IRF

CLMENT CARRIER

Shock response

Consider a VAR(1) in difference where the parameters have been estimated:

$$\Delta Y_t = \Delta Y_{t-1}\hat{A} + \epsilon_t,$$

To compute the response to an exogenous shock of size s to the first variable in Y, construct the vector $\delta = [s, 0, ..., 0]$. The response at after h periods is given by $\delta\hat{A}^h$.

- For models with multiple lags the companion form (or simply recursive computations) can be used.
- For models with exogenous variables, at path for the exogenous variables has to be specified. In general it should be equal to zero or to a random walk forecast, at least in periods following an initial shock.
- The deterministics can be omitted.
- For VECM models, things are more complicated but not much more difficult.

Conditional forecasts

The options so far:

- Create a model for the exogenous variable.
- Use naïve methods (i.e. RW).
- Compute prediction density for the exogenous variable and plug in the model. Gaussian + linear = Gaussian.
- Condition on true value.

Application sur R

```
require(lassovar)
## Loading required package:  lassovar
require(ggplot2)
## Loading required package:  ggplot2
require(reshape2)
## Loading required package:  reshape2
require(urca)
## Loading required package:  urca
require(MSBVAR)
## Loading required package:  MSBVAR
## ##
## ## MSBVAR Package v.0.9-2
## ## Build date:  Tue Jul  7 12:43:19 2015
## ## Copyright (C) 2005-2015, Patrick T. Brandt
## ## Written by Patrick T. Brandt
```

Date: July 7, 2015.

```
## ##
## ## Support provided by the U.S. National Science Foundation
## ## (Grants SES-0351179, SES-0351205, SES-0540816, and SES-0921051)
## ##
##
##
## Attaching package:  'MSBVAR'
##
## The following object is masked from 'package:urca':
##
##     summary
```

```
load("vardata2")
```

I keep variables from Q1 1998 :

```
data<-subset(vardataframe[117:180,])
```

First difference of all series :

```
difdata <- tail(data,-1) - head(data,-1)
```

Shock Response

Function for computing the IRF :

```
forecast<-function(data,lag,horizon,choc){
  fore<-matrix(0,nrow=dim(data)[2],ncol=horizon)
  lv<-lassovar(dat=data,lags=lag, ic="BIC")
  coeff<-lv$coefficients[-1,]
  for (i in 1:horizon){
    fore[,i]<-coeff^i%*%choc
  }
return(t(fore))
}
```

Conditional Shock

Function to generate RW for exogonous variables. I fixed the variance of the schock equal to the variance of oil price index on the sample. The reason is that, in the following IRF I only use oil price as exogenous variable. I need to modify the function.

```
rw<-function(t,x){
  y<-matrix(0,dim(x)[2],t)
  y[,1]<-t(x)
  for(i in 2:t){
    y[,i] <- y[,i-1] + matrix(rnorm(dim(x)[2],0,0.4942424),dim(x)[2],1)
  }
  return(y)
}
```

Function to compute IRF to RW evolution of exogeneous variables

```
conditional<-function(exogen,data,lag,horizon){
  all=data.frame(exogen,data)
  fore<-matrix(0,nrow=dim(data)[2]+dim(exogen)[2],ncol=horizon+1)
  fore[,1]<-t(all[dim(all)[1],])
  fore[1:dim(exogen)[2],-1]<-rw(horizon,as.matrix(exogen[dim(exogen)[1],]))
  lv<-lassovar(dat=all,lags=lag, ic="BIC")
  coeff<-as.matrix(t(lv$coefficients[-1,]),26,26)
  intercept<-as.matrix(lv$coefficients[1,],26,1)
  for (i in 2:(horizon+1)){
    fore[-dim(exogen)[2],i]<-intercept[-dim(exogen)[2],]+(coeff%*%fore[,i-1])[-dim(exogen
  }
  rownames(fore)<-names(all)
  return(t(fore))
}
```

Application with Oil Price as exogenous variable

I transform the HICP index in an inflation rate (year-on-year)

```
HICP<-vardataframe[113:180,6]

inflation<-NULL
for (i in seq(from=5,to=length(HICP),by=1)){
  inflation[i]=-1+exp(HICP[i])/exp(HICP[i-4])
}

inflation<-inflation[5:68]*100

data$HICP<-NULL
data$inflation<-inflation
```

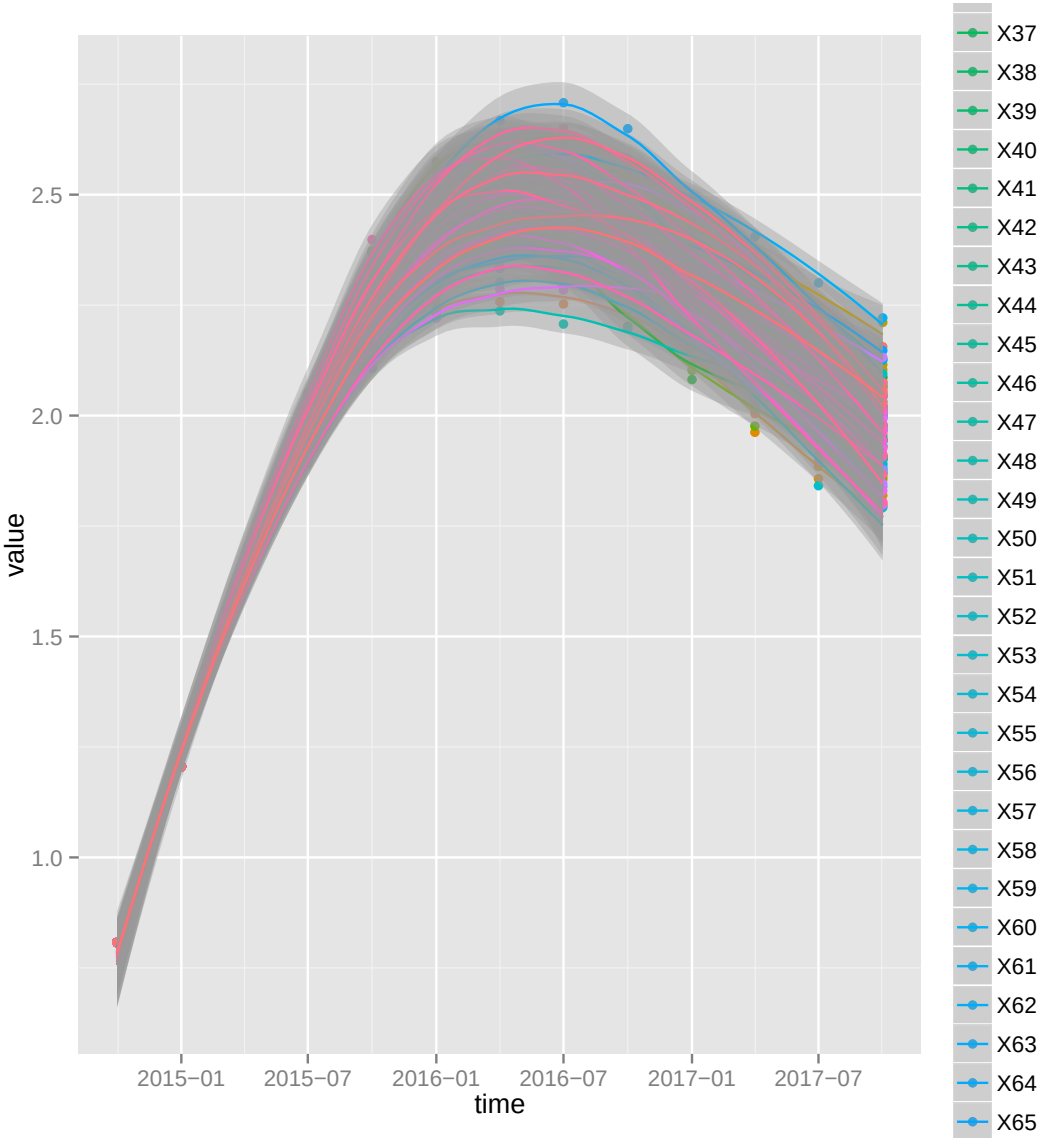
I choose oil price as exogenous variable.

```
exo<-data.frame(data$POILU)
colnames(exo)<-'POILU'
end<-subset(data[,-which(names(data) %in% c("POILU"))])
```

I iterate 100 random walk scenario for oil price, and I keep the prediction of inflation.

```
iter<-100
HICPpred<-matrix(0,13,iter)
for (i in 1:iter){
  HICPpred[,i]<-matrix(conditional(exo,end,1,12)[,"inflation"])
}
```

```
HICPpred<-data.frame(HICPpred)
HICPpred$time<-seq(as.Date("2014/10/01"), as.Date("2017/12/31"), by = "quarter")
var <- melt(HICPpred,  id = 'time', variable.name = 'series')
ggplot(var, aes(time,value, col=series)) + geom_point() + stat_smooth()
## geom_smooth:  method="auto" and size of largest group is <1000, so using
loess.  Use 'method = x' to change the smoothing method.
```


2.5
2.0
1.5
1.0
value
2015−01
2015−07
2016−01
2016−07
2017−01
2017−07
time
X37
X38
X39
X40
X41
X42
X43
X44
X45
X46
X47
X48
X49
X50
X51
X52
X53
X54
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X59
X60
X61
X62
X63
X64
X65