + Ut \quad (3.2)$$

With constant only

$$\Delta Yt = \alpha + \delta Yt - 1 + Ut \quad (3.3)$$

With constant and trend

$$\Delta Yt = \alpha + \beta T + \delta Yt - 1 + Ut \quad (3.4)$$

The co-integration test was also used in this study to examine the long-term relationship between all variables (crude oil price, consumer price index, and exchange rate). Two approaches were used in this co-integration test. The hypothesis for this study is presented as follows:

H0:δ=0(not stationary for $\hat{\mu}_t$ or not co-integrated if $t_\delta > \tau$)
H1:δ<0(stationary for $\hat{\mu}_t$ or have co-integrated if $t_\delta < \tau$)

Where $\hat{\mu}_t$ is an error term and τ is a critical t-statistic in this model. The Engle–Granger procedure was used to examine the stationary variable series in level of the residual term. However, the Engle–Granger procedure does not settle the problem if many variables are co-integrated. We assumed that only one vector has co-integration. Therefore, the Johansen test was used in this study to solve the problem by using the VAR system. The VECM was used to examine the dynamic behavior of the model. The VECM explains that the examined model adjusts towards its long-term equilibrium in each time period, thus indicating that the disequilibrium will converge to a long-term equilibrium state. The VECM was also used to determine the relationship between the variables in the short term. Equation 3.5 shows the VAR equation.

$$Y_t = \sum_{j=1}^{k} A_j Y_{t-j} + \mu_t \quad (3.5)$$

After the co-integration test, the vector error-correction (VEC) Granger causality/block exogeneity Wald test was employed to examine the causal relationship between two variables. The causality test determines the reaction between two variables. If variable X Granger causes Y and Y also Granger causes X, the value after X and Y can help predict the value for the next period of Y and X, respectively. Equations 3.6 and 3.7 show the formula for the Granger causality-regression test for a two-way variable.

$$Y_t = \sum_{i=1}^{p} \sigma_i Y_{t-1} + \sum_{i=1}^{q} \beta_j X_{t-j} + \mu_{1t} \quad (3.6)$$

$$X_t = \sum_{i=1}^{p} \gamma_i Y_{t-1} + \sum_{i-1}^{q} \delta_j X_{t-j} + \mu_{2t} \quad (3.7)$$

5. Findings

The empirical results of the study is discussed and interpreted in this section. Monthly data from 2009 to 2011 were used for the variables. Unemployment is the dependent variable, and exchange rate and oil price are the independent variables. A unit root test based on the ADF test was conducted to measure the stationarity properties of the time series data. Thereafter, the Johansen co-integration test was employed to examine the existence of a long-term

relationship between unemployment, oil price, and exchange rate. VECM was used to determine the effects of oil price shocks and exchange rate volatilities on unemployment rates. VEC Granger causality/block exogeneity Wald test was used to examine the relationship between the variables.

Table 1: ADF Unit Root Test Results

Variables	Intercept		Intercept + Trend	
	Level	First Difference	Level	First Difference
U	−0.434 (0.884)	−8.284*** (0.000)	−1.837 (1.000)	−8.311*** (0.000)
OIL	−1.802 (0.374)	−5.939*** (0.000)	−2.236 (0.456)	−6.044*** (0.000)
EX	−1.353 (0.594)	−4.923*** (0.000)	3.091 (1.000)	−6.608*** (0.000)

***, **, and * indicate the rejection of the null hypothesis of non-stationary time series data at 1%, 5%, and 10% significance level, respectively.

Table 1 shows the results of the unit root test based on the ADF test. Unit root tests are crucial in examining the stationarity properties of time series data. The results indicate that all variables are non-stationary in levels and stationary in first differences at one percent.

Table 2: Co-integration Test

Rank	Max–Eigen Statistic	Critical Value (Eigen) at 5%	Trace Statistic	Critical Value (Trace) at 5%
r*= 0	22.101	21.132	30.915	29.797
r ≤ 1	6.084	14.265	8.814	15.495
r ≤ 2	2.730	3.8415	2.730	3.841

Note: The likelihood ratio test indicates three co-integrating equations at the 0.05 level.

The main focus of this paper is to assess whether oil price and exchange rate react to unemployment in the long term. To test the long-term equilibrium relationship between the variables, the co-integration test was used in this study. The results are shown in Table 2. Optimal lag selection was conducted based on the Akaike Information Criterion (AIC). The lag length for the Johansen co-integration test minimizes the AIC. The result shows that one co-integrating equation exists at 5%. Therefore, a long-term equilibrium relationship exists between unemployment, oil price, and exchange rate. The t-trace statistic value is 30.915, which is higher than the critical value (trace) of 29.797 at five percent significance level. This trace statistic shows that the variables have a long-term relationship at a 5% significance level. For the Max–Eigen statistic, the result shows that the relationship between the variables in the long term is at a five percent significance level. The Max–Eigen statistic at 22, 101 is higher than the critical value (Eigen) at 21.132 at a 5% level.

Table 3: VECM

	Coefficient	Standard Error	t-value
ECM(−1)	−0.931***	0.181***	−5.139***
ΔOIL(−1)	−0.204	0.210	0.968
ΔEX(−1)	190.683***	65.928***	2.892***
C	1.453	3.268	−0.445
R^2	0.615	D.W statistic	2.160
Adj R^2	0.561	F-Statistic	11.561

***, **, and * indicate the rejection of the null hypothesis of non-stationary time series data at 1%, 5%, and 10% significance level, respectively.

The VECM analyzed the relationship between oil price, exchange rate, and unemployment. Optimal lag selection was conducted to choose which lag shows the best model. The lowest AIC was chosen. Table 3 shows that the error correction coefficient is −0.930 and statistically significant at 1%. This result confirms that a long-term relationship exists between the variables. The coefficient of exchange rate is statistically significant, meaning that the exchange rate influences the unemployment rate in the short term. The coefficient of oil price is not significant, meaning that oil price does not affect unemployment in the short-term.

Table 4: Diagnostic test

Normality test	Jarque–Bera: 1.039	Prob.: 0.595
B-G test	Obs*R-squared: 1.589	Chi-Square: 0.452
ARCH	Obs*R-squared: 0.516	Chi Square: 0.473

Note: *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Based on the diagnostic test in Table 4, the result suggests that the model does not suffer from autocorrelation and heteroskedasticity. The series is normally distributed because the null hypothesis is rejected. Therefore, the result from the model is reliable.

Table 5: VEC Granger Causality/ Block Exogeneity Wald Tests

Dependent variable	Short-term causality (Wald test)			
	ΔOIL	ΔEX	ΔU	All
ΔU	0.938 (0.333)	8.338*** (0.000)	-	10.025** (0.006)
ΔEX	0.085** (0.771)	-	0.145 (0.771)	0.246 (0.8841)
ΔOIL	-	0.202 (0.653)	0.400 (0.527)	0.490 (0.783)

Note: *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 5 presents the VEC Granger causality/block exogeneity Wald tests. When unemployment is a dependent variable, only the variable of the exchange rate is significant at 1% and Granger causes unemployment in the short term. Oil price is not significant and does not Granger cause unemployment in the short term. The entire model with unemployment as the dependent variable is statistically significant at 5%.

Conclusion

This paper investigated the relationship between oil price, exchange rate, and unemployment. Empirical analysis was used to obtain the results. The ADF unit root test was conducted. All variables were found to be non-stationary in level and stationary in first difference. VAR with the co-integration model show that a relationship exists between oil price, exchange rate, and unemployment. Co-integrating the equation of unemployment yields a negative coefficient and significance. This result confirms that a relationship exists between the variables in the long term. The analysis also suggests that the exchange rate influences the unemployment rate in the short term. The diagnostic test shows that the model is free from heteroskedasticity and autocorrelation. The VEC Granger causality/block exogeneity Wald tests show that oil price does not influence unemployment. Exchange rate causes unemployment. This result conforms to the earlier result obtained by Chimnani et al. (2012).

This paper will be instrumental in the formulation of policies to ensure that high unemployment will not occur. Any policy regarding oil price control is not necessary to be formulated because oil price fluctuations do not influence unemployment. However, oil price fluctuations might cause other problems that are not incorporated in this study, such as inflation as investigated by Shaari et al. (2012). Any policy pertaining to exchange rates should be seriously addressed to avoid higher unemployment because of fluctuations. Therefore, the exchange rate should be regulated to control unemployment.

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