Using Stock Returns to Identify Shocks to Government Spending

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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): $G \uparrow \Rightarrow Y, H, C, W/P \uparrow$
  - Historical narrative, Ramey and Shapiro (1998): $G \uparrow \Rightarrow Y, H \uparrow C, W/P \downarrow$

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
  - $G \uparrow \Rightarrow Y, H, C \uparrow W/P \downarrow$ then $\uparrow$

Outline

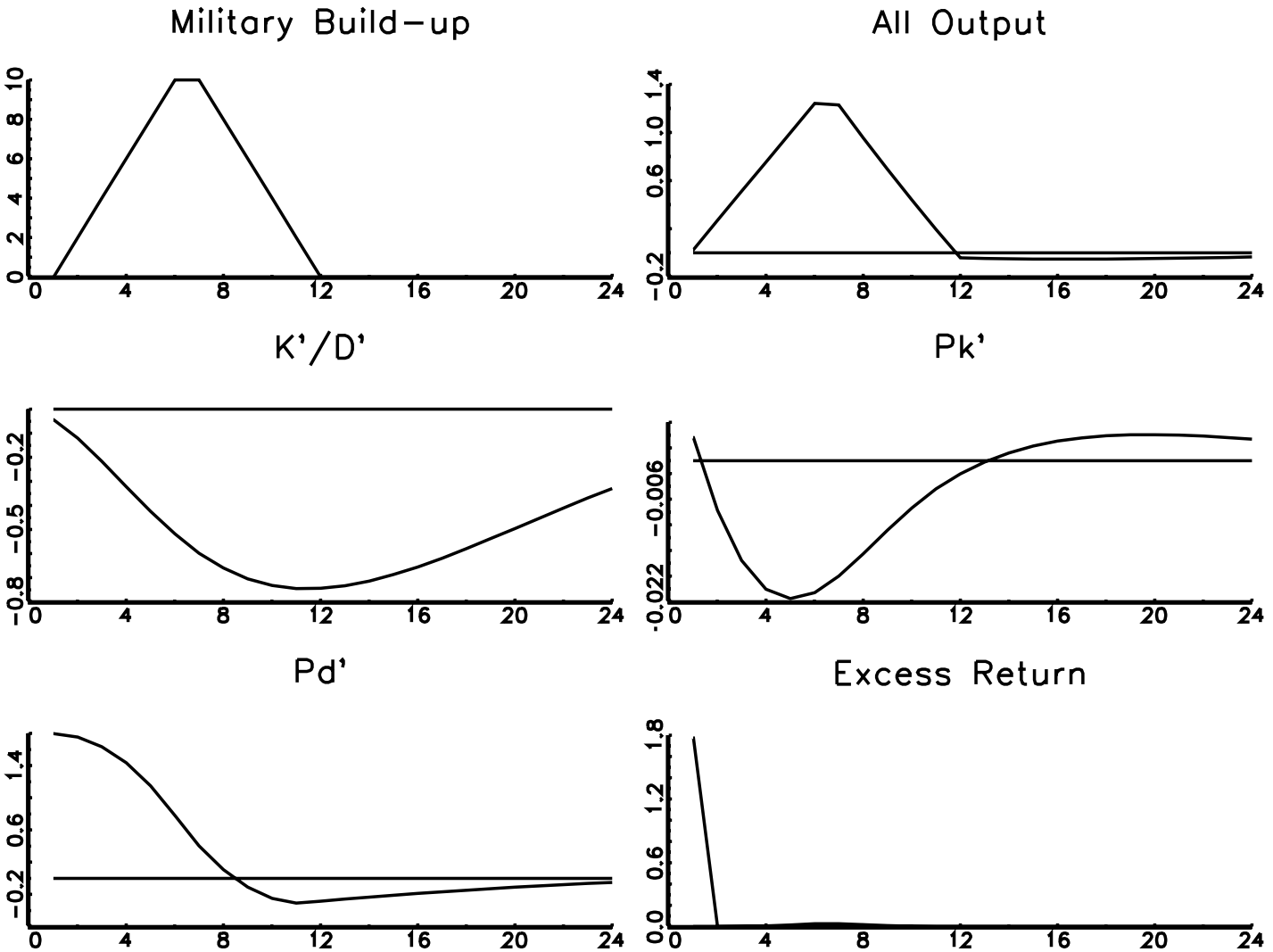
- Model
- Describe data
- Identification strategy
- Findings

Model: Preferences and Technology

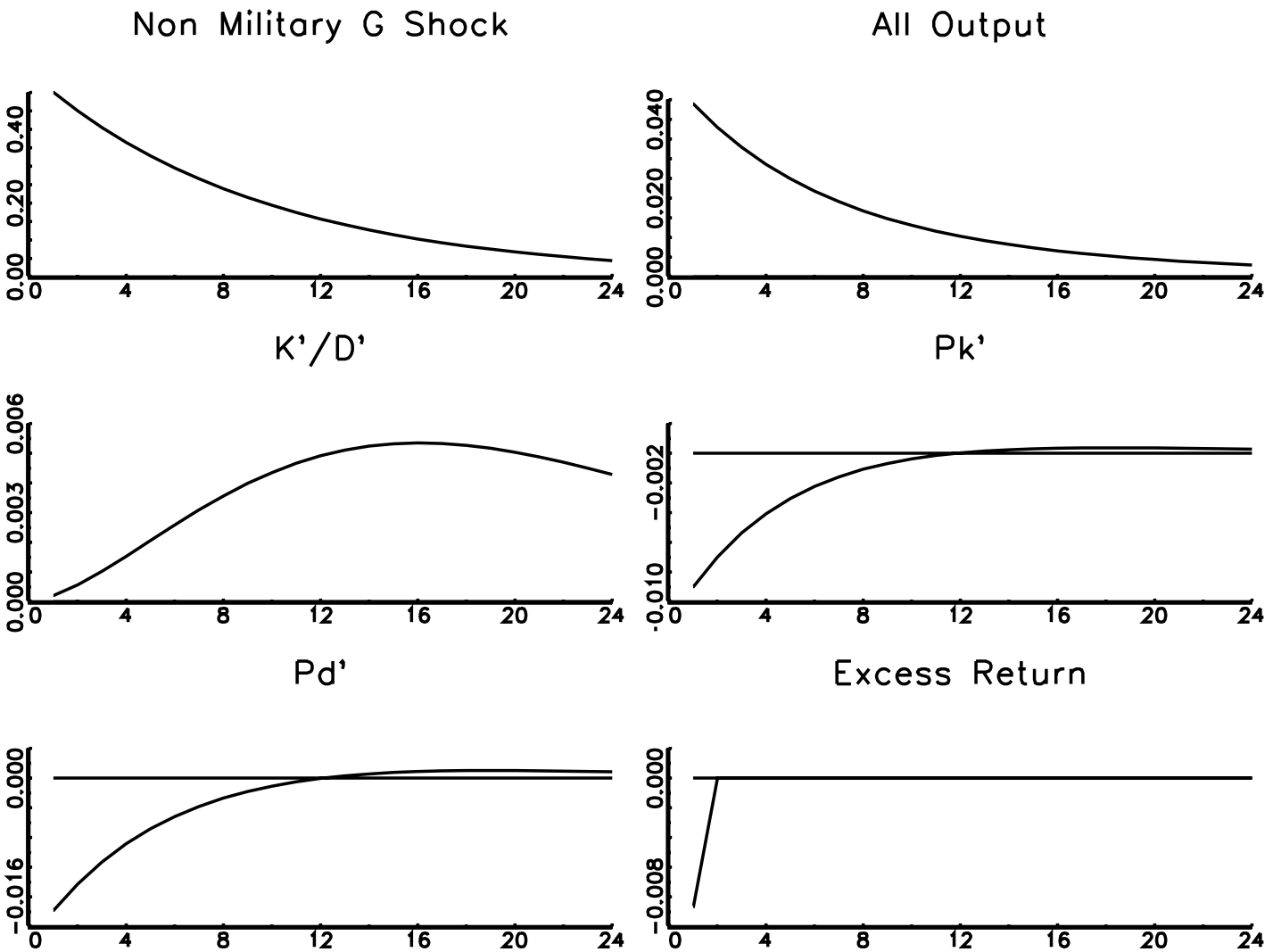
$$\max \sum \beta^t \left(\ln c_t - n_{ct} - n_{mt}\right)$$

$$\begin{aligned} c_t + x_{ct}/q_t + x_{mt}/q_t + g_t &\leq A_t k_t^{\alpha} n_{ct}^{1-\alpha} \\ m_t + \bar{m} &\leq A_t q_t d_t^{\alpha} n_{mt}^{1-\alpha} \\ k_{t+1} &= (1-\delta)k_t + g(x_{ct}, x_{ct-1}) \\ d_{t+1} &= (1-\delta)d_t + h(x_{mt}, x_{mt-1}) \end{aligned}$$

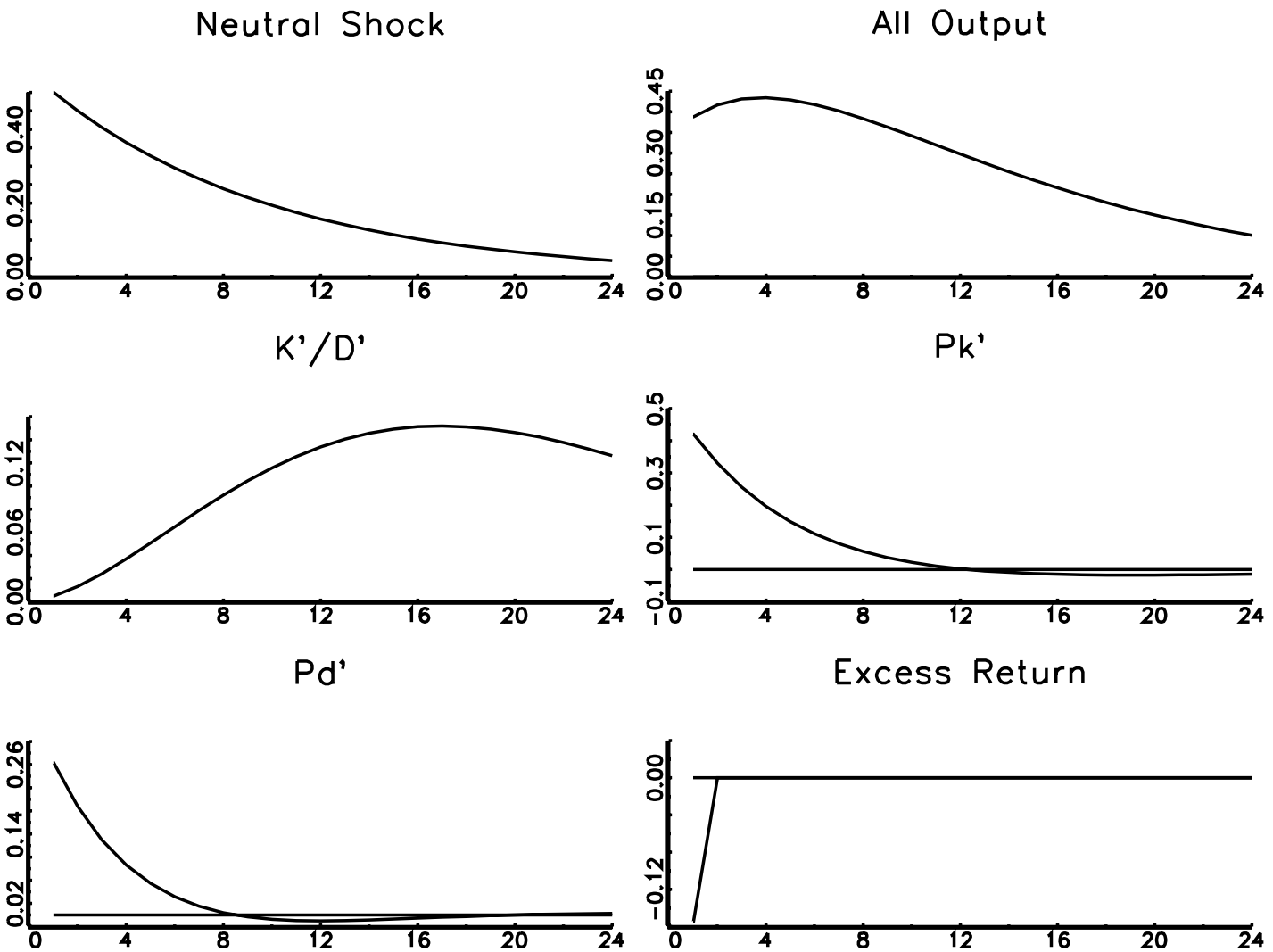
Model: Responses to Military Shock



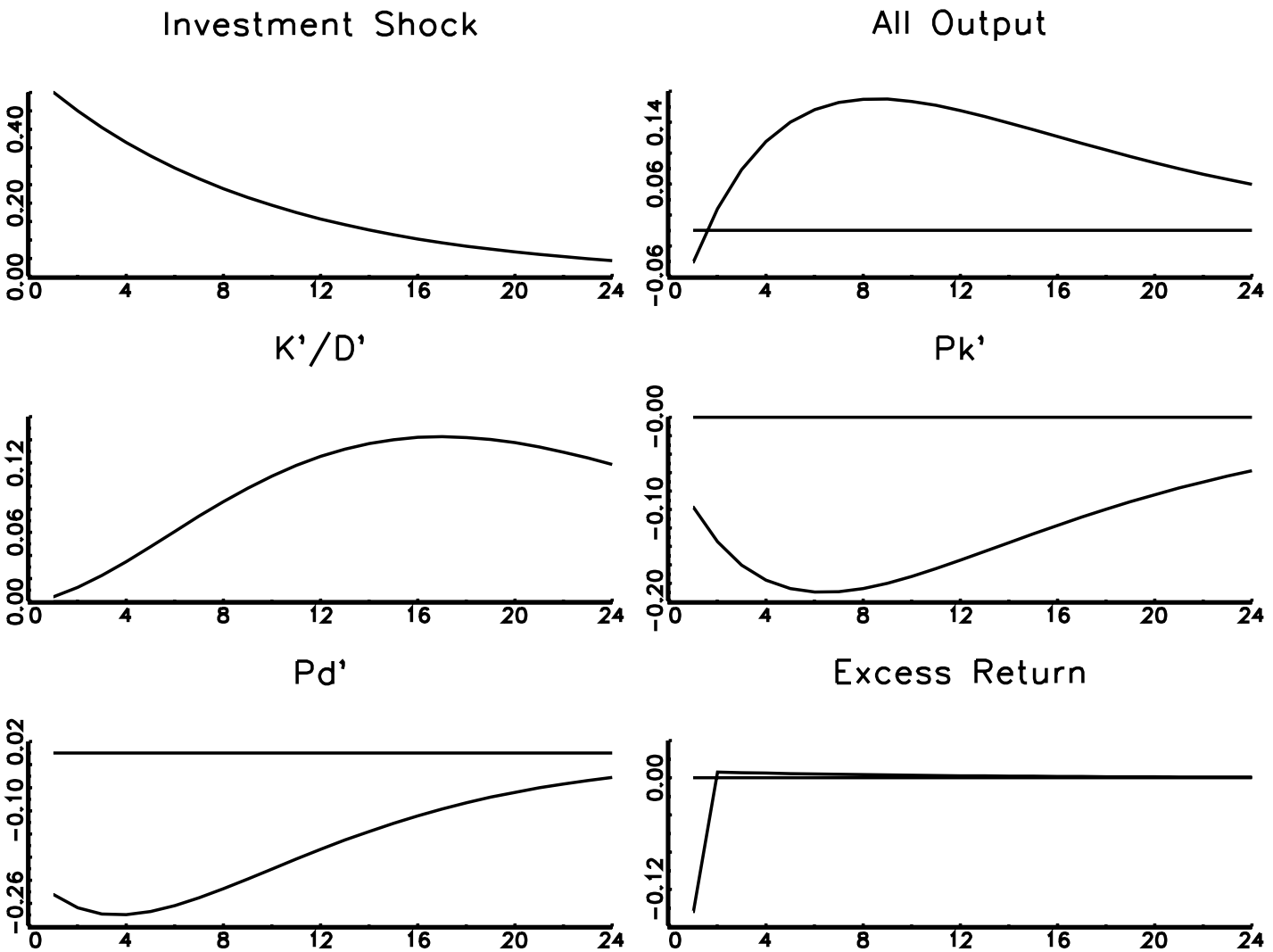
Model: Responses to G Shock



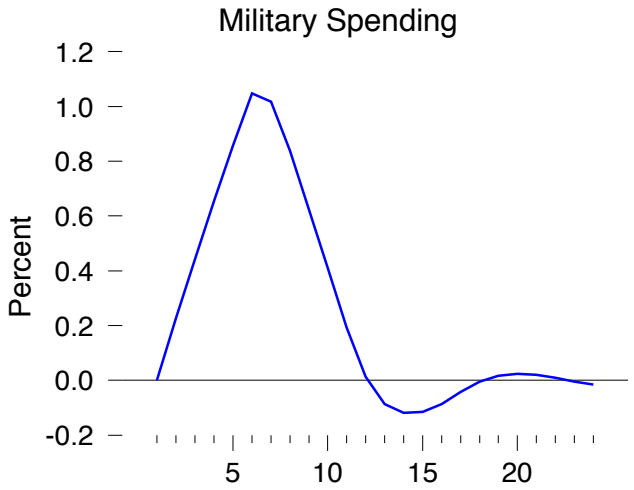
Model: Responses to Neutral Technology Shock

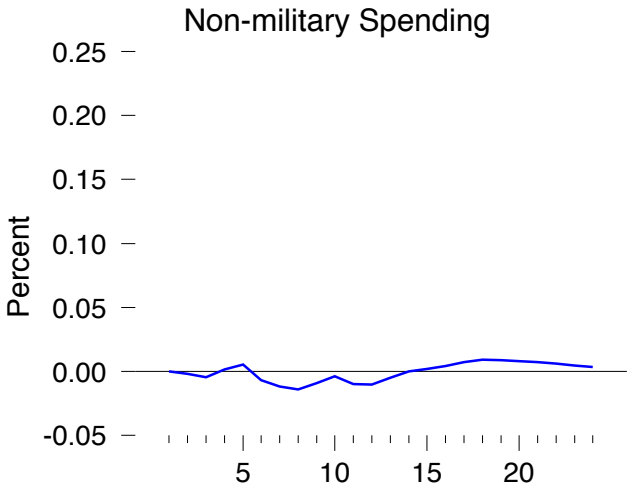


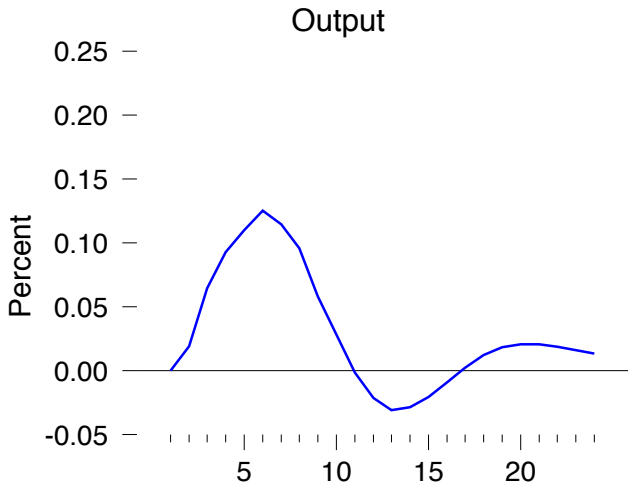
Model: Responses to Investment Technology Shock

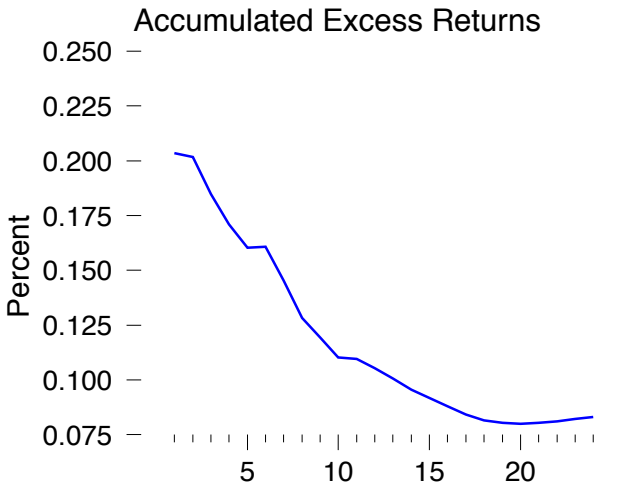


Responses Estimated from *Model* Generated Data









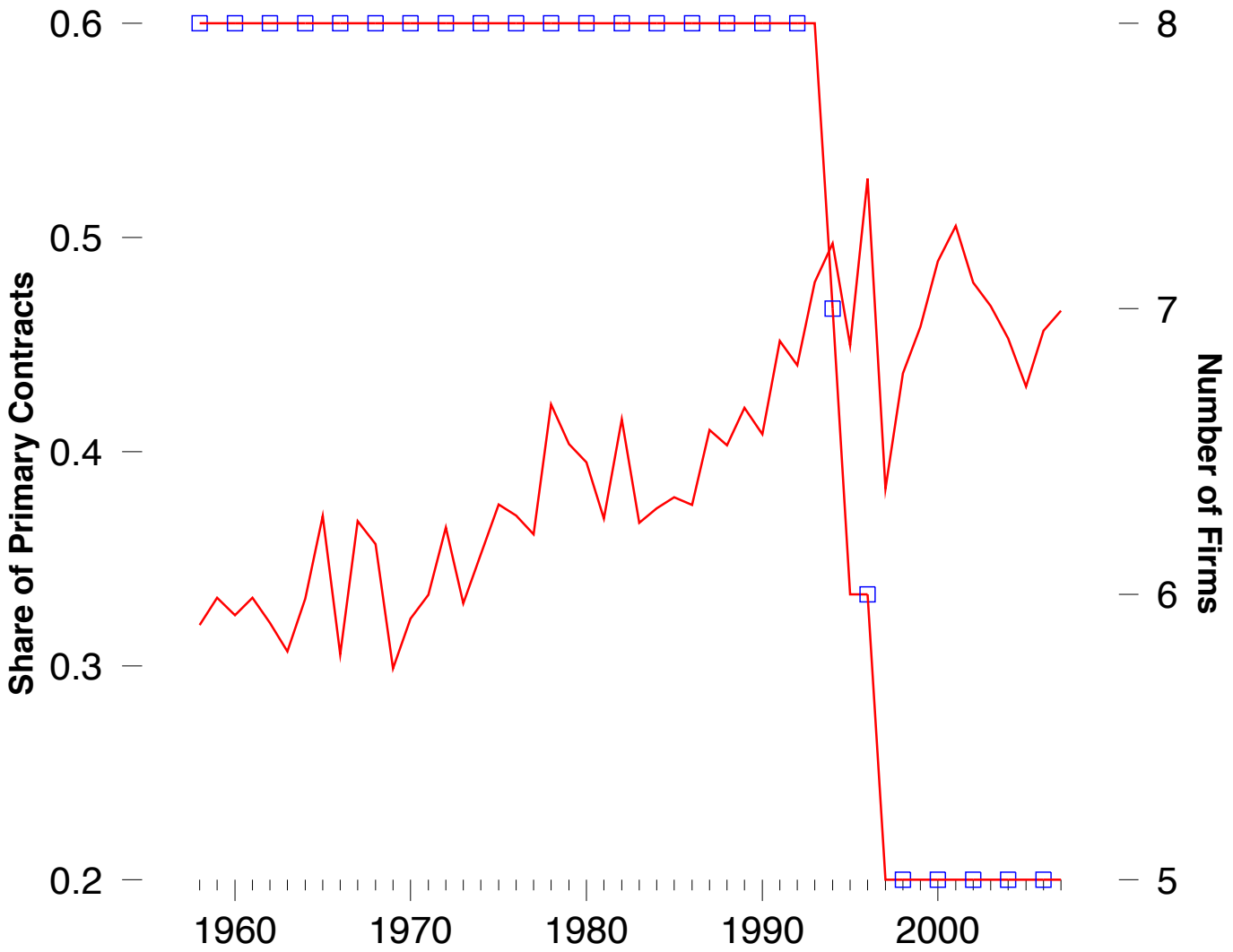
Data

- 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)

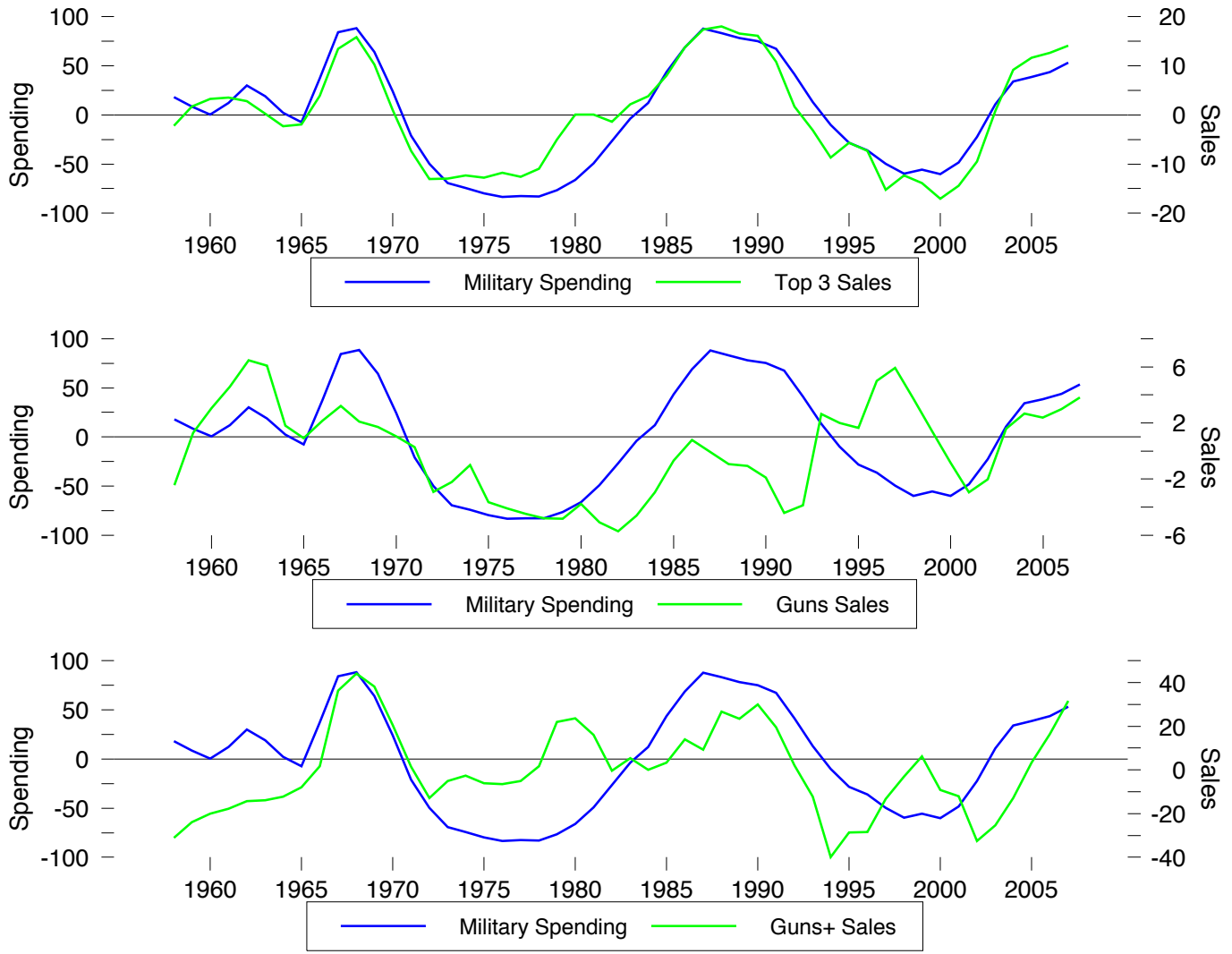
Top 3 US Military Contractors

Primary Contractor	SIC Industry	Years in Top 3
General Dynamics	Ship and Boat Building, Repairing	1958-1962, 1965-1971, 1974-1974, 1978-1992
Grumman	Aircraft	1970-1972
Lockheed Aircraft, Lockheed (1977-1994), Lockheed Martin (1995-)	Guided Missiles, Space Vehicle, Parts	1958-1977, 1983-1987, 1992-2007
Martin, Martin Marietta (1961-1993)	Guided Missiles, Space Vehicle, Parts	1959-1962, 1993
McDonnell Aircraft, McDonnell Douglas (1966-1996)	Aircraft	1963-1964, 1966, 1968-1969, 1971-1996
Northrop, Northrop Grumman (1994-)	Search, Detection, Navigation, Guidance, Aeronautical Systems	1975, 1992, 1994-2007
Raytheon	Search, Detection, Navigation, Guidance Aeronautical Systems	1988-1991, 1996, 1998-2000
United Aircraft, United Technologies (1969-)	Aircraft, Parts	1958, 1966-1968, 1975-1982

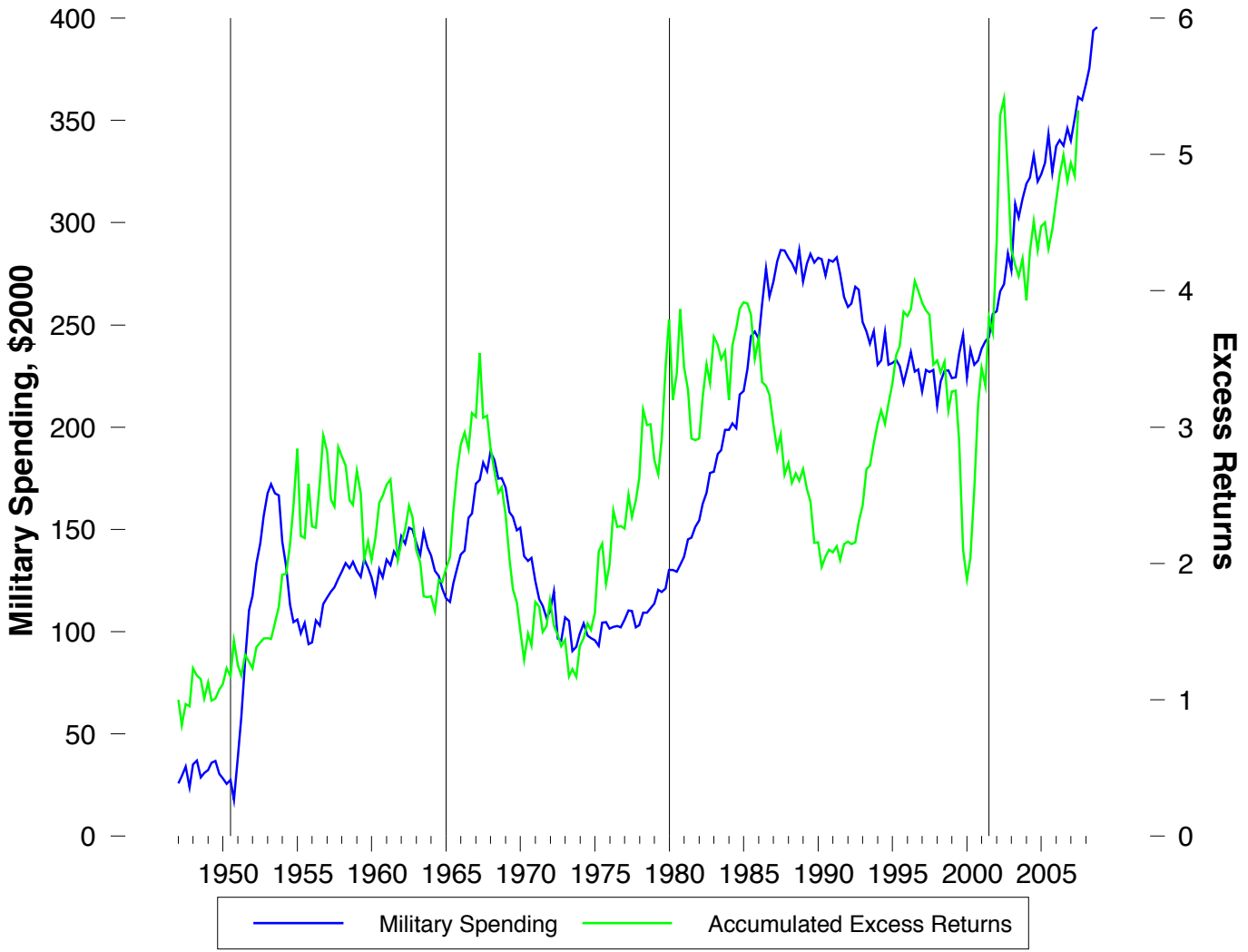
Top 3 Share of Primary Contracts



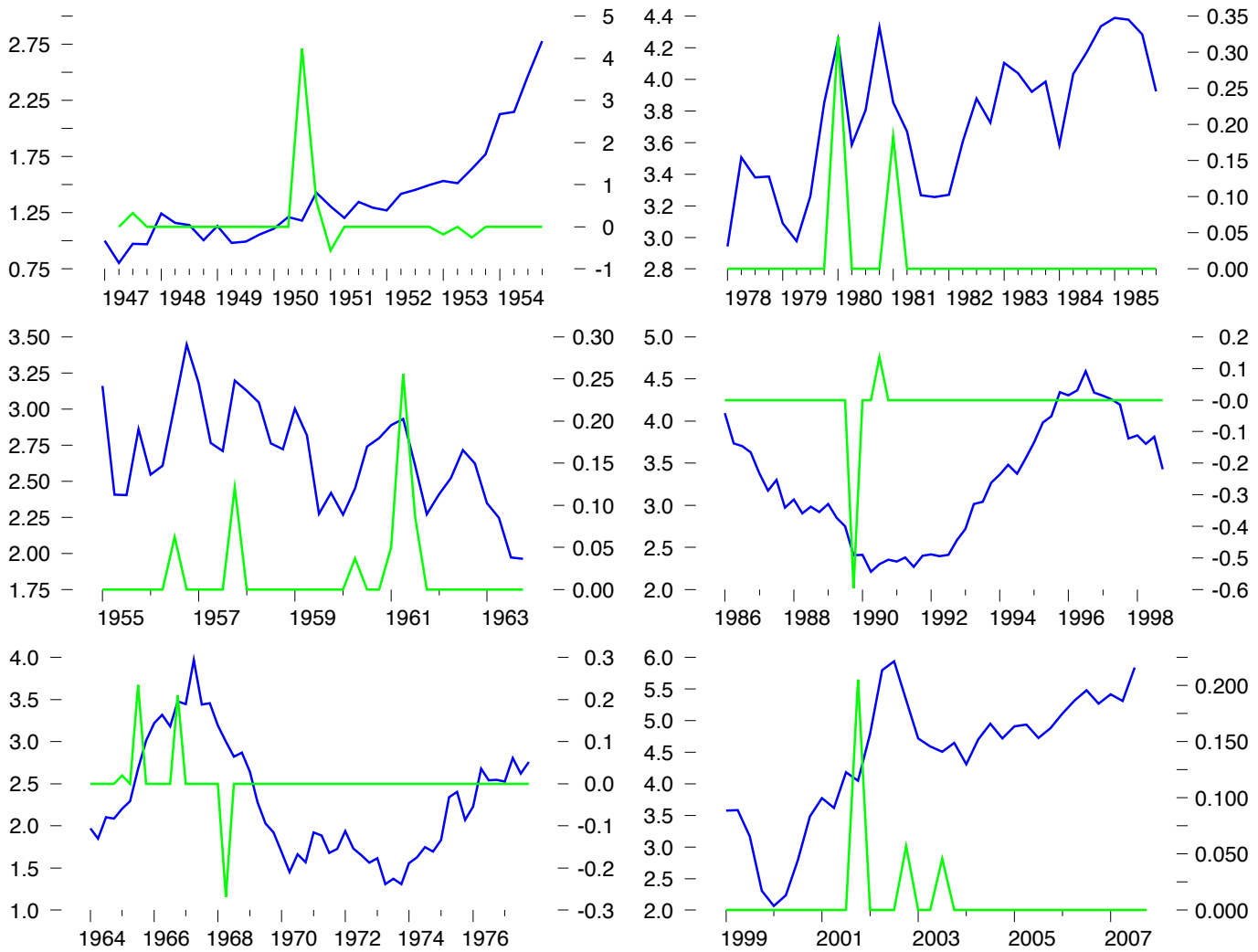
Detrended Sales and Military Spending



Accumulated Excess Returns and Military Spending



Excess Returns and Ramey (2008)'s Shocks



Explanatory Power of Spending Indicators

Variable	Top 3	Guns	Guns+	War Dates	War Dates+
			1948:1–2007:4		
Military Spending	.07	.05	.06	.26	.58
Government Spending	.08	.02	.03	.24	.56
Output	.03	.03	.03	.08	.07
Consumption	.05	.06	.06	.08	.12
			1957:3–2007:4		
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

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

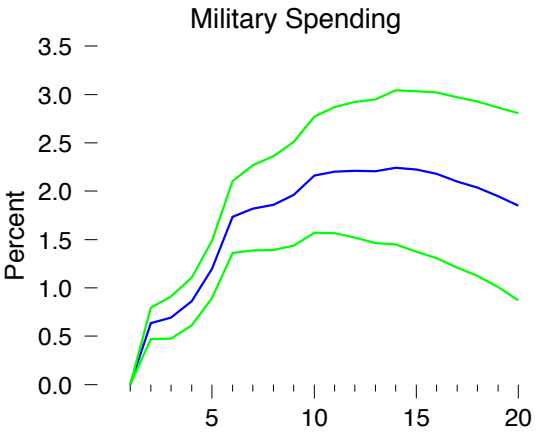
- $S =$ accumulated excess returns
- VAR: $MilG, Y, R, X, S, \quad X = G, C, H, W/P$
- G-shock: Choleski innovation in S, S ordered last
- If represent economy well, good estimate of G- shock when
  - Tech change in Top 3 as in whole economy
  - Markup dynamics as in whole economy
  - Variation in sales dominated by shocks to defense spending

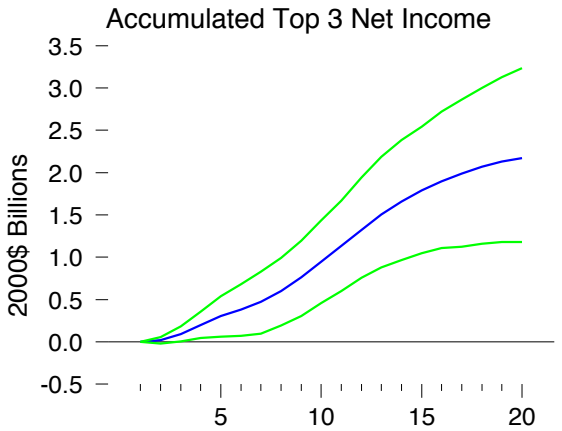
Excluding Korean War

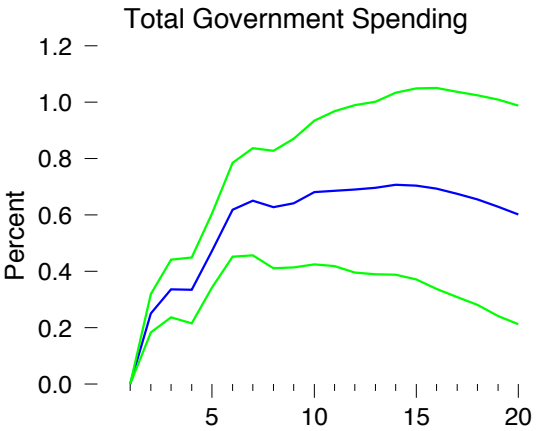
- 1959:1-2006:4, trend, six lags
  - Returns poor forecast of Korean War build up
  - Excess Profits Tax, *W* & *P* controls
- Eisenhower Farewell Address:

> *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







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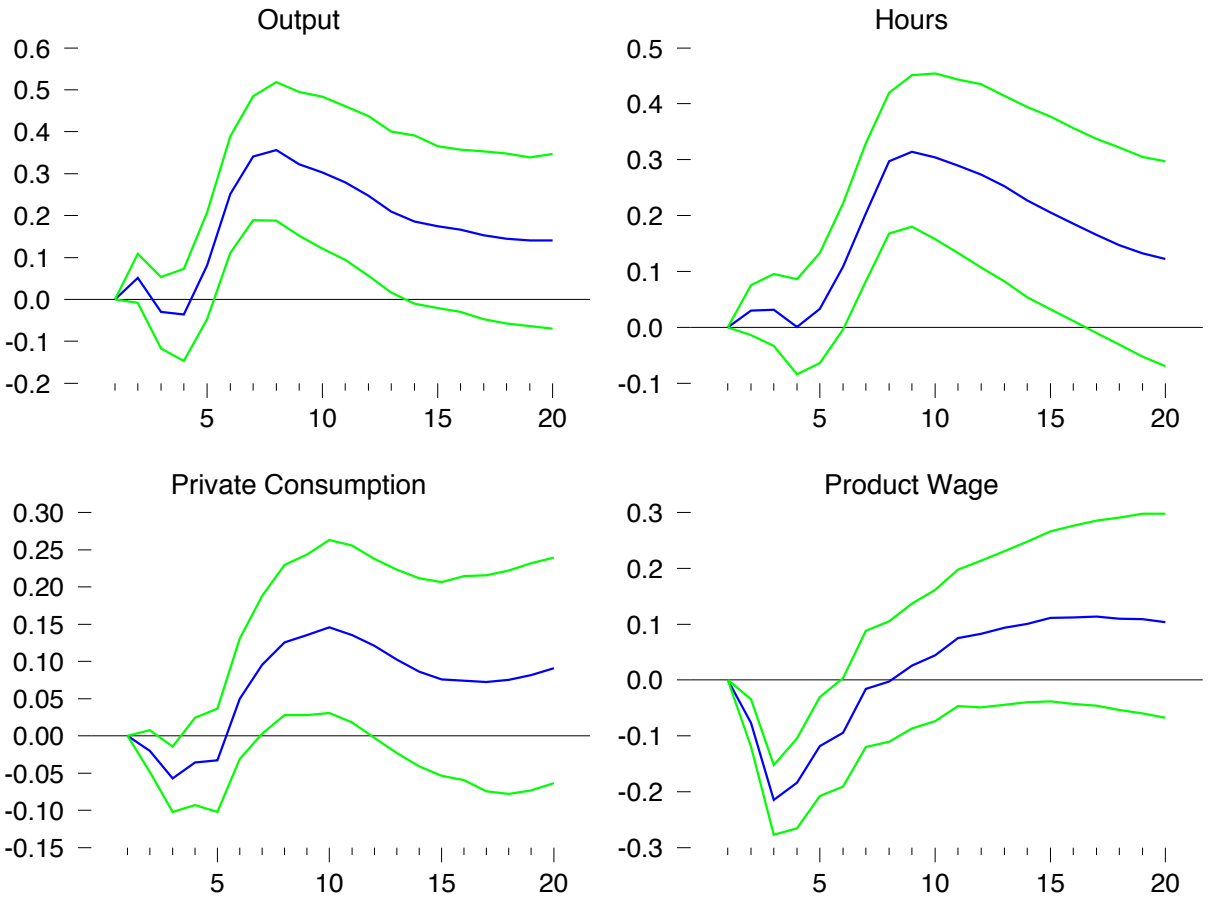
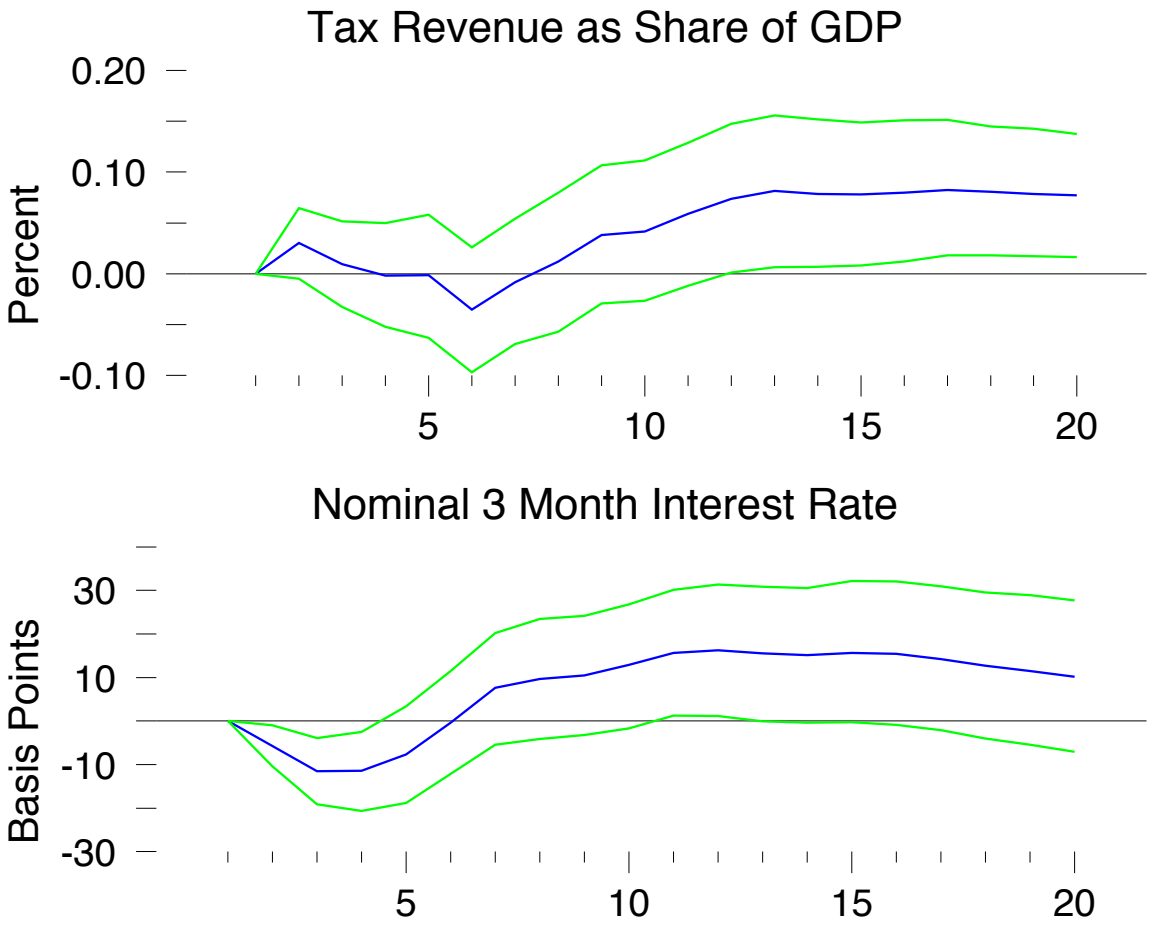


[Other Variables]

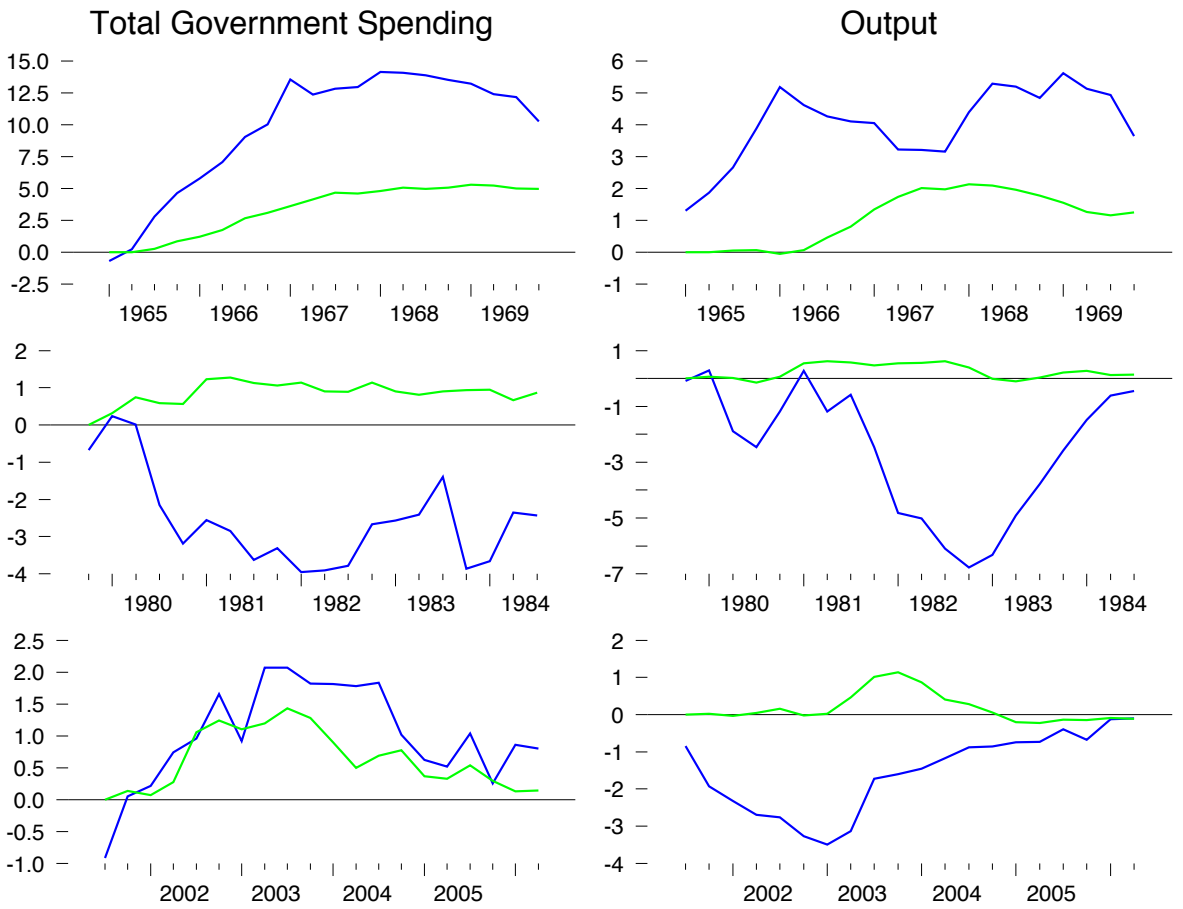
Government Spending Multiplier

- 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?: $\frac{dY}{dG} + \frac{dY}{dP}\frac{dP}{dG}$

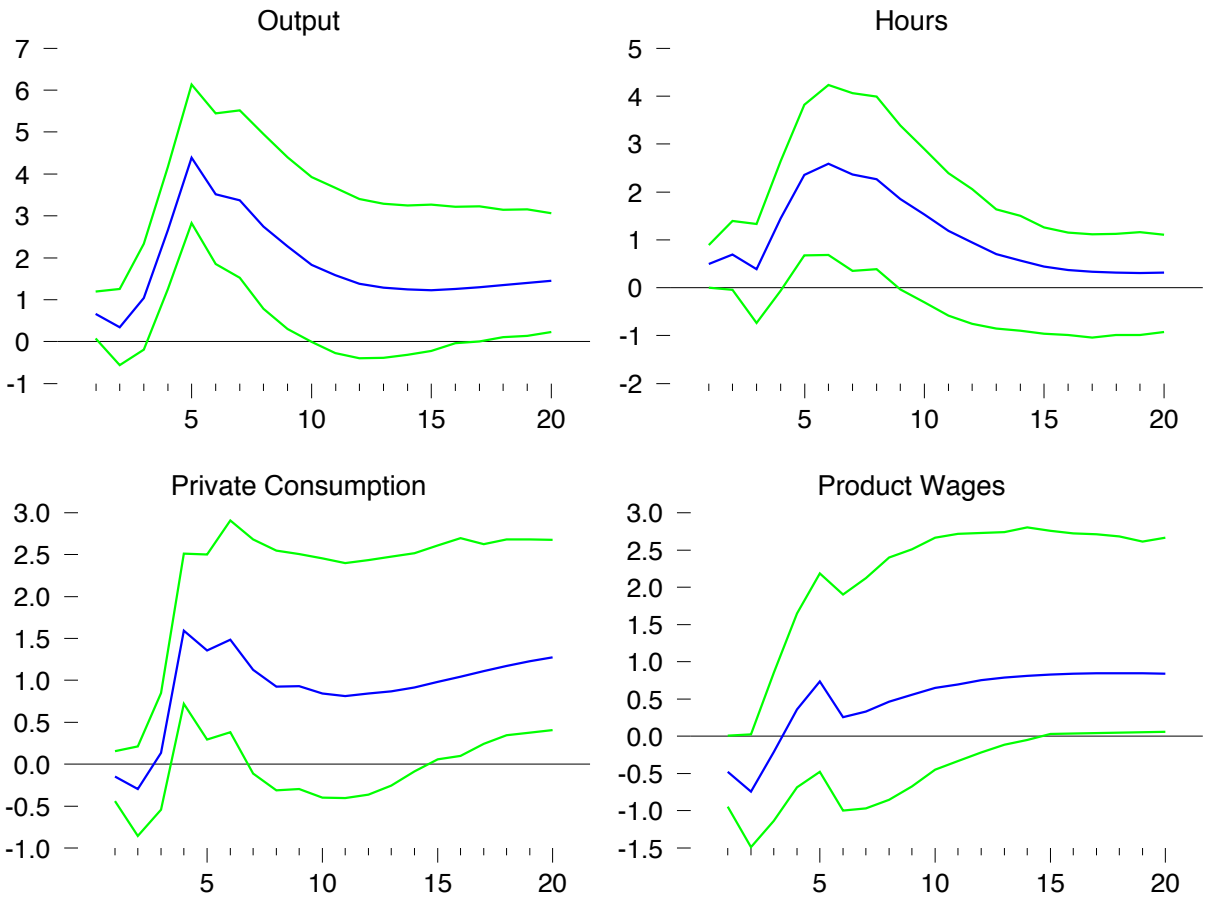
Responses of Policy Variables



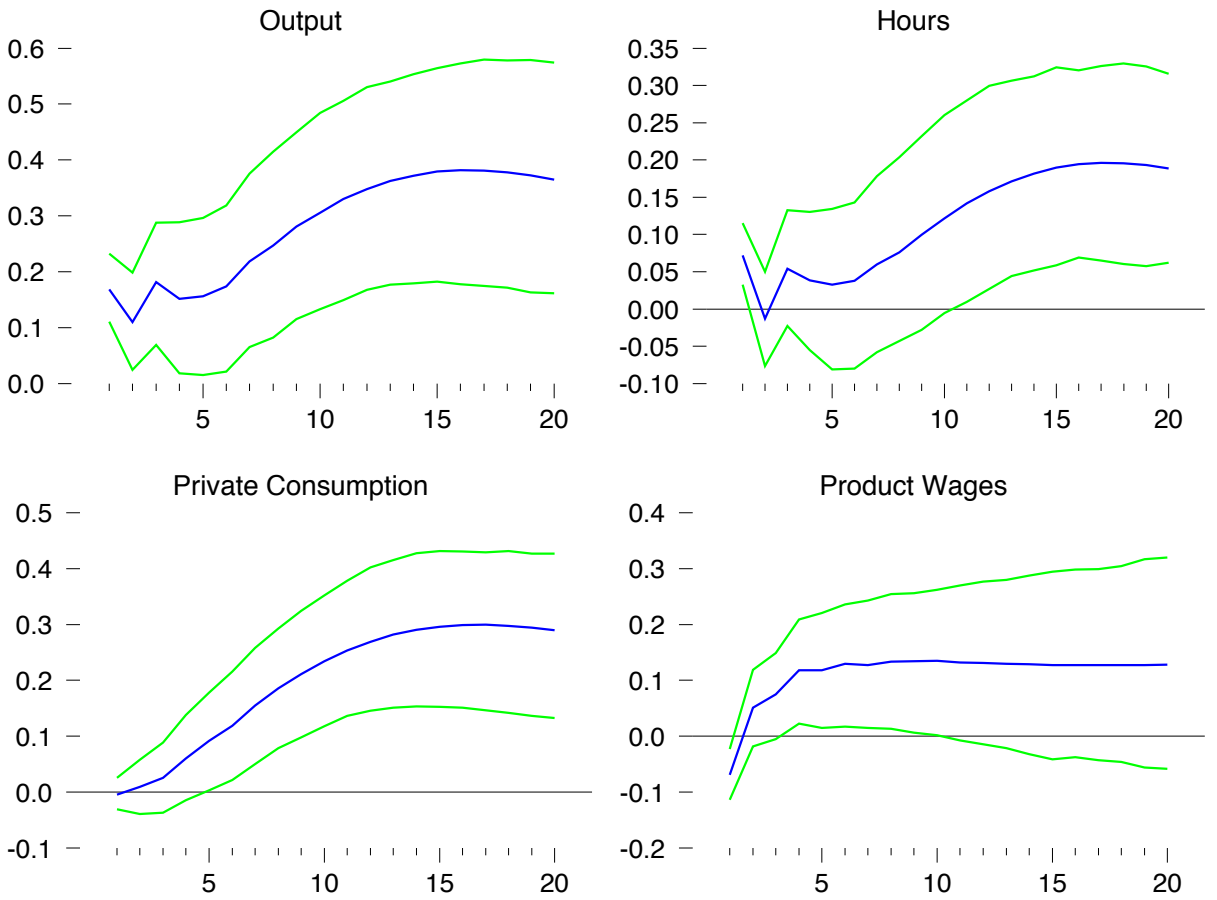
Historical Effects of Shocks



Effects of War Dates



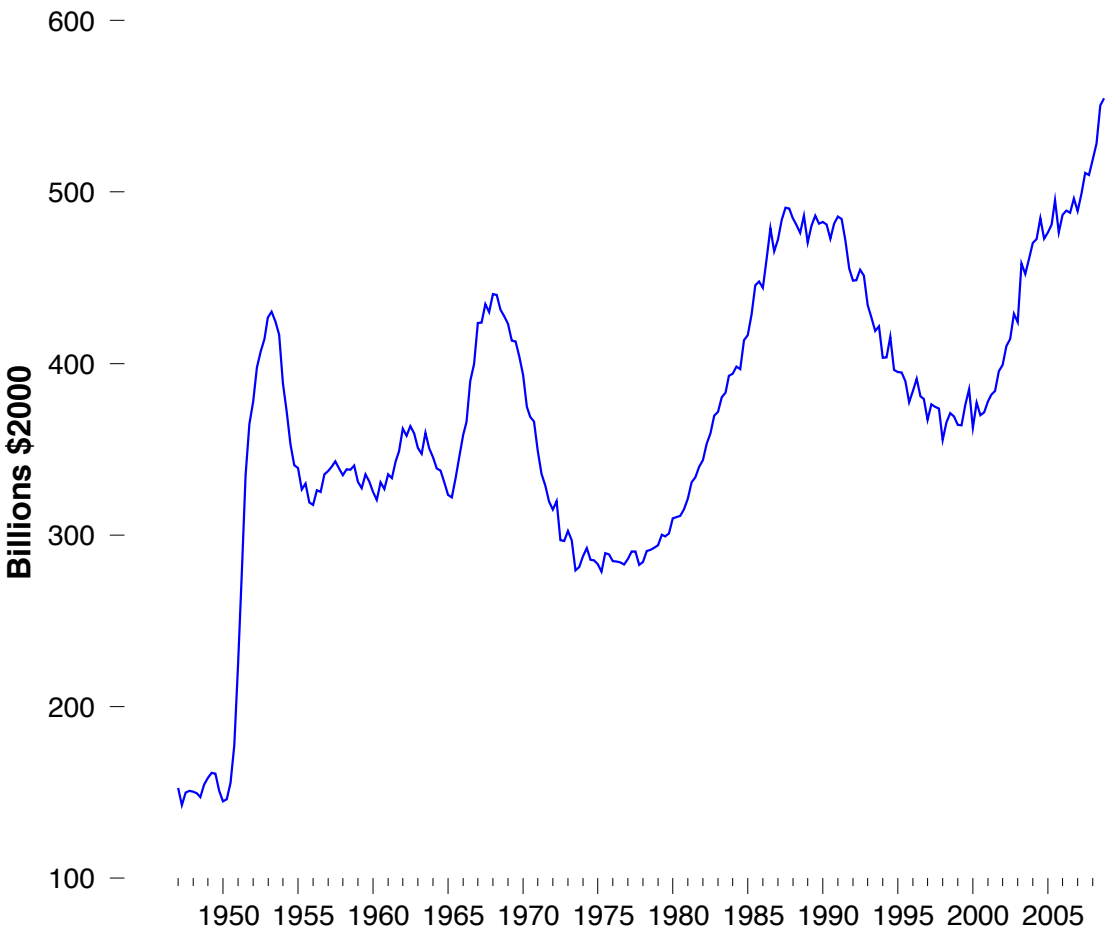
Effects of Using Spending Innovations



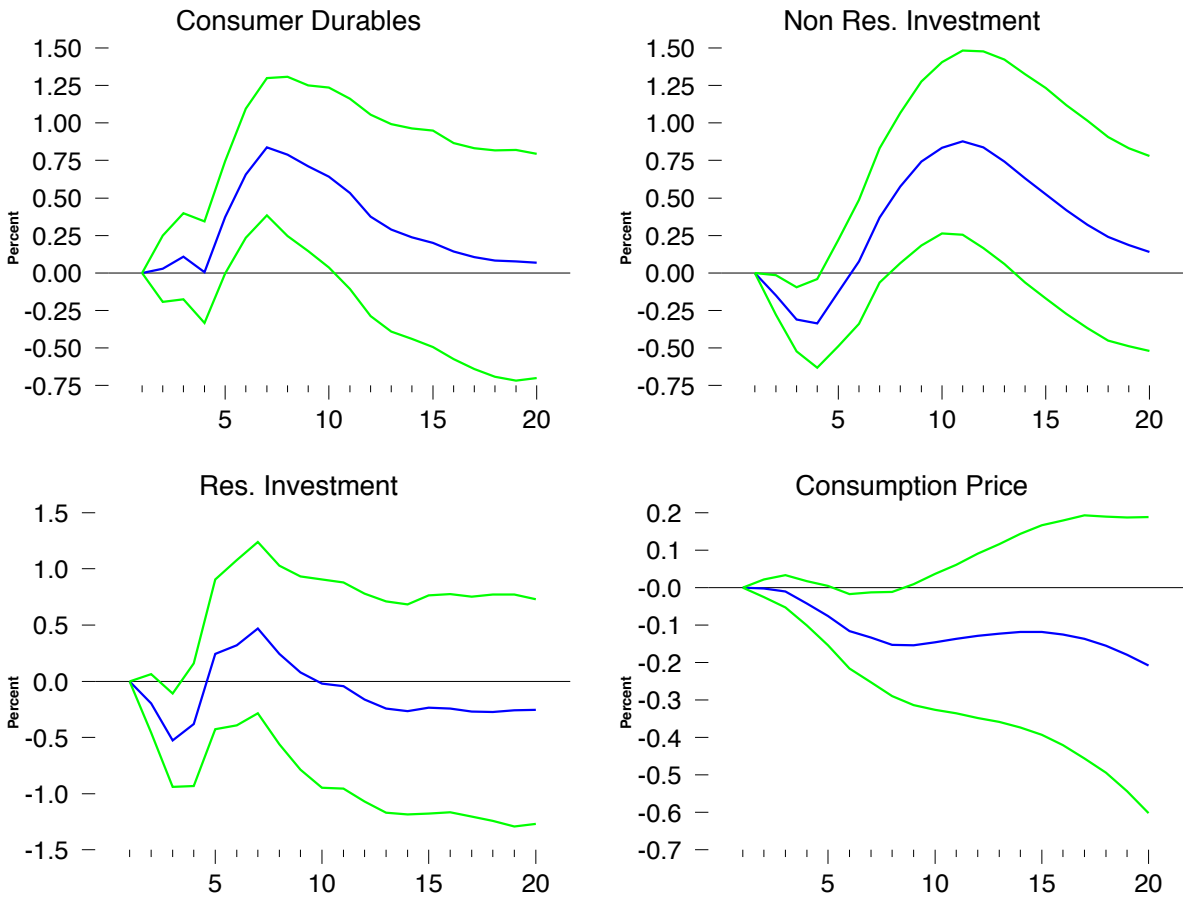
Conclusion

- 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
- $G \uparrow \Rightarrow Y, H, C \uparrow W/P \downarrow$ then $\uparrow$

US Military Spending, 1947-2008



Model: Shocks

$$\begin{bmatrix} a_t \\ g_t \\ q_t \\ m_t \\ s_t \\ s_{t-1} \\ s_{t-2} \end{bmatrix} = \begin{bmatrix} \rho_a & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \rho_g & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \rho_q & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_1 & b_2 & b_3 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} a_{t-1} \\ g_{t-1} \\ q_{t-1} \\ m_{t-1} \\ s_{t-1} \\ s_{t-2} \\ s_{t-3} \end{bmatrix} + \begin{bmatrix} \varepsilon_t \\ \eta_t \\ \nu_t \\ 0 \\ \mu_t \\ 0 \\ 0 \end{bmatrix}$$

Effects of Excess Return Shocks