ECON 4101 Econometrics
Reproducibility Term Paper

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```
bayesPosterior <- readMat('../BayesPosterior.mat'); IRMposs <- bayesPosterior$IRMposs
IRFelas <- readMat('../IRFelas.mat'); IRFelas <- IRFelas$IRFelas;
findex <- readMat('../findex.mat'); findex <- findex$findex;

xmax = 17
mindist <- 0.0061

IRF <- IRFelas[,,findex]
time <- c(0:xmax);
CI <- apply(IRMposs, c(1,2), quantile, probs = c(.16,.84))
CI1458912=apply(apply(IRMposs, c(1,3), cumsum), c(1,2), quantile, probs = c(.16,.84))
for (i in c(1, 4, 5, 8, 9, 12)) {
  CI[, i, ] <- CI1458912[, , i]
}

CI5 = apply(IRMposs, c(1,2), quantile, probs=c(.025, .975))
CI5_1458912=apply(apply(IRMposs, c(1,3), cumsum), c(1,2), quantile, probs = c(.025, .975));
for (i in c(1, 4, 5, 8, 9, 12)) {
  CI5[, i, ] <- CI5_1458912[, , i]
}
```

```
fn <- function(title, Months, ylabel, y, yl, yu, ylim) {
  df <- data.frame(Months=Months, ylabel = y, yl = yl, yu = yu)
  ggplot(df, aes(x=Months)) +
    geom_line(aes(y=ylabel), color='red') +
    geom_line(aes(y=yl), color='blue', linetype='dashed') +
    geom_line(aes(y=yu), color='blue', linetype='dashed') +
    geom_hline(aes(yintercept=0)) +
    scale_y_continuous(limits = ylim) +
    ggtitle(title) +
    labs(y = ylabel) +
    theme(axis.text=element_text(size=6),
          axis.title=element_text(size=8),
          plot.title=element_text(size=8))
}
```

```
g1 <- fn('Flow Supply Shock', time, 'Oil Production', -cumsum(IRF[1,]), -CI[1,1,], -CI[2,1,], c(-2,2))
g5 <- fn('Flow Demand Shock', time, 'Oil Production', cumsum(IRF[5,]), CI[1,5,], CI[2,5,], c(-2,2))
g9 <- fn('Speculative Demand Shock', time, 'Oil Production', cumsum(IRF[9,]), CI[1,9,], CI[2,9,], c(-2,2))

g2 <- fn('Flow Supply Shock', time, 'Real Activity', -IRF[2,], -CI[1,2,], -CI[2,2,], c(-10,10))
g6 <- fn('Flow Demand Shock', time, 'Real Activity', IRF[6,], CI[1,6,], CI[2,6,], c(-10,10))
g10 <- fn('Speculative Demand Shock', time, 'Real Activity', IRF[10,], CI[1,10,], CI[2,10,], c(-10,10))

g3 <- fn('Flow Supply Shock', time, 'Real Price of Oil', -IRF[3,], -CI[1,3,], -CI[2,3,], c(-10,10))
```

```r
g7 <- fn('Flow Demand Shock', time, 'Real Price of Oil', IRF[7,], CI[1,7,], CI[2,7,], c(-10,10))
g11 <- fn('Speculative Demand Shock', time, 'Real Price of Oil', IRF[11,], CI[1,11,], CI[2,11,], c(-10,

g4 <- fn('Flow Supply Shock', time, 'Inventories', -cumsum(IRF[4,]), -CI[1,4,], -CI[2,4,], c(-20,20))
g8 <- fn('Flow Demand Shock', time, 'Inventories', cumsum(IRF[8,]), CI[1,8,], CI[2,8,], c(-20,20))
g12 <- fn('Speculative Demand Shock', time, 'Inventories', cumsum(IRF[12,]), CI[1,12,], CI[2,12,], c(-20

globs <- list(g1,g2,g3,g4,g5,g6,g7,g8,g9,g10,g11,g12)
```
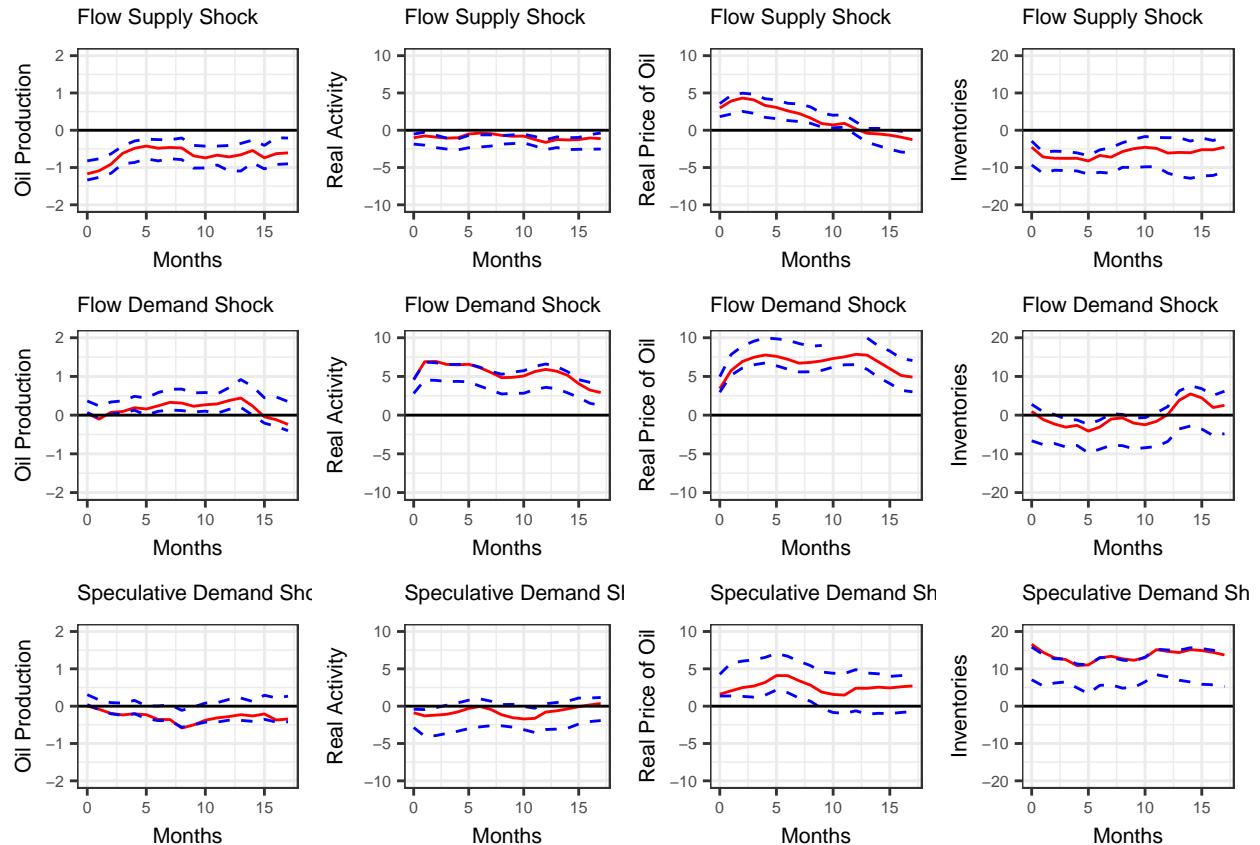
```r
# Figure 1
grid.arrange(grobs=globs, layout_matrix = matrix(1:12, byrow = T,nrow=3))
```



```r
bayesPosterior <- readMat('../BayesPosterior.mat'); IRMposs <- bayesPosterior$IRMposs
IRFelas <- readMat('../IRFelas.mat'); IRFelas <- IRFelas$IRFelas;
findex <- readMat('../findex.mat'); findex <- findex$findex;
U <- readMat('../U.mat'); U <- U$U
BETAnc <- readMat('../BETAnc.mat'); BETAnc <- BETAnc$BETAnc

IdentMat <- matrix(IRFelas[,1,findex], nrow=4)
Uhat <- U
p=24;
t=439; # length(kmData)
K <- nrow(IdentMat)
q <- ncol(IdentMat)

# Compute structural multipliers
A = rbind(BETAnc, cbind(diag(K*(p-1)), diag(x=0, K*(p-1), K)))
```

```r
J = cbind(diag(K), diag(x=0, K, K*(p-1)))
IRF = matrix(J %*% (A %^% 0) %*% t(J) %*% IdentMat, nrow = K^2, ncol = 1)
for (i in 1:(t-p-1)) {
  IRF = cbind(IRF, matrix(J %*% (A %^% i) %*% t(J) %*% IdentMat, nrow = K^2, ncol = 1))
}

# Compute structural shocks Ehat from reduced form shocks Uhat
Ehat = MASS::ginv(IdentMat) %*% Uhat[1:q,];

# Cross-multiply the weights for the effect of a given shock on the real
# oil price (given by the relevant row of IRF) with the structural shock
# in question
yhat1 = diag(x=0,t-p,1);
yhat2 = diag(x=0,t-p,1);
yhat3 = diag(x=0,t-p,1);
yhat4 = diag(x=0,t-p,1);
for (i in 1:(t-p)) {
  yhat1[i,] = IRF[3, 1:i] %*% Ehat[1, i:1]
  yhat2[i,] = IRF[7, 1:i] %*% Ehat[2, i:1]
  yhat3[i,] = IRF[11, 1:i] %*% Ehat[3, i:1]
  yhat4[i,] = IRF[15, 1:i] %*% Ehat[4, i:1]
}

time = seq(from = (1973+2/12+1/12*p), to = 2009+8/12, by = 1/12); # starts at 1975.2
cumshock = yhat1 + yhat2 + yhat3 + yhat4;

df <- data.frame(Years=time, CumEffect=yhat1)
g <- ggplot(mapping=aes(x=time)) + geom_vline(aes(xintercept=1978+9/12)) +
  geom_vline(aes(xintercept=1980+9/12)) +
  geom_vline(aes(xintercept=1985+12/12)) +
  geom_vline(aes(xintercept=1990+7/12)) +
  geom_vline(aes(xintercept=1997+7/12)) +
  geom_vline(aes(xintercept=2002+11/12)) +
  scale_y_continuous(limits = c(-100, 100)) +
  ylab('')
g1 <- g + geom_line(aes(y=yhat1), color='blue') +
  ggtitle('Cumulative Effect of Flow Supply Shock on Real Price of Crude Oil')
g2 <- g + geom_line(aes(y=yhat2), color='blue') +
  ggtitle('Cumulative Effect of Flow Demand Shock on Real Price of Crude Oil')
g3 <- g + geom_line(aes(y=yhat3), color='blue') +
  ggtitle('Cumulative Effect of Speculative Demand Shock on Real Price of Crude Oil')

# Figure 2
grid.arrange(grobs=list(g1,g2,g3), nrow=3)
```
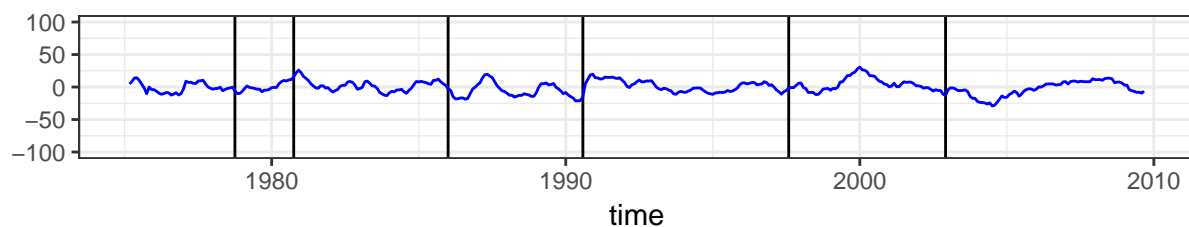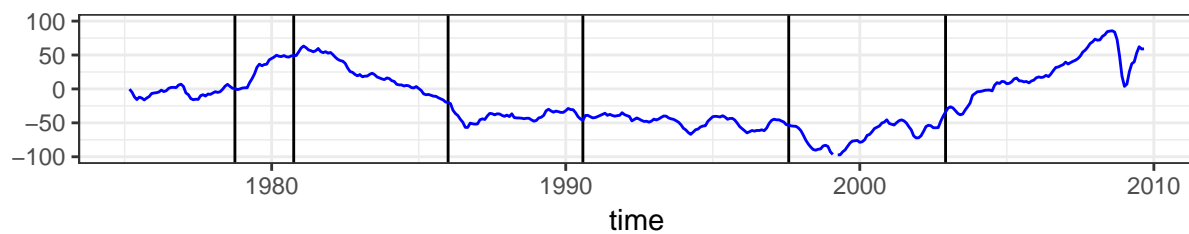
Cumulative Effect of Flow Supply Shock on Real Price of Crude Oil

Cumulative Effect of Flow Demand Shock on Real Price of Crude Oil

Cumulative Effect of Speculative Demand Shock on Real Price of Crude O