

**TITLE: MACROECONOMIC RESPONSES TO OIL  
PRICE CHANGES AND VOLATILITY**

**BY:  
SOONG FUI KIUN  
(EGA99045)**

**SUBMITTED TO THE FACULTY OF ECONOMICS  
AND ADMINISTRATION, UNIVERSITY OF MALAYA  
IN PARTIAL FULFILLMENT OF THE REQUIREMENT  
FOR THE DEGREE MASTER OF ECONOMICS**

**NOVEMBER 2001**

Perpustakaan Universiti Malaya



A511374560

## Abstract

Petroleum is the third factor of production and is expected to remain so as Malaysia targets to achieve full industrialization in twenty years time. It is therefore, crucial to understand the impact of oil price on the macroeconomy. Thus, this paper attempts to examine the **short-run dynamics** of industrial production, interest rates and, stock market activity, in relation to oil price changes **and** oil price volatility by using the vector autoregressive (**VAR**) model. Volatility is modeled using the Generalised Autoregressive Conditional Heteroskedasticity (**GARCH**) model. Systematic shocks are introduced and the impacts of anticipated and unanticipated oil price changes are analyzed using the using **impulse response functions** and **variance decompositions**. The results indicate that the effects the unanticipated increase in oil prices has longer and more profound negative impact on the economy than do the anticipated changes.

The system needs typically a period of 6 to 7 months to adjust to impacts of anticipated oil changes, whereas a period of 10 months to a year is common for completion of adjustment to unanticipated changes. Anticipated oil price changes can explain a higher proportion of the forecast variance of the macroeconomic variables compared to unanticipated changes.

<b>Contents</b>	<b>Page</b>
<b>Abstract</b>	i
<b>Contents</b>	ii
<b>List of Tables</b>	v
<b>List of Figures</b>	vi
<b>Chapter 1: Introduction</b>	1
1.1. Objectives	2
1.2. Organization of Study	3
<b>Chapter 2: Literature Review</b>	5
2.1. Oil and the Macroeconomy	5
2.2. Oil Price Asymmetries	6
2.3. Oil and Employment	7
2.4. Oil and the Financial Sector	11
<b>Chapter 3: Methodology</b>	16
3.1. Data and Definition of Variables	16
3.2. Test of Unit Root, Order of Integration and Cointegration	17
3.3. Vector Autoregression (VAR)	21
3.3.1. Impulse Response Function (IRF)	23
3.3.2. Variance Decomposition (VDC)	24
3.3.3. Variance-Covariance and Correlation Matrices of Residuals	25

	<b>Page</b>
3.4. Oil Price Volatility	27
3.4.1. GARCH models	27
3.4.2. Testing for ARCH Effects	28
3.4.3. Responses to Oil Price Volatility	30
<b>Chapter 4: Empirical Results to Responses to Oil Price Changes</b>	<b>31</b>
4.1. Empirical Results: Unit Root, Order of Integration and Cointegration	31
4.2. The Estimated Vector Autoregression (VAR)	35
4.2.1. Empirical Results: Impulse Response Function	40
4.2.2. Empirical Results: Variance Decomposition	44
<b>Chapter 5: Empirical Results for Responses to Oil Price Volatility</b>	<b>48</b>
5.1. The Estimated GARCH model	48
5.2. The Estimated Vector Autoregression (VAR) model	50
5.2.1. Empirical Results: Impulse Response Function (IRF)	52
5.2.2. Empirical Results: Variance Decomposition (VDC)	55
<b>Chapter 6: Conclusion and Implications</b>	<b>59</b>
6.1. Objectives of This Study	59
6.2. Summary of Results	59
6.3. Implication of the Results of the Study	61
6.4. Recommendation for Future Research	62

	<b>Page</b>
<b>Bibliography</b>	63
<b>Appendix I: IRF &amp; VDC Analysis of Oil Price Changes with Different Orderings</b>	65
<b>Appendix II: IRF &amp; VDC Analysis of Oil Price Volatility with Different Orderings</b>	74

<b>List of Tables</b>	<b>Page</b>
4.1. The Augmented Dickey-Fuller test statistics for lnppi, lnipi, Intbill and rsr	32
4.2. Johansen test for Cointegration for lnppi, lnipi, Intbill and rsr	34
4.3. Akaike Information Criteria and Bayesian Schwarz (BIC) for VAR(p)	36
4.4. Unrestricted VAR(2)	37
4.5. Variance-Covariance Matrix of Residuals of VAR(2)	38
4.6. Correlation Matrix of Residuals of VAR(2)	38
4.7. Variance Decomposition Analysis due to an Innovation in oil price, industrial production, interest rate and real stock returns	45
5.1. GARCH(1,1) for modelling oil price growth: Preliminary Model	49
5.2. GARCH(1,1) for modelling oil price growth: Final Model	49
5.3. Akaike Information Criteria and Bayesian Schwarz (BIC) for VAR(p)	50
5.4. Unrestricted VAR(3)	51
5.5. Variance-Covariance Matrix of Residuals of VAR(3)	52
5.6. Correlation Matrix of Residuals of VAR(3)	52
5.7. Variance Decomposition Analysis due to an Innovation in oil price volatility, industrial production, interest rate and real stock returns	56

<b>List of Figures</b>	<b>Page</b>
4.1. The Responses due to One Standard Deviation Shock to Oil Price Changes	41
5.1. The Responses due to One Standard Deviation Shock to Oil Price Volatility	53