

Predicting US Federal Employment Growth

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Main Questions

- What determines growth in US Government employment expenditures?
- Can we model and predict this growth?
- Do politics matter?

Outline

- Literature review
- The data
- Univariate models of defense and nondefense expenditures
 - modelling
 - forecasts
- Multivariate model incorporating political effects and recessions
 - modelling
 - forecasts
- Conclusion

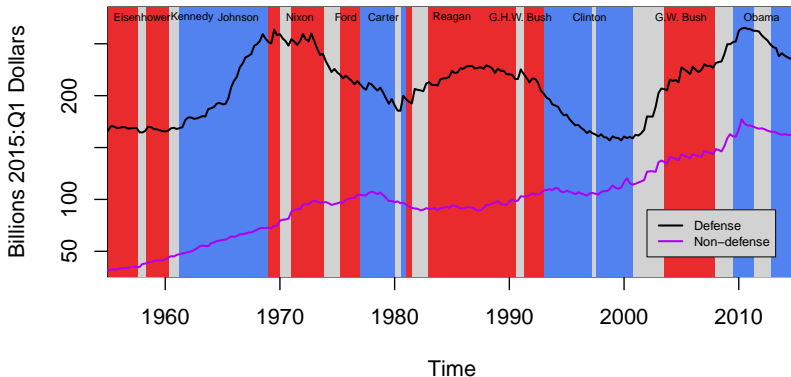
Literature Review

- No apparent similar articles
- Previous work on expenditure priorities in the US looked at trade off between defense and health spending¹
 - Suggests some possible concerns regarding what measures of gov't allocations and expenditures are used
 - Shows trade off in allocations, but not, generally, in actual expenditures
- A few papers look at political effects on federal allocations, but they're generally concerned with what states or districts receive funds, not how ideology shapes funding priorities
 - Some suggestion that unified federal gov't increases allocations to same party districts²

¹Peroff, Kathleen and Margaret Podolak-Warren, Does Spending on Defence Cut Spending on Health?: A Time-Series Analysis of the US Economy 192974, *British Journal of Political Science*, 1979, 9 (01), 2139.

²Berry, Christopher R, Barry C Burden, and William G Howell, The president and the distribution of federal spending, *American Political Science Review*, 2010, 104 (04), 783799.

US Federal Expenditures on Employment



- Time series of federal employment expenditures ³
 - 1955:Q1 to 2015:Q1
 - In billions of 2015:Q1 dollars
 - Seasonally adjusted⁴
- Presidential party shown on graph⁵
- Later models incorporate times series of House and Senate majority party control, and interaction terms showing when and who controls all of congress and or the presidency as well.

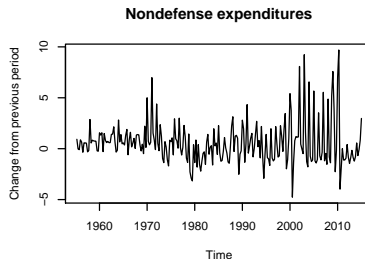
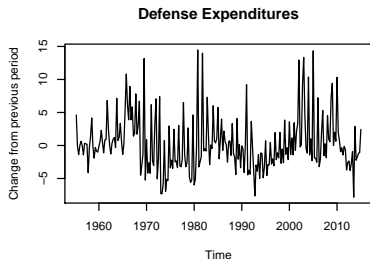
³Fed employment expenditure data are from the FRED, transformed into current dollars using CPI from the FRED

⁴Unfortunately, these data were only available quarterly seasonally adjusted

⁵Political time series generated from public sources 

univariate modelling

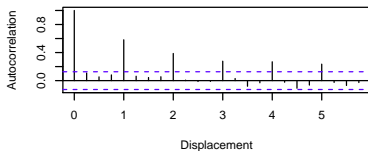
- Augmented Dickey-Fuller test suggest both series are not covariance stationary
- Change from previous quarter is covariance stationary for both⁶



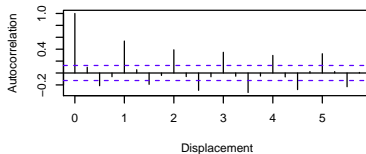
⁶Interestingly, nondefense percent change from previous quarter is not covariance stationary

univariate modelling

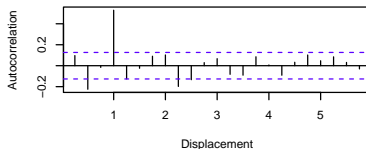
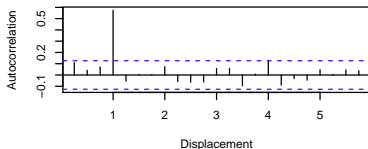
Autocorrelation function of Defense expend.



Autocorrelation function of Nondefense expend.



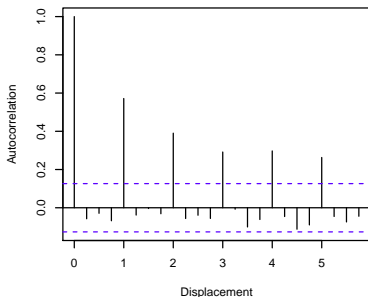
Partial autocorrelation function of Defense expend. Partial autocorrelation function of Nondefense expend



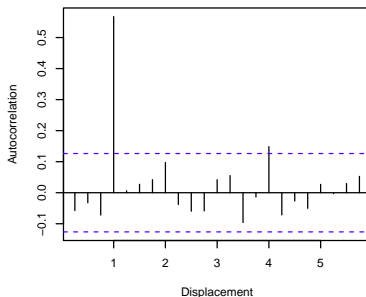
univariate modelling: defense

- Based on AIC's I selected an ARIMA(4,1,0) process for defense expenditures

ACF of Defense ARIMA(4,1,0)



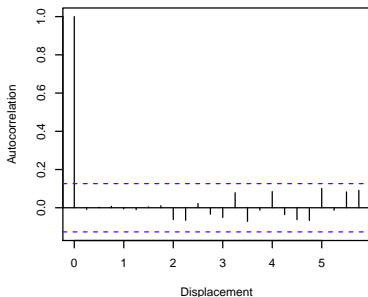
PACF of Defense ARIMA(4,1,0)



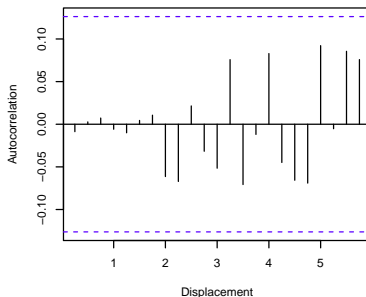
univariate modelling: nondefense

- Based on AIC's I selected an ARIMA(11,1,1) process for nondefense expenditures

ACF of Defense ARIMA(11,1,1)



PACF of Nondefense ARIMA(11,1,1)



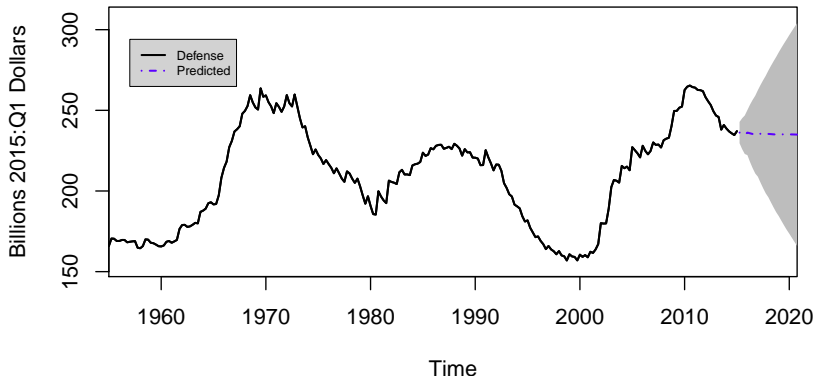
univariate modelling: equations

$$\text{Defense.diff}_t = \sum_{\tau=1}^4 \phi_{\tau} \text{Defense.diff}_{t-\tau} + \varepsilon_t \quad (1)$$

$$\text{Nondefense.diff}_t = \sum_{\tau=1}^{11} \phi_{\tau} \text{Nondefense.diff}_{t-\tau} + \theta \varepsilon_{t-1} + \varepsilon_t$$

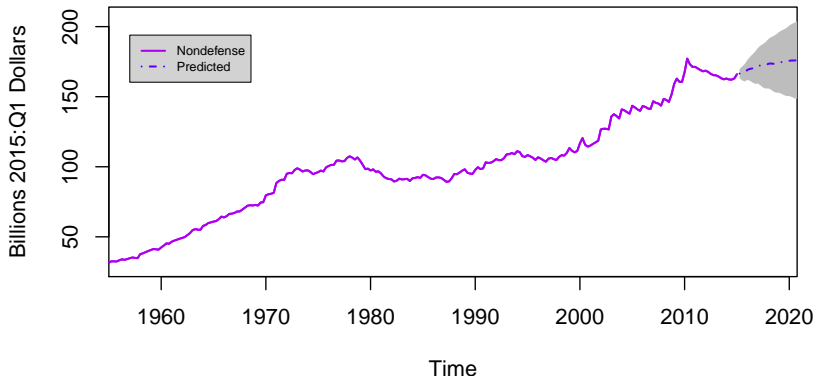
univariate model forecasting: defense

US Federal Expenditures on Defense Employment



univariate model forecasting: nondefense

US Federal Expenditures on Nondefense Employment



multivariate modelling: equations

VAR(1)⁷

$$\begin{aligned}\text{Defense.diff}_t &= \delta_0 + \phi_1 \text{Defense.diff}_{t-1} + \phi_2 \text{Nondefense.diff}_{t-1} \\ &+ \delta_1 \text{house.rep}_{t-1} + \delta_2 \text{senate.rep}_{t-1} + \delta_3 \text{pres.rep}_{t-1} \\ &+ \delta_4 \text{congress.rep}_{t-1} + \delta_5 \text{pres.one.chamber.rep}_{t-1} + \delta_6 \text{fed.rep}_{t-1} \\ &+ \delta_7 \text{recession}_{t-1} + \varepsilon_t \\ \text{Nondefense.diff}_t &= \delta_0 + \phi_1 \text{Defense.diff}_{t-1} + \phi_2 \text{Nondefense.diff}_{t-1} \\ &+ \delta_1 \text{house.rep}_{t-1} + \delta_2 \text{senate.rep}_{t-1} + \delta_3 \text{pres.rep}_{t-1} \\ &+ \delta_4 \text{congress.rep}_{t-1} + \delta_5 \text{pres.one.chamber.rep}_{t-1} + \delta_6 \text{fed.rep}_{t-1} \\ &+ \delta_7 \text{recession}_{t-1} + \varepsilon_t\end{aligned}\tag{2}$$

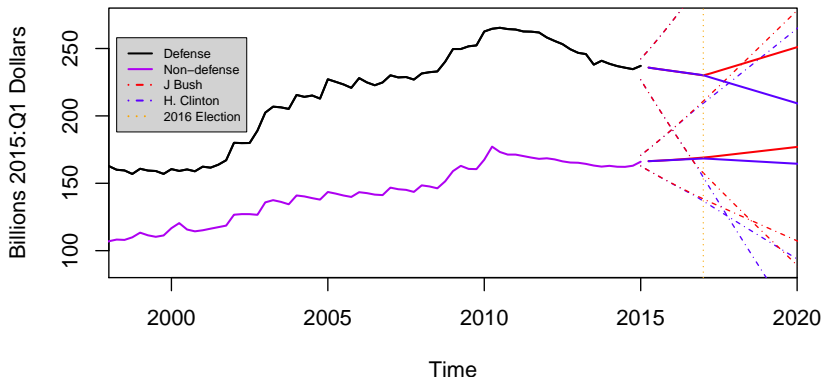
⁷ when including very high lags, max lag > 16, resulted in very high p

multivariate model forecasting: VAR results

	(Defense)	(Nondefense)
diff.defense.l1	0.093 (0.078)	0.041 (0.040)
diff.nondefense.l1	-0.289* (0.155)	-0.006 (0.079)
house.rep.l1	-2.617** (1.126)	-0.628 (0.573)
senate.rep.l1	-6.396*** (2.010)	-3.231*** (1.023)
pres.rep.l1	-1.585** (0.678)	0.419 (0.345)
congress.rep.l1	7.424*** (2.779)	3.812*** (1.414)
pres.one.chamber.rep.l1	7.766*** (1.903)	2.101** (0.968)
fed.rep.l1	-3.757* (2.167)	-2.243* (1.102)
recession.l1	1.557** (0.783)	0.489 (0.399)
const	0.954* (0.506)	0.370 (0.257)
Observations	239	239
R ²	0.128	0.082
Adjusted R ²	0.093	0.046
Residual Std. Error (df = 229)	3.962	2.016
F Statistic (df = 9; 229)	3.719***	2.261**

multivariate model forecasting: VAR results

Forecasted US Federal Expenditures on Employment



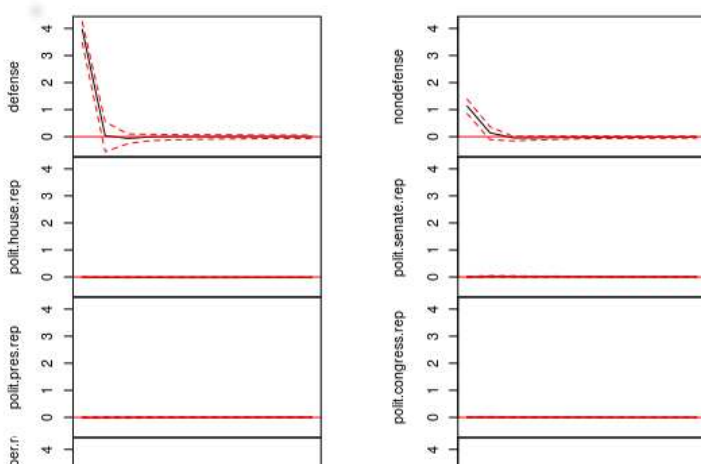
conclusion

- Separate models of Federal Employment Expenditures suggest
 - flat (but uncertain) defense federal employment growth
 - moderate nondefense employment growth
- Federal Employment Expenditures together with Political and Recession indicators suggest
 - Recessions have a small positive effect on defense spending
 - Largest negative political effect on federal employment growth when Presidency and House are controlled by Dems, Senate Controlled by Reps
 - moderate nondefense employment increase
 - Counterfactual forecasting suggests increased federal spending under a Republican administration vs a Democratic administration⁸
- A few concerns
 - GARCH, small effect on volatility from 1 year lag.
 - Model may be misspecified; Unable to include current effects
 - Some political scenarios occurred very infrequently
 - Not sure how VAR() handles binary variables

⁸ Forecast 1: Republican take Presidency and retain Senate and House control. Forecast 2: Democrats retain Presidency, regain Senate, but still not in control of House. House unlikely to shift significantly until after next census.

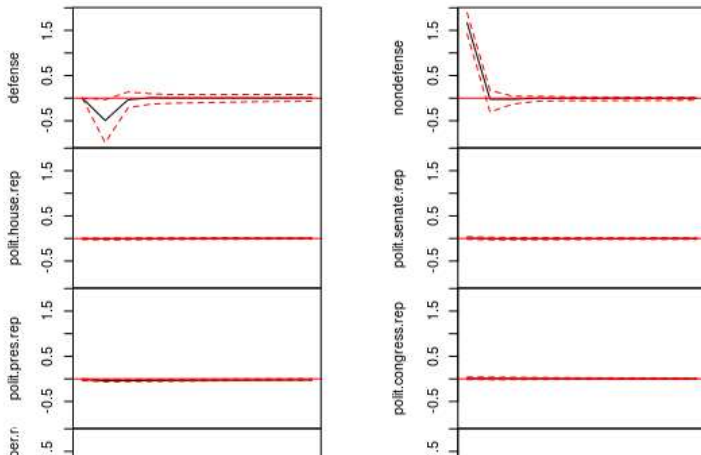
extras: IRFs

Orthogonal Impulse Response from defense



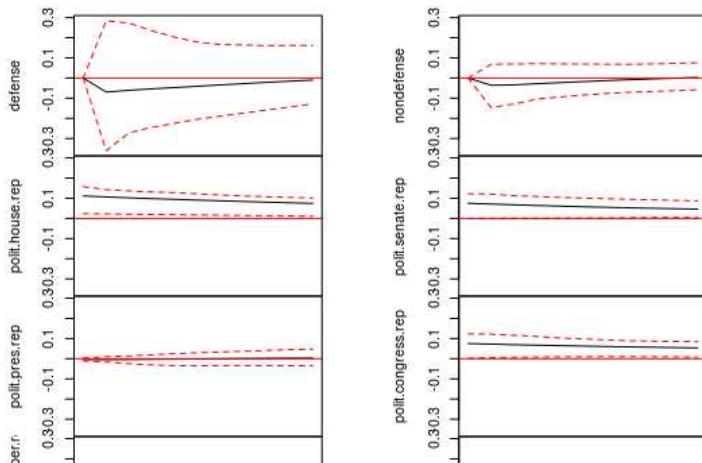
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Orthogonal Impulse Response from nondefense



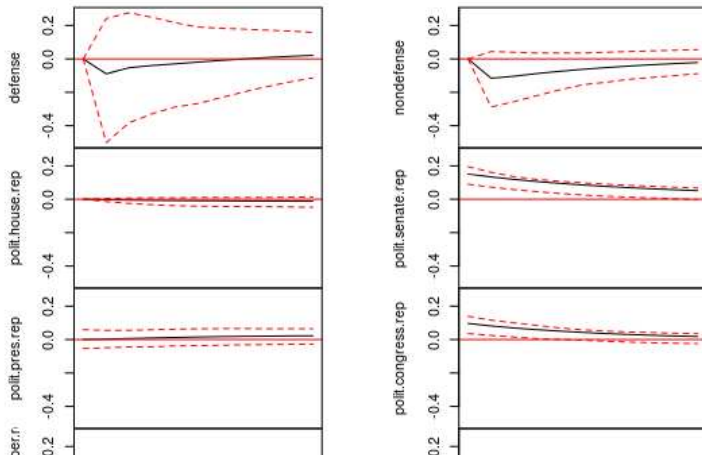
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Orthogonal Impulse Response from polit.house.rep



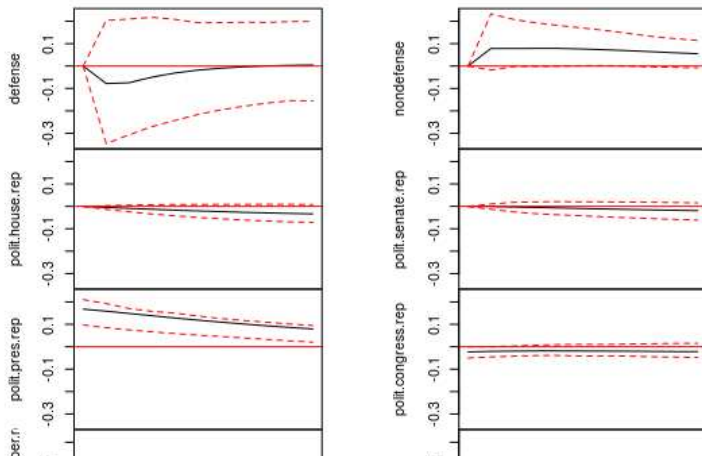
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Orthogonal Impulse Response from polit.senate.rep



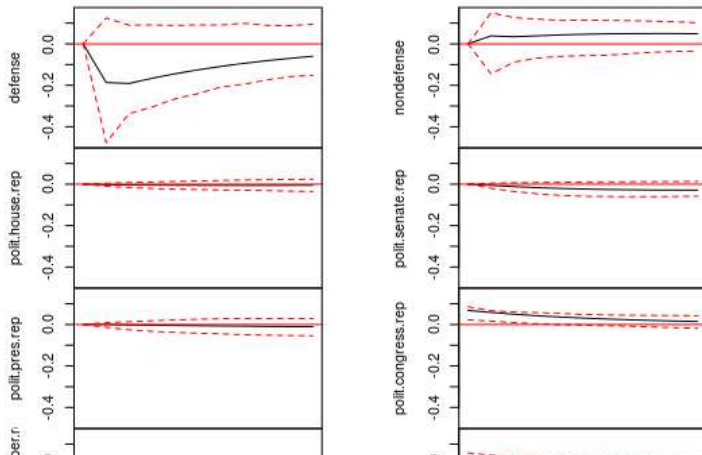
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Orthogonal Impulse Response from polit.pres.rep



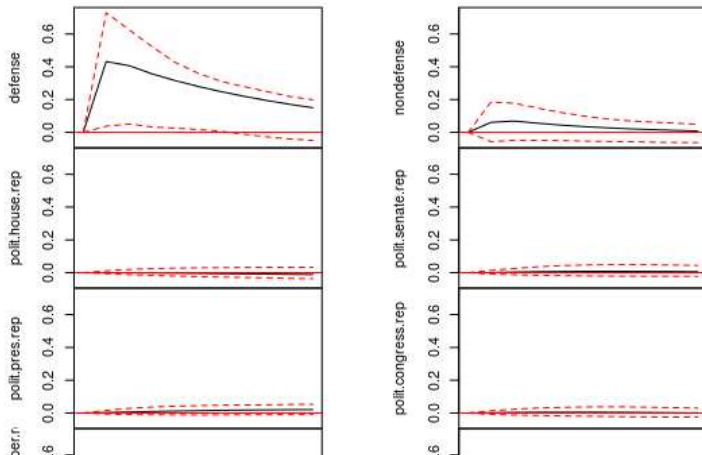
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Orthogonal Impulse Response from polit.congress.rep



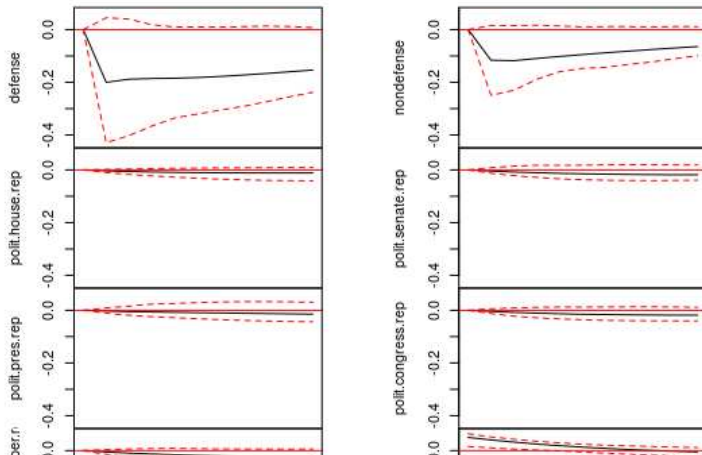
extras: IRFs

Orthogonal Impulse Response from polit.pres.one.chamber.rep



extras: IRFs

Orthogonal Impulse Response from polit.fed.rep



extras: IRFs

Orthogonal Impulse Response from polit.recession

