2021 秋季本科时间序列

第 8 次作业答案

12 月 18 日

1. (a) 3 个变量的差分序列皆具备平稳性。具体如图 1 所示。

   代码如下：

```r
library(readxl)
library(dplyr)
data <- read_excel("outdata202106_hz_quarterly.xlsx")
#7天回购利率参与机构广、交易量大、且不易被个别机构操纵、反应灵敏，是短期市场利率的代表，适宜作为中国货币政策工具变量
CMTS <- data %>%
  select(q_dates_data, logrealGDP_va, CPI,R7dRepo, logM2) %>%
  filter(q_dates_data >= 1999.75 & q_dates_data <=2019.75)
CMTS_diff <- tibble(
  logGDP_diff = diff(CMTS$logrealGDP_va, lag = 1),
  CPI_diff = diff(CMTS$CPI, lag = 1),
  r7d_diff = diff(CMTS$R7dRepo,lag = 1)
)
#各变量时间序列图
for(i in 2:4){
 TS <- ts(CMTS[i], start=1999.75, end=2019.75, frequency=4)
 plot(TS)
}
#各变量差分时间序列图
for(i in 1:3){
  TS <- ts(CMTS_diff[i], start=2000.00, end=2019.75,
```

```
        frequency=4)
    plot(TS)
}
```

(b) 第 3 个方程的参数估计显示，$\Delta \log GDP_{t-1}$ 和 $\Delta \log CPI_{t-1}$ 的估计系数随着 VAR 模型滞后阶数增加而增大。

代码如下：

```
library(vars)
diff_CMTS <- tibble(
diff_logGDP = diff(CMTS$logrealGDP_va, lag = 1),
diff_logCPI = diff(log(CMTS$CPI), lag = 1),
R7dRepo=CMTS$R7dRepo[-1]
)
VAR1 <- VAR(diff_CMTS, p=1, type='const')
VAR2 <- VAR(diff_CMTS, p=2, type='const')
VAR3 <- VAR(diff_CMTS, p=4, type='const')

coef <- tribble(
~"p", ~"diff_logGDP.l1",~"diff_logCPI.l1",
#----------/---------------/
"1" , 0.012381728, 0.261548408,
"2" , 0.021701371, 0.278758500,
"4" , 0.034865028, 0.312024954,
)
knitr::kable(coef,digits = 4,
caption = "R7dRepo方程估计系数")
```

所以该方程得估计系数为

p	$\Delta \log GDP_{t-1}$	$\Delta \log CPI_{t-1}$
1	0.0124	0.2615
2	0.0217	0.2788
4	0.0349	0.3120

(c) 根据 AIC 准则，滞后阶数应取 1 阶。

代码如下：

```
VARselect(diff_CMTS, type = "const")
```

(d) 三种估计结果分别如图 2，图 3，图 4 所示。

代码如下：

```
plot(irf(VAR1))
plot(irf(VAR2))
plot(irf(VAR3))
```

(e) 当经济体面临一个外生的货币政策冲击时，将在今后 10 期，即 2.5 年的时间内受其影响，短期 GDP 增速迅速下降，CPI 增速小幅上升，然后回落，长期来看会恢复到经济的长期均衡。因此 7 天回购利率作为中国货币政策工具变量能捕捉货币政策松紧变化的效果。

(f) 取 $p = 1$, 计算出 $j = 4, 8, 12, 36$ 期的预测方差分解, 结果如图 5 所示

代码如下:

```
fe1 = fevd(VAR1, n.ahead=36)
fe1$diff_logGDP[c(4,8,12,36),]
fe1$diff_logCPI[c(4,8,12,36),]
fe1$R7dRepo[c(4,8,12,36),]
```

(g) 脉冲响应结果相差不大, 从方差分解看, M2 环比增速对 GDP 和 CPI 增速的贡献大于 it，所以 M2 环比增速更适合作为中国货币政策工具的分析指标。代码如下:

```
#i_t在前
diff_CMTS_4 <- tibble(
  diff_logGDP = diff(CMTS$logrealGDP_va, lag = 1),
  diff_logCPI = diff(log(CMTS$CPI), lag = 1),
  R7dRepo=CMTS$R7dRepo[-1],
  diff_logM2 = diff(CMTS$logM2, lag = 1)
)
VARselect(diff_CMTS_4 ,type="const")
#结合SC 与模型的自由度判断, 取 4 阶不符合大样本, 滞后阶数应
    取 1 阶。
VARg1 <- VAR(diff_CMTS_4, p=1, type='const')
plot(irf(VARg1))
fevd1 <- fevd(VARg1, n.ahead=36)
fevd1$diff_logGDP[c(4,8,12,36),]
fevd1$diff_logCPI[c(4,8,12,36),]
fevd1$R7dRepo[c(4,8,12,36),]
fevd1$diff_logM2[c(4,8,12,36),]
```

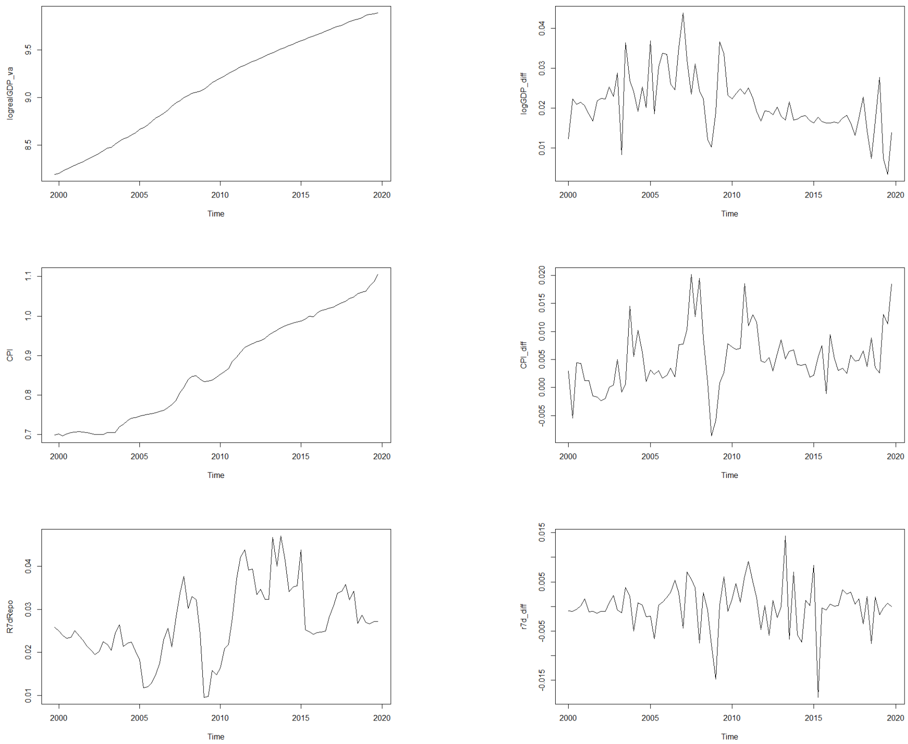

图 1: 各变量及其差分时间序列图

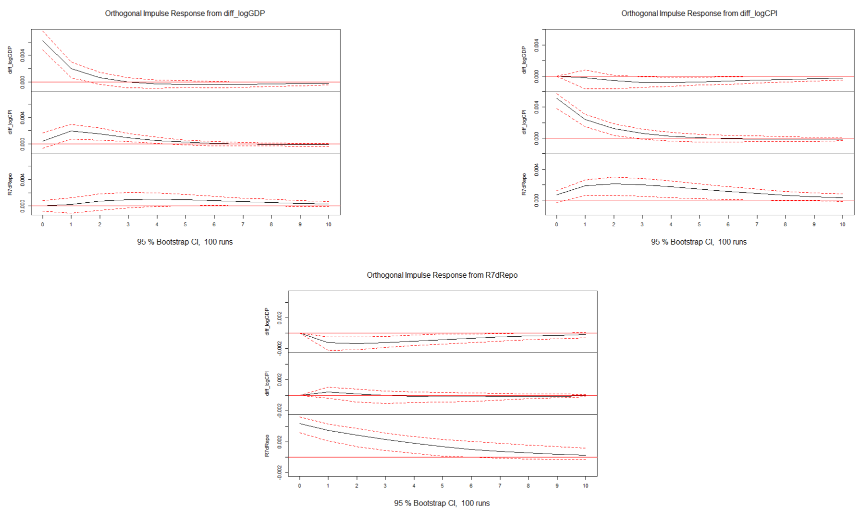

图 2: VAR1 估计结果

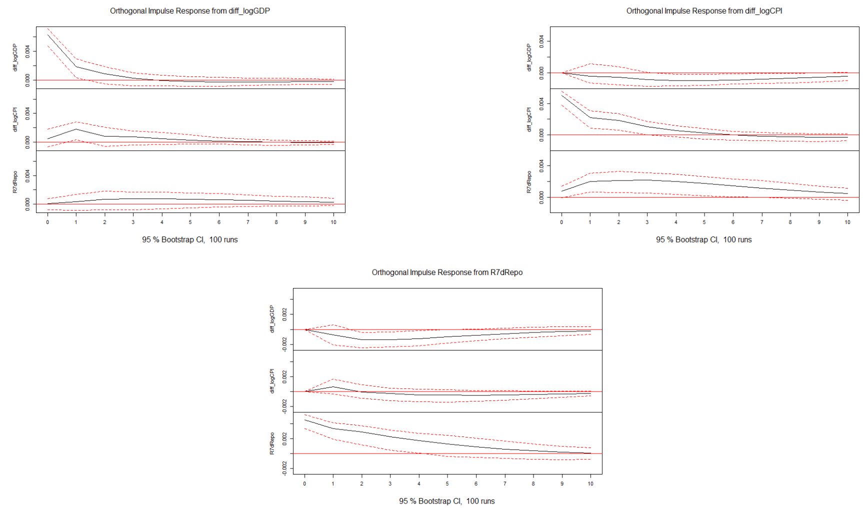

图 3: VAR2 估计结果

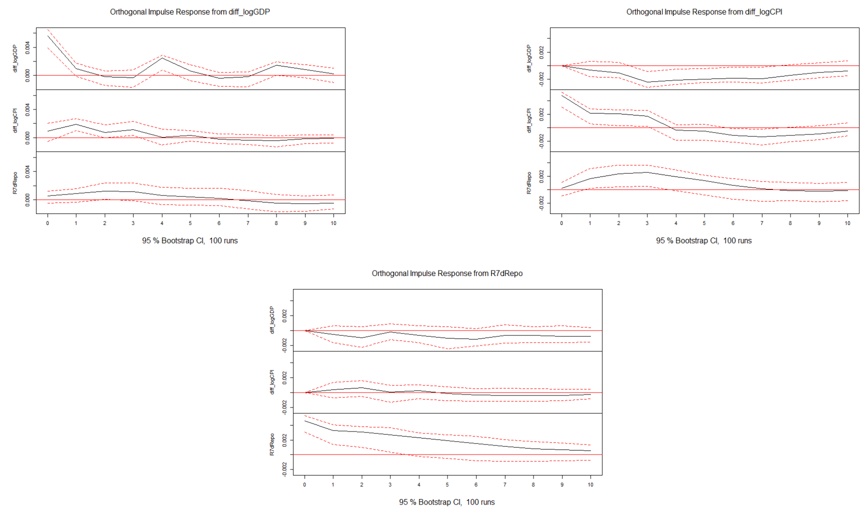

图 4: VAR3 估计结果

	diff_logGDP	diff_logCPI	R7dRepo
[1,]	0.8765121	0.02116362	0.1023243
[2,]	0.8042645	0.05619225	0.1395433
[3,]	0.7955345	0.06222088	0.1422446
[4,]	0.7949253	0.06273450	0.1423402

	diff_logGDP	diff_logCPI	R7dRepo
[1,]	0.1745420	0.8203681	0.005089906
[2,]	0.1806342	0.8110138	0.008351965
[3,]	0.1803897	0.8099305	0.009679821
[4,]	0.1804251	0.8097386	0.009836354

	diff_logGDP	diff_logCPI	R7dRepo
[1,]	0.02631053	0.2178152	0.7558743
[2,]	0.06055606	0.2645216	0.6749224
[3,]	0.06650023	0.2689545	0.6645453
[4,]	0.06703845	0.2692269	0.6637346

图 5: $p=1$ 时,$j=4,8,12,36$ 期的预测方差分解

```r

#M2在前
diff_CMTS_44 <- tibble(
  diff_logGDP = diff(CMTS$logrealGDP_va, lag = 1),
  diff_logCPI = diff(log(CMTS$CPI), lag = 1),
  diff_logM2 = diff(CMTS$logM2, lag = 1),
  R7dRepo=CMTS$R7dRepo[-1]
)
VARg2 <- VAR(diff_CMTS_44, p=1, type='const')
plot(irf(VARg2))
fevd2 <- fevd(VARg2, n.ahead=36)
fevd2$diff_logGDP[c(4,8,12,36),]
fevd2$diff_logCPI[c(4,8,12,36),]
fevd2$diff_logM2[c(4,8,12,36),]
fevd2$R7dRepo[c(4,8,12,36),]
```

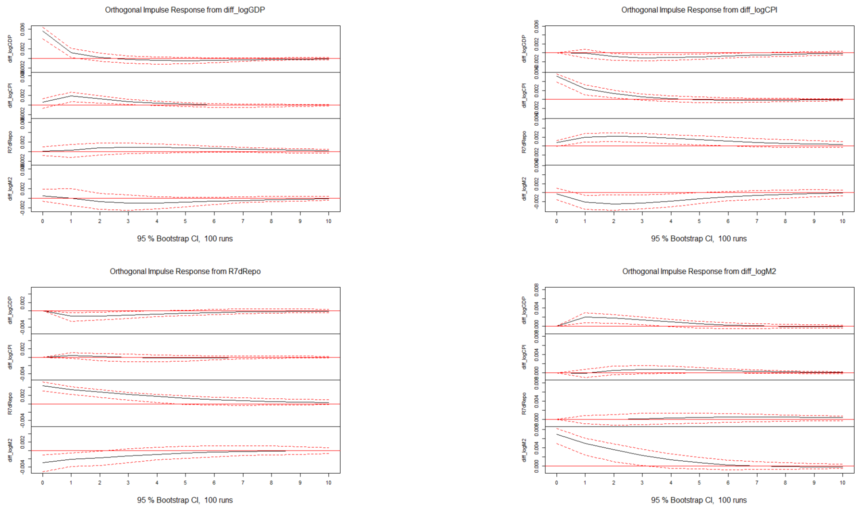

图 6: VARg1 估计结果

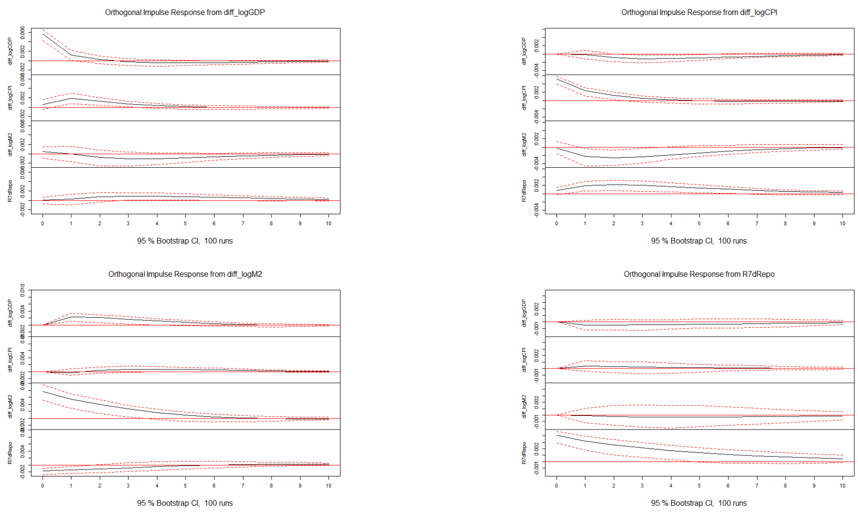

图 7: VARg2 估计结果

```
> fevd1$diff_logGDP[c(4,8,12,36),]
     diff_logGDP diff_logCPI    R7dRepo diff_logM2
[1,]   0.6812527  0.04061380 0.09788047  0.1802530
[2,]   0.6157871  0.09004270 0.11344427  0.1807259
[3,]   0.6124650  0.09356204 0.11410418  0.1798688
[4,]   0.6120375  0.09355416 0.11413330  0.1802751
> fevd1$diff_logCPI[c(4,8,12,36),]
     diff_logGDP diff_logCPI     R7dRepo diff_logM2
[1,]   0.1430382   0.8341322 0.004969701 0.01785992
[2,]   0.1413965   0.8076795 0.006067595 0.04485642
[3,]   0.1412950   0.8061625 0.006209901 0.04633262
[4,]   0.1413179   0.8061341 0.006211412 0.04633657
> fevd1$R7dRepo[c(4,8,12,36),]
     diff_logGDP diff_logCPI   R7dRepo   diff_logM2
[1,]  0.02440645   0.2183479 0.7570023 0.0002433313
[2,]  0.04772501   0.2612399 0.6809493 0.0100857899
[3,]  0.05010339   0.2614093 0.6699586 0.0185287470
[4,]  0.05014989   0.2608091 0.6683819 0.0206591019
> fevd1$diff_logM2[c(4,8,12,36),]
     diff_logGDP diff_logCPI   R7dRepo diff_logM2
[1,]  0.01396174   0.1284694 0.1442060  0.7133629
[2,]  0.02989181   0.1645040 0.1413898  0.6642144
[3,]  0.03089649   0.1652974 0.1411085  0.6626976
[4,]  0.03089333   0.1652581 0.1410759  0.6627726
```

```
> fevd2$diff_logGDP[c(4,8,12,36),]
     diff_logGDP diff_logCPI diff_logM2    R7dRepo
[1,]   0.6812527  0.04061380  0.2635229 0.01461054
[2,]   0.6157871  0.09004270  0.2718032 0.02236699
[3,]   0.6124650  0.09356204  0.2695952 0.02437775
[4,]   0.6120375  0.09355416  0.2696769 0.02473145
> fevd2$diff_logCPI[c(4,8,12,36),]
     diff_logGDP diff_logCPI diff_logM2     R7dRepo
[1,]   0.1430382   0.8341322 0.01571381 0.007115809
[2,]   0.1413965   0.8076795 0.04289532 0.008028690
[3,]   0.1412950   0.8061625 0.04452492 0.008017603
[4,]   0.1413179   0.8061341 0.04453098 0.008017009
> fevd2$diff_logM2[c(4,8,12,36),]
     diff_logGDP diff_logCPI diff_logM2     R7dRepo
[1,]  0.01396174   0.1284694  0.8565618 0.001007131
[2,]  0.02989181   0.1645040  0.8024058 0.003198424
[3,]  0.03089649   0.1652974  0.8000667 0.003739409
[4,]  0.03089333   0.1652581  0.8000407 0.003807888
> fevd2$R7dRepo[c(4,8,12,36),]
     diff_logGDP diff_logCPI diff_logM2   R7dRepo
[1,]  0.02440645   0.2183479 0.11701580 0.6402298
[2,]  0.04772501   0.2612399 0.09489772 0.5961374
[3,]  0.05010339   0.2614093 0.09448926 0.5939981
[4,]  0.05014989   0.2608091 0.09491702 0.5941240
```

图 8: $p = 1$ 时,$j = 4, 8, 12, 36$ 期的预测方差分解