The Macroeconomic Effects of Oil Price Shocks on ASEAN-5 Economies

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Economics Research Workshop
Bank Negara Malaysia

9 November 2015
Outline

1. Introduction
   - Background: ASEAN-5’s Exposure to Oil Market
   - Objective

2. The Evolution of the Global Oil Market
   - Oil Price Shocks
   - ASEAN-5 and Oil Shock Transmission Mechanism

3. Econometric Framework
   - SVAR Framework
   - Model Specifications

4. Empirical Analysis
   - Global Oil Price
   - Responses of ASEAN-5 to Various Oil Shocks

5. Conclusion
ASEAN-5’s Exposure to Oil Market

- **ASEAN-5** - Indonesia, Malaysia, the Philippines, Singapore and Thailand
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Presenter: Mala Raghavan

Oil Price and ASEAN-5

9 November 2015
ASEAN-5’s Exposure to Oil Market

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- **Trade intensity** = imports plus exports as a percentage of GDP
  - high integration into global production chains - can be heavily influenced by developments in global activities
- **Oil self-sufficiency** = oil production less consumption over oil consumption
  - highlighting the oil dependency - net oil exporter or net oil importer
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- WHY???
The focus of this paper

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- to identify an appropriate operational conduct for monetary policy when facing with oil price shocks.
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Oil price movements are almost synonymous to the movements in global economic activity until 2010. From 2010 onwards, however, the oil price kept rising despite the weakening of global economic activities.
Drivers of oil price

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From 2010 onwards, however, the oil price kept rising despite the weakening of global economic activities.
Three main drivers of oil price shocks as defined by Killian (2009)

- **Oil Supply Shock**
  - Driven by oil supply disruption.

- **Oil Demand Shock**
  - Driven by global economic activities.

- **Oil-Specific Demand Shock**
  - Driven by expectations about the future changes in oil conditions.

The economic consequence of each of these shocks are very different; relevant to monetary policy makers for devising appropriate monetary policy measures.
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ASEAN-5 and Oil Shock Transmission Mechanism

World Oil Production → World Oil Price → World Oil Demand

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Assess the macroeconomic effects of each shock on ASEAN-5:
- Indonesia, Malaysia, the Philippines, Singapore and Thailand

Macroeconomic Variables:
- Trade Balances, Output, Inflation and Exchange Rates

Monetary policy responses

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Monetary policy responses
### Choice of Variables and Period of Study

- **Period of study:** January 2000 to December 2013 (168 Observations)

### Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil Block</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$os_t$</td>
<td>Global Oil Production</td>
<td>Percentage change per annum</td>
</tr>
<tr>
<td>$ga_t$</td>
<td>Global Real Activity</td>
<td>Deviation from trend</td>
</tr>
<tr>
<td>$op_t$</td>
<td>World Oil Price Index,</td>
<td>Percentage change per annum</td>
</tr>
<tr>
<td><strong>Domestic Block</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$tb_t$</td>
<td>Real Trade Balance</td>
<td>SA and detrended</td>
</tr>
<tr>
<td>$y_t$</td>
<td>Industrial/Manufacturing Production</td>
<td>Logs, SA and detrended</td>
</tr>
<tr>
<td>$\pi_t$</td>
<td>Consumer Price Index</td>
<td>Percentage change per annum</td>
</tr>
<tr>
<td>$r_t$</td>
<td>Inter-Bank Rate/TBR</td>
<td>Percentage</td>
</tr>
<tr>
<td>$q_t$</td>
<td>Real Effective Exchange Rate</td>
<td>Logs, SA and detrended</td>
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</tbody>
</table>

Sources of Data - US Energy Information Website; Kilian - UM Personal Website; Spot Oil Price: West Texas, Datastream
Structural Vector Autoregressive (SVAR) Framework

SVAR(p)

\[ X_t = A_1 X_{t-1} + \ldots + A_p X_{t-p} + \varepsilon_t \] (1)

\( X_t \) is a \((n \times 1)\) vector of variables

\( A_i \) is a \((n \times n)\) coefficient matrix for \( i = 0, 1, \ldots, p \).

\[ E(\varepsilon_t) = 0 \]

\[ E(\varepsilon_t \varepsilon_t') = \Sigma \]

\( \Sigma \) is a diagonal matrix containing the variances of the structural disturbances.
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SVAR Framework

SVAR(4)

A_0X_t = A_1X_{t-1} + \ldots + A_4X_{t-4} + \varepsilon_t

X_t = (X_1, t, X_2, t);

\varepsilon_t = [\varepsilon_{1, t}, \varepsilon_{2, t}]

X_1, t = [os_t, ga_t, op_t] - Oil block

X_2, t = [tb_t, yt_t, \pi_t, rt_t, qt_t] - Domestic block

Model interactions between the three oil variables (Killian 2009)

Model interactions with each of the economy - Foreign block

exogeneity restrictions

New Keynesian Theory to impose short run restrictions on the contemporaneous structure and empirical dynamics of the domestic variables;
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- New Keynesian Theory to impose short run restrictions on the contemporaneous structure and empirical dynamics of the domestic variables;
Identification of the Contemporaneous Matrix

\[
A_0 = \begin{bmatrix}
1 & 0 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & | & 0 & 0 & 0 & 0 & 0 \\
\vdots & \vdots & \vdots & | & \vdots & \vdots & \vdots & \vdots & \vdots \\
0 & 0 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
\end{bmatrix}
\]

(2)
Identification of the Contemporaneous Matrix

\[
A_0 = \begin{bmatrix}
1 & 0 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & | & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & | & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & a_{43} & | & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & | & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & a_{73} & | & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & a_{83} & | & 0 & 0 & 0 & 0 & 1
\end{bmatrix}
\]

(2)
Identification of the Contemporaneous Matrix

\[ A_0 = \begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0^{(0)} & 1 & 0 & 0 & 0 & 0 & 0 \\
0^{(0)} & 0^{(0)} & 1 & 0 & 0 & 0 & 0 \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
0 & 0 & 0 & 0^{(0)} & 1 & 0 & 0 \\
0 & 0 & 0 & 0^{(0)} & 0 & 1 & 0 \\
0^{(0)} & 0^{(0)} & 0^{(0)} & 0^{(0)} & 0^{(0)} & 0^{(0)} & 1 \\
\end{bmatrix} \] (2)

Generate

- Impulse response function (IRF)
Identification of the Contemporaneous Matrix

\[ \mathbf{A}_0 = \begin{bmatrix}
1 & 0 & 0 & | & 0 & 0 & 0 & 0 & 0 & 0 \\
\alpha^{(0)}_{21} & 1 & 0 & | & 0 & 0 & 0 & 0 & 0 & 0 \\
\alpha^{(0)}_{31} & \alpha^{(0)}_{32} & 1 & | & 0 & 0 & 0 & 0 & 0 & 0 \\
\cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\
\alpha^{(0)}_{41} & \alpha^{(0)}_{42} & \alpha^{(0)}_{43} & | & 1 & 0 & 0 & 0 & 0 & 0 \\
\alpha^{(0)}_{51} & \alpha^{(0)}_{52} & \alpha^{(0)}_{53} & | & \alpha^{(0)}_{54} & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & \alpha^{(0)}_{63} & | & \alpha^{(0)}_{64} & \alpha^{(0)}_{65} & 1 & 0 & 0 & 0 \\
0 & 0 & \alpha^{(0)}_{73} & | & 0 & \alpha^{(0)}_{75} & \alpha^{(0)}_{76} & 1 & 0 & 0 \\
\alpha^{(0)}_{81} & \alpha^{(0)}_{82} & \alpha^{(0)}_{83} & | & \alpha^{(0)}_{84} & \alpha^{(0)}_{85} & \alpha^{(0)}_{86} & \alpha^{(0)}_{87} & 1 & 0 \\
\end{bmatrix} \tag{2} \]

Generate

- Impulse response function (IRF)
- Historical decomposition (HDC)
### Identification of the Contemporaneous Matrix

\[
A_0 = \begin{bmatrix}
1 & 0 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
\alpha_{21}^{(0)} & 1 & 0 & | & 0 & 0 & 0 & 0 & 0 \\
\alpha_{31}^{(0)} & \alpha_{32}^{(0)} & 1 & | & 0 & 0 & 0 & 0 & 0 \\
\hline
\hline
\alpha_{41}^{(0)} & \alpha_{42}^{(0)} & \alpha_{43}^{(0)} & | & 1 & 0 & 0 & 0 & 0 \\
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0 & 0 & a_{73}^{(0)} & | & 0 & a_{75}^{(0)} & a_{76}^{(0)} & 1 & 0 \\
\alpha_{81}^{(0)} & \alpha_{82}^{(0)} & \alpha_{83}^{(0)} & | & a_{84}^{(0)} & a_{85}^{(0)} & a_{86}^{(0)} & a_{87}^{(0)} & 1 \\
\end{bmatrix}
\]  

(2)

### Generate

- Impulse response function (IRF)
- Historical decomposition (HDC)
- Variance decomposition (VDC)
Responses of global oil price to oil supply, oil demand and oil specific shocks

- IRF - All three oil shocks lead to an increase in real price of oil.
Responses of global oil price to oil supply, oil demand and oil specific shocks

- **IRF** - All three oil shocks lead to an increase in real price of oil.
  
  ![Graph showing the responses of oil supply, demand, and specific shocks](image)

- **HDC** - Since 2000, the oil-supply shocks have made comparatively small contributions to the world oil price.
  
  ![Graph showing oil price changes from 2000 to 2013](image)
Responses of ASEAN-5 to oil supply disruption shocks

- $y$ (↓); $\pi$ (↑); Transitory stagflationary effect; monetary policy tend to be more accommodative. Exporter: $tb$ (↑) and $q$ (↓); Importers: $tb$ (↓) and $q$ (↑);

**Graphs:**
- Malaysia
- Singapore
- Thailand

**Legend:**
- $y$: GDP growth
- $\pi$: Inflation
- $r$: Interest rate
- $q$: Real oil price
- $tb$: Trade balance

**Axes:**
- Time periods (0, 12, 24, 36, 48)
- Values for $y$, $\pi$, $r$, $q$, $tb$
Responses of ASEAN-5 to oil supply disruption shocks

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Responses of ASEAN-5 variables to oil demand shocks

- \( y (↑); \pi (↑); \) Inflationary effect; monetary policy is tightened.
- Overall outcome is similar between the exporter and the importers.
Responses of ASEAN-5 variables to oil demand shocks

- $y$ (↑); $\pi$ (↑); Inflationary effect; monetary policy is tightened.
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Responses of ASEAN-5 variables to oil specific shocks

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Malaysia Singapore Thailand

-0.1 0 0.1 -0.1 0 0.1 -0.1 0 0.1
0 12 24 36 48 0 12 24 36 48 0 12 24 36 48

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Responses of ASEAN-5 variables to oil specific shocks

- Transitory (↑) in y; π (↑); Inflationary effect; monetary policy is tightened.
Oil supply disruption shock played minimal role
Oil demand shock is dominant in explaining the variations in ASEAN-5 output
Between 2003-2008; oil demand shock has positive contribution to inflation and policy rate.
Oil-specific demand shock is also responsible for instigating inflationary pressure at various times.
Historical Decomposition of Output, Inflation and Monetary Policy

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Presenter: Mala Raghavan
By decomposing the oil price shocks into supply-driven, demand-driven and oil-specific shocks, the paper examines the oil-macroeconomy relationship of the ASEAN-5.
Conclusion

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- Identifying the underlying source of a oil price shock is important for assessing the effects of the oil shock on these economies.
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Whether monetary policy is tightened in response to higher oil price depends on the impact of the various oil shocks on output relative to inflation.
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Conclusion

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- However, these economies can pursue prudent monetary policy measures that are more supportive of growth.
As small open economies there is little the ASEAN-5 can do to influence future oil price shocks. However, these economies can pursue prudent monetary policy measures that are more supportive of growth. This is crucial for the operational conduct of monetary policy for achieving price and output stabilities.
Thank You