Using Stock Returns to Identify Shocks to Government Spending

Jonas D.M. Fisher       Ryan Peters
Chicago Fed

Atlanta Fed Fiscal Policy Conference, January 8-9, 2010
Motivation

- What is the $G$ multiplier?
- Use response to $G$ shocks to test models
- Two approaches lead to different answers
  - VAR innovations to $G$, Blanchard and Perotti (2002):
    \[ G \uparrow \Rightarrow Y, H, C, \frac{W}{P} \uparrow \]
  - Historical narrative, Ramey and Shapiro (1998):
    \[ G \uparrow \Rightarrow Y, H \uparrow C, \frac{W}{P} \downarrow \]
Motivation

- **Drawbacks to both approaches**
  - VAR innovations: Ramey (2008) critique
  - Narrative strategy: few observations, all increases, assume certainty, inherently subjective

- Seek alternative immune to Ramey critique, with more observations, increases and decreases, incorporating uncertainty, less subjective

- Uhlig and Mountford (2005): sign restriction approach satisfies these criteria
Alternative Approach

- Low frequency swings in military spending: Korean War, Vietnam War, Carter-Reagan Buildup, End of Cold War, 9/11 [spending]

- Anticipated military build ups should be reflected in stock returns of military contractors

- Explore using innovations in excess returns of military contractors to identify spending shocks

- Key findings:
  - Multiplier = 1.5
  - $G \uparrow \implies Y, H, C \uparrow \ W/P \downarrow \ 	ext{then} \uparrow$
Outline

- Model
- Describe data
- Identification strategy
- Findings
Model: Preferences and Technology

\[ \max \sum \beta^t (\ln c_t - n_{ct} - n_{mt}) \]

\[

c_t + x_{ct}/q_t + x_{mt}/q_t + g_t \leq A_t k_t^\alpha n_{ct}^{1-\alpha} \\
m_t + \bar{m} \leq A_t q_t d_t^\alpha n_{mt}^{1-\alpha} \\
k_{t+1} = (1 - \delta)k_t + g(x_{ct}, x_{ct-1}) \\
d_{t+1} = (1 - \delta)d_t + h(x_{mt}, x_{mt-1})
\]
Model: Responses to Military Shock

Military Build-up

K'/D'

Pd'

All Output

P(k')

Excess Return

-0.8 -0.5 -0.2

0 4 8 12 16 20 24

0 1 2 3 4 5 6 7 8

0 2 4 6 8 10

0 2 4 6 8 10

0 4 8 12 16 20 24

0 4 8 12 16 20 24

0 -0.022 -0.006

0 4 8 12 16 20 24

0 2 4 6 8 10

0 4 8 12 16 20 24

-0.2 0.6 1.4

Fisher and Peters

Stock Returns and Shocks to Government Spending
Model: Responses to G Shock

Non Military G Shock

K'/D'

All Output

P_k'

P_d'

Excess Return
Model: Responses to Neutral Technology Shock

Neutral Shock

\[ \frac{K'}{D'} \]

All Output

\[ Pk' \]

\[ Pd' \]

Excess Return

\[ -0.12 \]

\[ 0.00 \]
Model: Responses to Investment Technology Shock

Investment Shock

All Output

$K'/D'$

$P_k'$

$P_d'$

Excess Return

Fisher and Peters

Stock Returns and Shocks to Government Spending
Responses Estimated from *Model Generated Data*

Military Spending

Non-military Spending

Output

Accumulated Excess Returns

Fisher and Peters

Stock Returns and Shocks to Government Spending
Data

- Top 3 Primary Munitions Contractors 1957-2007
- Guns+: Include by SIC/NAICS code
  - Ordnance and Accessories
  - Ship & Boat Building & Repairing
  - Guided Missiles & Space Vehicles & Parts
  - Aircraft & Parts & Auxiliary Equipment, NEC
  - Tanks and Tank Components
  - Search, Detection, Navigation, Guidance, Aeronautical Systems
- Guns: Guns+ less last two (Fama-French/Lustig, et al)
- War Dates (Ramey-Shapiro/Eichenbaum-Fisher)
- War Dates+ (Ramey)
## Top 3 US Military Contractors

<table>
<thead>
<tr>
<th>Primary Contractor</th>
<th>SIC Industry</th>
<th>Years in Top 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grumman</td>
<td>Aircraft</td>
<td>1970-1972</td>
</tr>
<tr>
<td>Lockheed (1977-1994),</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lockheed Martin (1995-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Martin,</td>
<td>Guided Missiles, Space Vehicle, Parts</td>
<td>1959-1962, 1993</td>
</tr>
<tr>
<td>Martin Marietta (1961-1993)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northrop Grumman (1994-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Technologies (1969-)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Top 3 Share of Primary Contracts

Fisher and Peters

Stock Returns and Shocks to Government Spending
Detrended Sales and Military Spending

![Graphs showing detrended sales and military spending from 1960 to 2005.](image)

- Top 3 Sales
- Military Spending
- Guns Sales
- Guns+ Sales

Fisher and Peters: Stock Returns and Shocks to Government Spending
Excess Returns and Ramey (2008)’s Shocks

Fisher and Peters

Stock Returns and Shocks to Government Spending
### Explanatory Power of Spending Indicators

<table>
<thead>
<tr>
<th>Variable</th>
<th>Top 3</th>
<th>Guns</th>
<th>Guns+</th>
<th>War Dates</th>
<th>War Dates+</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Military Spending</td>
<td>.07</td>
<td>.05</td>
<td>.06</td>
<td>.26</td>
<td>.58</td>
</tr>
<tr>
<td>Government Spending</td>
<td>.08</td>
<td>.02</td>
<td>.03</td>
<td>.24</td>
<td>.56</td>
</tr>
<tr>
<td>Output</td>
<td>.03</td>
<td>.03</td>
<td>.03</td>
<td>.08</td>
<td>.07</td>
</tr>
<tr>
<td>Consumption</td>
<td>.05</td>
<td>.06</td>
<td>.06</td>
<td>.08</td>
<td>.12</td>
</tr>
</tbody>
</table>

**1948:1–2007:4**

| Military Spending     | .21   | .07  | .17   | .06       | .09        |
| Government Spending   | .11   | .04  | .11   | .02       | .06        |
| Output                | .08   | .06  | .06   | .09       | .03        |
| Consumption           | .05   | .06  | .05   | .09       | .03        |

**1957:3–2007:4**

Note: The reported $R^2$’s are based on regressions of the predicted variable on the current value and six lags of the indicator variable. Variables are log first differences.
Identification Strategy

- $S = \text{accumulated excess returns}$
- G-shock: Choleski innovation in $S$, $S$ ordered last
- If represent economy well, good estimate of G-shock when
  - Tech change in Top 3 as in whole economy
  - Markup dynamics as in whole economy
  - Variation in sales dominated by shocks to defense spending
Excluding Korean War

- 1959:1-2006:4, trend, six lags
  - Returns poor forecast of Korean War build up
  - Excess Profits Tax, \( W \) & \( P \) controls

- Eisenhower Farewell Address:

  Our military organization today bears little relation to that known by any of my predecessors in peacetime, or indeed by the fighting men of World War II or Korea. Until the latest of our world conflicts, the United States had no armaments industry. American makers of plowshares could, with time and as required, make swords as well. But now we can no longer risk emergency improvisation of national defense; we have been compelled to create a permanent armaments industry of vast proportions.
Effects of Top 3 Excess Return Shocks

Accumulated Top 3 Excess Returns

Accumulated Top 3 Net Income

Military Spending

Total Government Spending

Fisher and Peters: Stock Returns and Shocks to Government Spending
Effects of Top 3 Excess Return Shocks

[Other Variables]

Fisher and Peters

Stock Returns and Shocks to Government Spending
Government Spending Multiplier

- 20 quarter accumulated $G$ response: 0.10
- 20 quarter accumulated $Y$ response: 0.03
- $G/Y = 0.2$
- $\frac{dy}{dG} = (0.03/0.10) \times (1/0.20) = 1.5$
- Is this all $G$?: $\frac{dY}{dG} + \frac{dY}{dP} \frac{dP}{dG}$
Responses of Policy Variables

Tax Revenue as Share of GDP

Nominal 3 Month Interest Rate

Fisher and Peters

Stock Returns and Shocks to Government Spending
Historical Effects of Shocks

Fisher and Peters

Stock Returns and Shocks to Government Spending
Effects of War Dates

- Output
- Hours
- Private Consumption
- Product Wages
Effects of Using Spending Innovations

Output

Private Consumption

Hours

Product Wages

Fisher and Peters

Stock Returns and Shocks to Government Spending
Anticipated military build ups should be reflected in stock returns of military contractors

Explore using innovations in excess returns of Top 3 primary military contractors to identify spending shocks

Multiplier = 1.5

\[ G \uparrow \Leftrightarrow Y, H, C \uparrow \frac{W}{P} \downarrow \text{then} \uparrow \]
Model: Shocks

\[
\begin{bmatrix}
    a_t \\
    g_t \\
    q_t \\
    m_t \\
    s_t \\
    s_{t-1} \\
    s_{t-2}
\end{bmatrix} = \begin{bmatrix}
    \rho_a & 0 & 0 & 0 & 0 & 0 & 0 \\
    0 & \rho_g & 0 & 0 & 0 & 0 & 0 \\
    0 & 0 & \rho_q & 0 & 0 & 0 & 0 \\
    0 & 0 & 0 & b_1 & b_2 & b_3 & 0 \\
    0 & 0 & 0 & 0 & 0 & 0 & 0 \\
    0 & 0 & 0 & 0 & 1 & 0 & 0 \\
    0 & 0 & 0 & 0 & 0 & 1 & 0
\end{bmatrix}
\begin{bmatrix}
a_{t-1} \\
g_{t-1} \\
q_{t-1} \\
m_{t-1} \\
s_{t-1} \\
s_{t-2} \\
s_{t-3}
\end{bmatrix} + \begin{bmatrix}
\varepsilon_t \\
\eta_t \\
\nu_t \\
0 \\
0 \\
0 \\
0
\end{bmatrix}
\]
## Effects of Excess Return Shocks

### Consumer Durables

<table>
<thead>
<tr>
<th>Percent</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Res. Investment

<table>
<thead>
<tr>
<th>Percent</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Non Res. Investment

<table>
<thead>
<tr>
<th>Percent</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Consumption Price

<table>
<thead>
<tr>
<th>Percent</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Fisher and Peters  Stock Returns and Shocks to Government Spending