The Macroeconomic Effects of Oil Price Shocks

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Crude oil producer price index and U.S. recessions
1. Effects on potential GDP

\[ K = \text{capital stock} \]
\[ N = \text{employment} \]
\[ E = \text{energy} \]
\[ Y = F(K, N, E) \]
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\[ \frac{\partial Y}{\partial E} = \frac{P_E}{P} \]

\[ \Rightarrow \frac{\partial \ln Y}{\partial \ln E} = \frac{P_E E}{PY} \]

\[ \frac{\partial \ln Y}{\partial \ln (P_E/P)} = \frac{\partial \ln Y}{\partial \ln E} \frac{\partial \ln E}{\partial \ln (P_E/P)} \]

\[ = \text{(expenditure share)} \times \text{(elasticity)} \]
2. Effects on aggregate and sectoral demand

E.g., if

- 5% of consumer spending goes to energy ($\alpha_t = 0.05$)
- energy price goes up 20%
- consumers purchase same quantity of energy

then

- saving or other spending must decline by 1%
Pre-2007 estimated impulse-response function (and 95% confidence intervals) relating 100 times log of real consumption spending to energy price increase that would reduce spending power by 1%

Reproduces Figure 8a in Edelstein and Kilian (2007)
Pre-2007 estimated impulse-response functions.

Reproduces Figure 8b-d in Edelstein and Kilian (2007)
Pre-2007 estimated impulse-response functions.

Reproduces Figure 8e in Edelstein and Kilian (2007)
Pre-2007 estimated impulse-response functions.

Reproduces Figure 11a in Edelstein and Kilian (2007)
3. What’s changed?

Energy expenditures as a share of total consumption
<table>
<thead>
<tr>
<th></th>
<th>Share of GDP (percent)</th>
<th>Standard deviation (quarterly percent changes, annual rate)</th>
<th>Share of GDP volatility (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goods and services</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1967 to 1985</td>
<td>100</td>
<td>4.3</td>
<td>100</td>
</tr>
<tr>
<td>1986 to 2007</td>
<td>100</td>
<td>2.1</td>
<td>100</td>
</tr>
<tr>
<td>1986 to 2009Q3</td>
<td>100</td>
<td>2.5</td>
<td>100</td>
</tr>
<tr>
<td><strong>. Goods</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1967 to 1985</td>
<td>37</td>
<td>9.2</td>
<td>54</td>
</tr>
<tr>
<td>1986 to 2007</td>
<td>30</td>
<td>5.0</td>
<td>51</td>
</tr>
<tr>
<td>1986 to 2009Q3</td>
<td>30</td>
<td>5.6</td>
<td>50</td>
</tr>
<tr>
<td><strong>. Motor vehicles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1967 to 1985</td>
<td>4.0</td>
<td>38.1</td>
<td>22</td>
</tr>
<tr>
<td>1986 to 2007</td>
<td>3.5</td>
<td>19.2</td>
<td>14</td>
</tr>
<tr>
<td>1986 to 2009Q3</td>
<td>3.3</td>
<td>24.9</td>
<td>16</td>
</tr>
</tbody>
</table>

Source: Ramey and Vine (2010)
4. Experience in the 2007-2009 recession
Down 26% July 07 to July 08
Down 6% July 07 to July 08

U.S. domestic car sales
(Thousands of units)
Up 14% July 07 to July 08

U.S. import car sales
(thousands of units)
Down 22% July 07 to July 08

U.S. import light truck sales
(thousands of units)
Black: 100 times log of actual real consumption
Blue: forecast formed 2007:M9
Green: Edelstein-Kilian forecast if we knew ex-post innovations energy price
Black: 100 times log of actual real spending on motor vehicles & parts
Blue: forecast formed 2007:M9
Green: forecast if we knew ex-post innovations in energy price
Black: Actual value for Michigan index of consumer sentiment
Blue: forecast formed 2007:M9
Green: forecast if we knew ex-post innovations in energy price
But what about housing?

(a) Average contribution of residential fixed investment to annual GDP growth rate
   2006:Q2 - 2007:Q3      -1.04%
   2007:Q4 - 2008:Q3      -0.91%

(b) Depressing effect of oil shock on income also hit housing

(c) Exurbs saw biggest housing price declines and highest default rates
Housing Prices Declines Greatest at the Suburban Fringe
Tampa MSA

Source: Cortright (2008)
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