```
X=matrix(c(15,120,19.31,111.79,99.77,120,1240,
164.3,1035.9,875.6,19.31,
164.3,25.218,148.98,131.22,111.79,1035.9,148.98,
953.86,799.02,
99.770,875.60,131.22,799.02,716.67),5,5)
Y=matrix(c(3.0500,26.004,3.9926,23.521,20.732),
5,1)
solve(t(X)%*%X)%*%t(X)%*%Y
###############
test_dta=read.table("tst.csv",sep=",",header=T)#da
ta.frame
cor(test_dta[,-2])
attach(test_dta)
X1=cbind(1,T,rGNP,R)#X2 ： inflation;rbind ：
rowbind
X2=cbind(P)
y=matrix(test_dta[,1],NROW(test_dta),1)
MX1=diag(NROW(test_dta))-X1%*%solve(t(X1)
%*%X1)%*%t(X1)

#I-X%*%(t(X)%*%X)^{-1}%*%t(X);residual
maker matrix
y_star=MX1%*%y
x2_star=MX1%*%X2
cor(y_star,x2_star)
X1=cbind(1,rGNP,R,P)
X2=cbind(T)
y=matrix(test_dta[,1],NROW(test_dta))
MX1=diag(NROW(test_dta))-X1%*%solve(t(X1)
%*%X1)%*%t(X1)
y_star=MX1%*%y
x2_star=MX1%*%X2
cor(y_star,x2_star)

##########centring matrix
mean_reg=lm(y~1)
summary(mean_reg)
derivation=residuals(mean_reg)#y-y^{hat};y_hat=
xb;e=y-xb
N=length(y)
i=matrix(1,N,1)
M0=diag(1,N)-1/N*i%*%t(i)#centringmatrix
derivation2=M0%*%y
derivation3=y-mean(y)
cbind(derivation,derivation2,derivation3)
############4.1
n=10000
omega=rnorm(n,0,1)
x=rnorm(n,0,1)
sigma=0.5*omega
y=0.5+0.5*x+sigma#DGP:datagenerationprocess
data=data.frame(y,x)
lm1=lm(y~x)
summary(lm1)
b_store=NULL******kongzhi
for(tin1:1000){#loop
index=sample(seq(1,n,1),1000)
#sub_reg=lm(y~x-1,data=data,subset=index)
#b_store[t]=coef(sub_reg)
x_sub=x[index]
y_sub=y[index]
b_store[t]=solve(t(x_sub)%*%x_sub)%*%t(x_sub)%
*%y_sub#(X'X)-1X'y
}
plot(density(b_store))
hist(b_store)********nullzidongxvanze heshide
fanwei
######
n=10000
var=5
X=rnorm(n,0,sqrt(var))
t(X)%*%X/n
####
n=10000
X1=rnorm(n)
X2=rnorm(n)
X=cbind(X1,X2)
beta=c(0.3,0.6)
Y=X%*%beta+rnorm(n)
result=lm(Y~X)
summary(result)
#var(b|x)=sigma^2*(X'X)^(-1)
M=(diag(n))-X%*%solve(t(X)%*%X)%*%t(X)
e=M%*%Y***10000*1
s2=t(e)%*%e/(n-2)***1*1
s2_unscaled=t(e)%*%e/n***1*1
lm_vcov=matrix(rep(s2,4),2,2)*solve(t(X)%*%X)#e
st.var
sqrt(lm_vcov)***2*2
lm_vcov_unscaled=matrix(rep(s2_unscaled,4),2,2)*s
olve(t(X)%*%X)
sqrt(lm_vcov_unscaled)***2*2
################
#install.packages("numDeriv")
require(numDeriv)#library(numDeriv)
require(quantreg)
```

```
dat=read.table("TableF2-2.csv",header=T,sep=",")
attach(dat)
t=NROW(dat)***t hang
G=1000000*GASEXP/(GASP*POP)
model=lm(log(G[2:t])~log(GASP[2:t])+log(INCOME[2:t])+log(PNC[2:t])+log(PUC[2:t])+log(G[1:(t-1)]),data=dat)
summary(model)
s2=sum(residuals(model)^2)/(t-7)
****52-7=45ziyoudu
sqrt(0.00021705)
#model=lm(log(G)~log(GASP)+log(INCOME)+log(PNC)+log(PUC),data=dat)
#summary(model)***52-5=47

Signif.codes:0‘***’0.001‘**’0.01‘*’0.05‘.’0.1‘’1
res=residuals(model)
s2=t(res)%*%res/(t-7)
s2=s2[1,1] ****0.002686022
X=cbind(1,log(GASP[2:t]),log(INCOME[2:t]),log(PNC[2:t]),log(PUC[2:t]),log(G[1:(t-1)]))
est.var=solve(t(X)%*%X)*s2#*****est.var=s^2*(x/X)-1 6*6
sd=sqrt(diag(est.var))****1*6
f1=function(b){
b[2]/(1-b[6])
}
f2=function(b){
b[3]/(1-b[6])
}
g2=jacobian(f1,coef(model))****1*6
g3=jacobian(f2,coef(model))   ****1*6
delta1=g2%*%est.var%*%t(g2)****0.0230941
delta2=g3%*%est.var%*%t(g3)****0.02636925
##############QR##########
rq_result<rq(log(G[2:t])~log(GASP[2:t])+log(INCOME[2:t])+log(PNC[2:t])+log(PUC[2:t])+log(G[1:(t-1)]),data=dat,tau=0.5)
summary(rq_result)*****fenweishuhuigui
########################
dat2=read.table("TableF4-1.csv",header=T,sep=",")
attach(dat2)
surface=HEIGHT*WIDTH
aspect=HEIGHT/WIDTH
X=cbind(1,log(surface),aspect)
Y=log(PRICE)
m1=lm(log(PRICE)~log(surface)+aspect)
summary(m1)*****zyd427
quanreg=function(b){
mu=X%*%b
LAD=sum(abs(Y-mu))
return(LAD)
}
m2=optim(par=c(0,0,0),quanreg)
rq_result<-rq(log(PRICE)~log(surface)+log(aspect),tau=0.5)
summary(rq_result)
########################################
K=100
R=100
b_ols=matrix(0,3,K)
b_lad=matrix(0,3,K)
for(kin1:K){
obs_list=sample(seq(1,420,1),R,replace=F)
b_ols[,k]=coef(lm(log(PRICE[obs_list])~log(surface[obs_list])+aspect[obs_list]))
b_lad[,k]=coef(rq(log(PRICE[obs_list])~log(surface[obs_list])+aspect[obs_list]),tau=0.5)
}
rowMeans(b_ols)
rowMeans(b_lad)
apply(b_ols,1,sd)#
apply(b_lad,1,sd)
###############P92
n=10000
x=rnorm(n,0,1)
plot(density(x))#PDF
critical_value1=qnorm(0.025,0,1)
critical_value2=qnorm(0.95+0.025,0,1)
abline(v=critical_value1,col=2)
abline(v=critical_value2,col=2)
#############4.8
qt(0.025,47)
qt(0.975,47)
#############4.10
plot(hist(PRICE,30))
X11()
plot(hist(log(PRICE),30))
m1=lm(log(PRICE)~log(surface)+aspect)
summary(m1)
vcov(m1)
x0=c(1,log(25.6*31.9),25.6/31.9)
prediction=coef(m1)%*%x0
mean(log(PRICE))
res=residuals(m1)
```

```
s2=t(res)%*%res/(430-3)
s2=s2[1,1]
X=cbind(1,log(surface),aspect)
est.var=solve(t(X)%*%X)*s2
var_x0=s2+x0%*%est.var%*%x0#4-46
sd_x0=sqrt(var_x0)
x0_upper=prediction+1.96*sd_x0
x0_lower=prediction-1.96*sd_x0
mean(exp(res))#smearing estimator
exp(prediction)*mean(exp(res))
exp(x0_lower)
exp(x0_upper)
######grid search
mu0=prediction
sigma0=sd_x0****1.104028
LO=exp(x0_lower)
decrement=0.005
#K=100
denL=1
denU=0
while(denL>denU){
LO=LO-decrement
denL=dlnorm(LO,mu0,sigma0)
pL=pnorm((log(LO)-mu0)/sigma0)#plnorm(LO,mu0,sigma0),duishuzhengtaifenbu duishubianhuan bianwei zhengtaifenbu
UO=exp(sigma0*qnorm(pL+0.95)+mu0)#qlnorm(pL+0.95,mu0,sigma0)
denU=dlnorm(UO,mu0,sigma0)
}****0.01034464
#######Lonleydata
dat3=read.table("TableF4-2.csv",header=T,sep=",")
attach(dat3)
m1=lm(EMPLOY~I(YEAR-1947)+PRICE+GNP+ARMED)
summary(m1)****zyd11
R1=lm(PRICE~I(YEAR-1947)+GNP+ARMED)
1/(1-0.9868)#VIF
#########PCA
datpca=read.table("TableF4-3.csv",header=T,sep=",")
attach(datpca)
m1=lm(log(BOX)~ACTION+COMEDY+ANIMATED+HORROR+I(MPRATING==1)+
I(MPRATING==2)+I(MPRATING==3)+log(BUDGET)+SEQUEL+STARPOWR)
summary(m1)****zyd51
buzz1=log(ADDICT)
buzz2=log(CMNGSOON)
buzz3=log(FANDANGO)****qvduishu qvchu guimo dyingxiang
buzz4=CNTWAIT3
N=nrow(datpca)
M0=diag(N)-1/N
buzz=cbind(buzz1,buzz2,buzz3,buzz4)****62*4
#colMeans(M0%*%buzz)
Z=apply(M0%*%buzz,2,function(x)x/(sd(x)))
V=1/(N-1)*t(Z)%*%Z#why??xiangguanxishu matrix 1/61-4*4
#cor(Z)
C=eigen(V)***4*4
sum(eigen(V)$values/4)
cor(eigen(V)$vectors)
c1=C$vectors[,1]
c2=C$vectors[,2]
Zc1=Z%*%c1zhuchengfen
****jieshi sigebianliang d dabufen bianhua
Zc2=Z%*%c2
cor(Zc1,Zc2)
cor(c1,c2)
m2=lm(log(BOX)~ACTION+COMEDY+ANIMATED+HORROR+I(MPRATING==1)+
I(MPRATING==2)+I(MPRATING==3)+log(BUDGET)+SEQUEL+STARPOWR+Zc1)
summary(m2)*****zyd50

########5.1
qnorm(0.95)=1.64
qt(0.95,430-3)=1.64
pnorm(1,1.33372,0.09072)=0.000117272
qnorm(0.975)=1.96
##########kafangfenbu(gailvzhi,ziyoudu)

############5.3
dat53=read.table("TableF5-2.csv",header=T,sep=",")
attach(dat53)
t=seq(2,NROW(dat53),1)
m1=lm(log(REALINVS[-1])~TBILRATE[-1]+INFL[-1]+log(REALGDP[-1])+t)
summary(m1)***198zyd
X=cbind(1,TBILRATE[-1],INFL[-1],log(REALGDP[-1]),t)
Y=log(REALINVS[-1])
M=diag(NROW(dat53)-1)-X%*%solve(t(X)%*%X)%*%t(X)
```

```
*****203*203
e=M%*%Y****203*1
s2=t(e)%*%e/(NROW(dat53)-1-5)**nhang-jiejvx
-bianlianggeshu
s2=s2[1,1]
est.var=s2*solve(t(X)%*%X)
b=coef(m1)
plus=b[2]+b[3]
f1=function(b){
b[2]+b[3]
}
g1=jacobian(f1,b)
g1_sd=sqrt(g1%*%est.var%*%t(g1))
g1_ttest=plus/g1_sd
f2=function(b){
b[4]
}
f3=function(b){
b[5]
}
q=matrix(c(0,1,0),3,1)
R=rbind(jacobian(f1,b),jacobian(f2,b),jacobian(f3,
b))
wald=t(R%*%b-q)%*%solve(R%*%solve(t(X)%
*%X)%*%t(R))%*%(R%*%b-q)/(s2)
qchisq(0.95,3)
1-pchisq(wald,3)
F=t(R%*%b-q)%*%solve(R%*%est.var%*%t(R))
%*%(R%*%b-q)/3
1-pf(F,3,203-5)
############5.4
dat54=read.table("TableF5-3.csv",header=T,sep=",
")
attach(dat54)
m54=lm(log(VALUEADD)~log(LABOR)+log(C
APITAL)+I(0.5*log(LABOR)^2)+I(0.5*log(CAPI
TAL)^2)
+I(log(LABOR)*log(CAPITAL)))
N=NROW(dat54)27
M0=diag(N)-1/N27*27
X=cbind(1,log(LABOR),log(CAPITAL),I(0.5*log
(LABOR)^2),I(0.5*log(CAPITAL)^2)
,I(log(LABOR)*log(CAPITAL)))
M=diag(N)-X%*%solve(t(X)%*%X)%*%t(X)
*****27*27redi matrix
Y=log(VALUEADD)
e=M%*%Y***27*1
ee=t(e)%*%e
R2=1-t(e)%*%e/t(Y)%*%M0%*%Y***R-square
s2=ee/(N-6)***S-square
est.var=s2[1,1]*solve(t(X)%*%X)
**Estamator variance6*6
m54_cd=lm(log(VALUEADD)~log(LABOR)+log(C
APITAL))
summary(m54_cd)
X_cd=cbind(1,log(LABOR),log(CAPITAL))
M_cd=diag(N)-X_cd%*%solve(t(X_cd)%*%X_cd)
%*%t(X_cd)
e_cd=M_cd%*%Y
ee_cd=t(e_cd)%*%e_cd
R2_cd=1-t(e_cd)%*%e_cd/t(Y)%*%M0%*%Y
s2_cd=ee_cd/(N-3)
est.var_cd=s2_cd[1,1]*solve(t(X_cd)%*%X_cd)
F=(R2-R2_cd)/3/((1-R2)/(N-6))
F=(ee_cd-ee)/3/(ee/(N-6))
1-pf(F,3,N-6)
qf(0.95,3,N-6)
f1=function(a){
a[2]+a[3]
}
b=coef(m54_cd)
q=1
R=jacobian(f1,b)
F=t(R%*%b-q)%*%solve(R%*%est.var_cd%*%t(R))
%*%(R%*%b-q)/1
qf(0.95,1,N-3)
1-pf(F,1,N-3)
t2=(b[2]+b[3]-1)^2/(est.var_cd[2,2]+est.var_cd[3,3]+
2*est.var_cd[2,3])
f2=function(a){
a[4]+a[5]+2*a[6]
}
b=coef(m54)
q=matrix(c(1,0),2,1)
R=rbind(jacobian(f1,b),jacobian(f2,b))
F=t(R%*%b-q)%*%solve(R%*%est.var%*%t(R))%
*%(R%*%b-q)/2
qf(0.95,2,N-6)
############5.6
dat56=read.table("TableF5-2.csv",header=T,sep=",")
attach(dat56)
t=nrow(dat56)
m56=lm(log(REALCONS[2:t])~log(REALDPI[2:t])
+log(REALCONS[1:(t-1)]),data=dat56)
summary(m56)
X=cbind(1,log(REALDPI[2:t]),log(REALCONS[1:(t
```

```
-1)]))
Y=log(REALCONS[2:t])
M=diag(t-1)-X%*%solve(t(X)%*%X)%*%t(X)
#####-1:jiejvxiang redi maker
e=M%*%Y
resi=residuals(m56)
s2=t(e)%*%e/(t-4)
s2=s2[1,1]
s22=t(resi)%*%resi/(t-3)
est.var=s2*solve(t(X)%*%X)
sqrt(diag(est.var))
#####biaozhunwu-gb-fangcha
b=coef(m56)
d=function(b){
b[2]/(1-b[3])}
g=jacobian(d,b) ***yakebijvz1daoshu
sd=sqrt(g%*%est.var%*%t(g))#0.0002585,why?Fangchajisuan daoshu*fangcha
((coef(m56)[2]/(1-coef(m56)[3]))-1)/sd#<1.96notrejected.
###########6.2
dat2=read.table("TableF4-1.csv",header=T,sep=",")
attach(dat2)
surface=HEIGHT*WIDTH
aspect=HEIGHT/WIDTH
X=cbind(1,log(surface),aspect,SIGNED)
Y=log(PRICE)
m1=lm(Y~X-1)
summary(m1)
smearing=mean(exp(residuals(m1)))
Exp_price=exp(fitted.values(m1))*smearing
###########6.3
datpca=read.table("TableF4-3.csv",header=T,sep=",")
attach(datpca)
other=1-ACTION-ANIMATED-COMEDY-HORROR
X=cbind(1,ACTION,ANIMATED,COMEDY,HORROR,other,I(MPRATING==1),
I(MPRATING==2),I(MPRATING==3),log(BUDGET),SEQUEL,STARPOWR)
solve(t(X)%*%X)
****error：Xcan not solve r(12*12)=11
buzz1=log(ADDICT)
buzz2=log(CMNGSOON)
buzz3=log(FANDANGO)
buzz4=CNTWAIT3
N=nrow(datpca)
M0=diag(N)-1/N
buzz=cbind(buzz1,buzz2,buzz3,buzz4)
Z=apply(M0%*%buzz,2,function(x)x/(sd(x)))
V=1/(N-1)*t(Z)%*%Z#why??
C=eigen(V)
sum(eigen(V)$values/4)
cor(eigen(V)$vectors)
c1=C$vectors[,1]
c2=C$vectors[,2]
Zc1=Z%*%c1
Zc2=Z%*%c2
m2=lm(log(BOX)~ACTION+COMEDY+ANIMATED+HORROR+I(MPRATING==1)+
I(MPRATING==2)+I(MPRATING==3)+log(BUDGET)+SEQUEL+STARPOWR+Zc1)
summary(m2)
exp(coef(m2)[2])-1
###########6.4
library(dplyr)
dat64=read.table("TableF6-1.csv",header=T,sep=",")
attach(dat64)
m1=lm(log(C)~log(Q)+log(Q)^2+log(PF)+LF+T+I,data=dat64)
summary(m1)
nT=length(unique(T))
nI=length(unique(I))
T_matrix=rbind(diag(nT-1),0)
T_variable=T_matrix[rep(1:nT,nI),]
I_variable=matrix(0,nrow(dat64),nI-1)
Temp=1
for(iin1:(nI-1)){
I_variable[Temp:(Temp+nT-1),i]=i
Temp=Temp+nT
}
Y=log(dat64$C)
m_full=lm(log(C)~log(Q)+I(log(Q)^2)+log(PF)+LF+T_variable+I_variable,data=dat64)
summary(m_full)
b=coef(m_full)
X=cbind(1,log(Q),log(Q)^2,log(PF),LF,T_variable,I_variable)
M=diag(nrow(dat64))-X%*%solve(t(X)%*%X)%*%t(X)
e=M%*%Y
t(e)%*%e
K=ncol(X)
s2=t(e)%*%e/(nrow(dat64)-K)
```

```
s2=s2[1,1]
m_timeonly=lm(log(C)~log(Q)+I(log(Q)^2)+log(
PF)+LF+T_variable,data=dat64)
summary(m_timeonly)
X_timeonly=cbind(1,log(Q),log(Q)^2,log(PF),LF,
T_variable)
M=diag(nrow(dat64))-X_timeonly%*%solve(t(X_
timeonly)%*%X_timeonly)%*%t(X_timeonly)
e_timeonly=M%*%Y
t(e_timeonly)%*%e_timeonly
F=((t(e_timeonly)%*%e_timeonly-t(e)%*%e)/5)/(
t(e)%*%e/(nrow(dat64)-K))
qf(0.95,5,nrow(dat64)-K)
1-pf(F,5,nrow(dat64)-K)
R=cbind(matrix(0,5,K-5),diag(5))
q=matrix(rep(0,5),5,1)
wald=t(R%*%b-q)%*%solve(R%*%solve(t(X)%
*%X)%*%t(R))%*%(R%*%b-q)/(s2)
wald/F
m_firmonly=lm(log(C)~log(Q)+I(log(Q)^2)+log(
PF)+LF+I_variable,data=dat64)
summary(m_firmonly)
X_firmonly=cbind(1,log(Q),log(Q)^2,log(PF),LF,I
_variable)
M=diag(nrow(dat64))-X_firmonly%*%solve(t(X_
firmonly)%*%X_firmonly)%*%t(X_firmonly)
e_firmonly=M%*%Y
t(e_firmonly)%*%e_firmonly
F=((t(e_firmonly)%*%e_firmonly-t(e)%*%e)/14)/
(t(e)%*%e/(nrow(dat64)-K))
qf(0.95,14,nrow(dat64)-K)
1-pf(F,14,nrow(dat64)-K)
m_no=lm(log(C)~log(Q)+I(log(Q)^2)+log(PF)+L
F,data=dat64)
summary(m_no)
X_no=cbind(1,log(Q),log(Q)^2,log(PF),LF)
ncol(X)
M=diag(nrow(dat64))-X_no%*%solve(t(X_no)%
*%X_no)%*%t(X_no)
e_no=M%*%Y
t(e_no)%*%e_no
F=((t(e_no)%*%e_no-t(e)%*%e)/19)/(t(e)%*%e/(
nrow(dat64)-K))
qf(0.95,19,nrow(dat64)-K)
1-pf(F,19,nrow(dat64)-K)
###########6.7
rm(list=ls(all=TRUE))
datfc=read.table("TableFC-1.csv",header=T,sep=",
")
attach(datfc)
gamma_den=function(a){
beta=a[1]
rho=a[2]
den=(beta+x)^(-rho)/gamma(rho)*y^(rho-1)*exp(-y/(
beta+x))
logL=log(den)
return(sum(logL))
}
x=E
y=Y
n=NROW(datfc)
MLE=maxLik(gamma_den,start=c(1,1),method="BF
GS")
summary(MLE)
m=lm(Y~E)
summary(m)
f=function(a){
beta=a[1]/a[2]
return(beta)
}
res=residuals(m)
s2=t(res)%*%res/(n-2)
s2=s2[1,1]
X=cbind(1,E)
est.var=solve(t(X)%*%X)*s2
g=jacobian(f,coef(m))
delta=g%*%est.var%*%t(g)
###########6.9
dat=read.table("TableF2-2.csv",header=T,sep=",")
attach(dat)
t=NROW(dat)
G=1000000*GASEXP/(POP)
model=lm(log(G)~log(INCOME)+log(GASP)+log(P
NC)+log(PUC)+I(YEAR-1952),data=dat)
summary(model)
res=residuals(model)
ee=t(res)%*%res
pre=I(YEAR<1974)
post=I(YEAR>1973)
model1=lm(log(G)~log(INCOME)+log(GASP)+log(
PNC)+log(PUC)+I(YEAR-1952),data=dat,subset=Y
EAR<1974)
summary(model1)
res1=residuals(model1)
ee1=t(res1)%*%res1
model2=lm(log(G)~log(INCOME)+log(GASP)+log(
```

```
PNC)+log(PUC)+I(YEAR-1952),data=dat,subset=
YEAR>1973)
summary(model2)
res2=residuals(model2)
ee2=t(res2)%*%res2
F1=(ee-ee1-ee2)/6/((ee1+ee2)/(t-2*6))
qf(0.95,6,t-2*6)
model3=lm(log(G)~log(INCOME)+log(GASP)+l
og(PNC)+log(PUC)+I(YEAR-1952)+I(YEAR==1
974)+I(YEAR==1975)+I(YEAR==1980)+I(YEA
R==1981),data=dat)
res3=residuals(model3)
ee3=t(res3)%*%res3
F2=(ee-ee3)/4/(ee3/(t-6-4))#why
model4=lm(log(G)~log(INCOME)+log(GASP)+l
og(PNC)+log(PUC)+I(YEAR-1952)+I(YEAR>19
73)+I(YEAR<1974)-1,data=dat)
res4=residuals(model4)
ee4=t(res4)%*%res4
F3=(ee4-ee1-ee2)/5/((ee1+ee2)/(t-2*6))
model5=lm(log(G)~log(INCOME)*pre+log(GAS
P)*pre+log(PNC)+log(PUC)+I(YEAR-1952),data
=dat)
res5=residuals(model5)
ee5=t(res5)%*%res5
F3=(ee5-ee1-ee2)/3/((ee1+ee2)/(t-2*6))
s2=ee/(t-6)
s2=s2[1,1]
X=cbind(1,log(INCOME),log(GASP),log(PNC),l
og(PUC),I(YEAR-1952))
est.var=solve(t(X)%*%X)*s2
sd=sqrt(diag(est.var))
f1=function(b){
b[2]/(1-b[6])
}
f2=function(b){
b[3]/(1-b[6])
}
g2=jacobian(f1,coef(model))
g3=jacobian(f2,coef(model))
delta1=g2%*%est.var%*%t(g2)
delta2=g3%*%est.var%*%t(g3)

library(MASS)


#########Endogeneity######
n=1000
####cor(x1x2)=0.2,cor(x2,Z)=0.5
rho12=0.2
rho2z=0.5
Sigma=matrix(c(1,rho12,0,0,rho12,1,0,rho2z,0,0,1,0,
0,rho2z,0,1),4,4)
X=mvrnorm(n,rep(0,4),Sigma)
Z=X[,4]
X=X[,-4]
beta=c(2,-1,0.9)
Y1=X%*%beta+rnorm(n)
lm1=lm(Y1~X-1)
summary(lm1)**123douhuigui
lm2=lm(Y1~X[,-1]-1)
summary(lm2)**zhidui23**youpian,neishengx
lm3=lm(Y1~X[,-3]-1)
summary(lm3)**zhidui12
#####################2SLS
sls1=lm(X[,2]~Z-1)
summary(sls1)
X2hat=predict(sls1)
lm2sls=lm(Y1~X2hat+X[,3]-1)
summary(lm2sls)
#######8.5
dat81=read.table("TableF8-1.csv",header=T,sep=",")
library(MASS)
library(Matrix)
attach(dat81)
N=nrow(dat81)
m0=lm(LWAGE~EXP+I(EXP^2)+WKS+OCC+IND
+SOUTH+SMSA+MS+UNION+ED+FEM+BLK)
summary(m0)
m1=lm(WKS~LWAGE+ED+UNION+FEM)
summary(m1)
bls=coef(m1)
m01=lm(LWAGE~IND+ED+UNION+FEM)
m11=lm(WKS~predict(m01)+ED+UNION+FEM)
summary(m11)
Z=cbind(1,IND,ED,UNION,FEM)
X=cbind(1,LWAGE,ED,UNION,FEM)
KX=ncol(X)
KZ=ncol(Z)
X_hat=cbind(1,Z%*%solve(t(Z)%*%Z)%*%t(Z)%*
%LWAGE,ED,UNION,FEM)
biv=solve(t(X_hat)%*%X_hat)%*%t(X_hat)%*%W
KS
solve(t(Z)%*%X)%*%t(Z)%*%WKS
eiv=WKS-X%*%biv
s2iv=t(eiv)%*%eiv/(N-KZ)
```

```
asy.var.iv=s2iv[1,1]*solve(t(X)%*%Z%*%solve(t(Z)%*%Z)%*%t(Z)%*%X)
sqrt(diag(asy.var.iv))
iv=ivreg(WKS~LWAGE+ED+UNION+FEM|IND+ED+UNION+FEM)
summary(iv)


########Hausman###########
Mls=diag(N)-X%*%solve(t(X)%*%X)%*%t(X)
Miv=diag(N)-X_hat%*%solve(t(X_hat)%*%X_hat)%*%t(X_hat)
els=Mls%*%WKS
eiv=Miv%*%WKS
s2ls=t(els)%*%els/(N-KX)
s2iv=t(eiv)%*%eiv/(N-KZ)
asy.var.ls=s2ls[1,1]*solve(t(X)%*%X)
asy.var.iv=s2iv[1,1]*solve(t(Z)%*%X)%*%(t(Z)%*%Z)%*%solve(t(X)%*%Z)
asy.var.iv=s2iv[1,1]*solve(t(X_hat)%*%X_hat)
H=t(biv-bls)%*%solve(asy.var.iv-asy.var.ls)%*%(biv-bls)
m=solve(t(X_hat)%*%X_hat)-solve(t(X)%*%X)
rankMatrix(m)
H=(t(biv-bls)%*%ginv(m)%*%(biv-bls))/s2ls
qchisq(0.95,1)
****Xiugai****x_hat

#########Wutest#####8.6Wutest
m12=lm(WKS~LWAGE+ED+UNION+FEM+I(Z%*%solve(t(Z)%*%Z)%*%t(Z)%*%LWAGE))
summary(m12)
####################8.7
dat87=read.table("TableF5-2.csv",header=T,sep=",")
attach(dat87)
N=nrow(dat87)
X=cbind(1,REALDPI[-1])
Y=REALCONS[-1]
Z=cbind(1,REALCONS[1:(N-1)],REALDPI[1:(N-1)])
m0=lm(REALCONS[-1]~REALDPI[-1])
summary(m0)
m01=lm(REALDPI[-1]~REALCONS[1:(N-1)]+REALDPI[1:(N-1)])
summary(m01)
m11=lm(REALCONS[-1]~predict(m01))
summary(m11)
m12=lm(REALCONS[-1]~REALDPI[-1]+predict(m01))
summary(m12)
X_hat=cbind(1,Z%*%solve(t(Z)%*%Z)%*%t(Z)%*%REALDPI[-1])
bls=solve(t(X)%*%X)%*%t(X)%*%Y
biv=solve(t(X_hat)%*%X_hat)%*%t(X_hat)%*%Y
Mls=diag(N-1)-X%*%solve(t(X)%*%X)%*%t(X)
Miv=diag(N-1)-X_hat%*%solve(t(X_hat)%*%X_hat)%*%t(X_hat)
els=Mls%*%Y
eiv=Miv%*%Y
s2ls=t(els)%*%els/(N-1-2)
s2iv=t(eiv)%*%eiv/(N-1-2)
asy.var.ls=s2ls[1,1]*solve(t(X)%*%X)
asy.var.iv=s2iv[1,1]*solve(t(X)%*%Z%*%solve(t(Z)%*%Z)%*%t(Z)%*%X)
#asy.var.iv=s2iv[1,1]*solve(t(X_hat)%*%X_hat)
H=t(biv-bls)%*%solve(asy.var.iv-asy.var.ls)%*%(biv-bls)
m=solve(t(X_hat)%*%X_hat)-solve(t(X)%*%X)
H=(t(biv-bls)%*%ginv(m)%*%(biv-bls))/s2ls
qchisq(0.95,1)
###
eiv=Y-X%*%biv
s2iv=t(eiv)%*%eiv/(N-1-2)
asy.var.ls=s2ls[1,1]*solve(t(X)%*%X)
asy.var.iv=s2iv[1,1]*solve(t(X)%*%Z%*%solve(t(Z)%*%Z)%*%t(Z)%*%X)
H=t(biv-bls)%*%solve(asy.var.iv-asy.var.ls)%*%(biv-bls)
####################8.8
dat81=read.table("TableF8-1.csv",header=T,sep=",")
attach(dat81)
N=nrow(dat81)
m0=lm(LWAGE~EXP+I(EXP^2)+WKS+OCC+IND+SOUTH+SMSA+MS+UNION+ED+FEM+BLK)
summary(m0)
m1=lm(WKS~LWAGE+ED+UNION+FEM)
summary(m1)
bls=coef(m1)
m01=lm(LWAGE~IND+ED+UNION+FEM+SMSA)
m11=lm(WKS~predict(m01)+ED+UNION+FEM)
summary(m11)###the length of variance is difference
###can not reg
Z=cbind(1,IND,ED,UNION,FEM,SMSA)
X=cbind(1,LWAGE,ED,UNION,FEM)
KX=ncol(X)
```

```
KZ=ncol(Z)
X_hat=cbind(1,Z%*%solve(t(Z)%*%Z)%*%t(Z)
%*%LWAGE,ED,UNION,FEM)
bls=solve(t(X)%*%X)%*%t(X)%*%WKS
biv=solve(t(X_hat)%*%X_hat)%*%t(X_hat)%*%
WKS
Mls=diag(N)-X%*%solve(t(X)%*%X)%*%t(X)
els=Mls%*%WKS
eiv=WKS-X%*%biv
s2ls=t(els)%*%els/(N)
s2iv=t(eiv)%*%eiv/(N)
est.var.iv=s2iv[1,1]*solve(t(X)%*%Z%*%solve(t(
Z)%*%Z)%*%t(Z)%*%X)
sqrt(diag(est.var.iv))
m=t(Z)%*%eiv/N
W=t(m)%*%solve(s2iv[1,1]/N^2*t(Z)%*%Z)%*
%m
W=t(m)%*%solve(s2ls[1,1]/N^2*t(Z)%*%Z)%*
%m
##9-2
(0.2436-0.06393)/2/((1-0.2436)/(N-5))#frac{(r2-r2
*)/J}{(1-r2)/(n-k)}
qf(0.99,2,N-5)
f1=function(b)b[4]
f2=function(b)b[5]
q=matrix(c(0,0),2,1)
R=rbind(jacobian(f1,b),jacobian(f2,b))
wald=t(R%*%b-q)%*%solve(R%*%est.var.white
%*%t(R))%*%(R%*%b-q)
qchisq(0.95,2)
1-pchisq(wald,3)
############9.3#white
income2=INCOME^2
income2=income2[AVGEXP>0]
age=AGE[AVGEXP>0]
income=INCOME[AVGEXP>0]
own=OWNRENT[AVGEXP>0]
m2=lm(resi^2~age+own+income+income2+I(age
^2)+I(age*own)+I(age*income)
+I(age*income2)+I(own*income)+I(own*income
2)+I(income*income2)+I(income2^2))
summary(m2)
white=N*0.199
1-pchisq(0.95,12)
qchisq(0.95,12)
#BP
ssr=t(resi)%*%resi
gi=resi^2/(ssr[1,1]/72)-1
Z=cbind(1,income,income2)
LM=0.5*t(gi)%*%Z%*%solve(t(Z)%*%Z)%*%t(Z)
%*%gi
qchisq(0.95,2)
############9.4
dat64=read.table("TableF6-1.csv",header=T,sep=",")
attach(dat64)
N=nrow(dat64)
nT=length(unique(T))
nI=length(unique(I))
T_matrix=rbind(diag(nT-1),0)
T_variable=T_matrix[rep(1:nT,nI),]
I_variable=matrix(0,nrow(dat64),nI-1)
Temp=1
for(iin1:(nI-1)){
I_variable[Temp:(Temp+nT-1),i]=i
Temp=Temp+nT
}
Y=log(dat64$C)
m_full=lm(log(C)~log(Q)+I(log(Q)^2)+log(PF),data
=dat64)
summary(m_full)


###howtocalculatewhite.asy.var?
b=coef(m_full)
X=cbind(1,log(Q),log(Q)^2,log(PF))
M=diag(nrow(dat64))-X%*%solve(t(X)%*%X)%*%
t(X)
e=M%*%Y#residual(m_full)
ssr=t(e)%*%e
gi=e^2/(ssr[1,1]/90)-1
Z=cbind(1,LF)
LM=0.5*t(gi)%*%Z%*%solve(t(Z)%*%Z)%*%t(Z)
%*%gi
qchisq(0.95,1)
m2=lm(log(e^2)~LF)
summary(m2)
w=exp(-coef(m2)[1]-coef(m2)[2]*LF)#weight=1/exp
(xxx)
m_full=lm(log(C)~log(Q)+I(log(Q)^2)+log(PF),data
=dat64,weight=w)#WLS
summary(m_full)
omega=diag(exp(fitted.values(m2)))
bgls=solve(t(X)%*%solve(omega)%*%X)%*%t(X)
%*%solve(omega)%*%log(C)
P=chol(solve(omega))
Xstar=P%*%X
```

```
M=diag(N)-Xstar%*%solve(t(Xstar)%*%Xstar)%*%t(Xstar)
Ystar=P%*%log(C)
e_star=Ystar-Xstar%*%bgls
s_star=t(e_star)%*%e_star/(N-4)
sd_gls=sqrt(diag(s_star[1,1]*solve(t(X)%*%solve(omega)%*%X)))
m3=lm(Ystar~Xstar-1)
summary(m3)
####11.1
dat81=read.table("TableF8-1.csv",header=T,sep=",")
attach(dat81)
m1=lm(LWAGE~EXP+I(EXP^2)+WKS+OCC+IND+SOUTH+SMSA+MS+UNION+ED+FEM+BLK)
summary(m1)****4152
N=NROW(dat81)*4165
T=7
Ni=NROW(dat81)/T
X=cbind(1,EXP,I(EXP^2),WKS,OCC,IND,SOUTH,SMSA,MS,UNION,ED,FEM,BLK)
K=NCOL(X)*13
resi=residuals(m1)
s0_white=matrix(0,K,K)**13×13
for(i in 1:N){
temp=resi[i]^2*(X[i,]%*%(t(X[i,])))
s0_white=s0_white+temp
}

S0_white=s0_white/(N)
est.var.white=N*solve(t(X)%*%X)%*%S0_white%*%solve(t(X)%*%X)
sqrt(diag(est.var.white))
s0_robust=matrix(0,K,K)**13×13
XX=matrix(0,K,K)
ind=1
for(iin1:Ni){
xe=colSums(resi[ind:(ind+T-1)]*X[ind:(ind+T-1),])
temp1=xe%*%t(xe)
s0_robust=s0_robust+temp1
temp2=t(X[ind:(ind+T-1),])%*%X[ind:(ind+T-1),]
XX=XX+temp2
ind=ind+T
}
est.var.robust=solve(XX)%*%s0_robust%*%solve(XX)
#est.var.robust=solve(t(X)%*%X)%*%s0_robust%*%solve(t(X)%*%X)
sqrt(diag(est.var.robust))
##########11.2
dat41=read.table("TableF4-1.csv",header=T,sep=",")
attach(dat41)
N=NROW(dat41)
surface=HEIGHT*WIDTH
aspect=HEIGHT/WIDTH
m1=lm(log(PRICE)~log(surface)+SIGNED+log(aspect))
summary(m1)
resi=residuals(m1)
G=length(unique(PICTURE))
X=cbind(1,log(surface),SIGNED,log(aspect))
K=NCOL(X)*4
s0_robust=matrix(0,K,K)
ind=1
for(iin1:G){
ng=length(PICTURE[PICTURE==i])
if(ng==1){
xe=resi[ind:(ind+ng-1)]*X[ind:(ind+ng-1),]
}elsexe=colSums(resi[ind:(ind+ng-1)]*X[ind:(ind+ng-1),])
temp1=xe%*%t(xe)
s0_robust=s0_robust+temp1
ind=ind+ng
}
est.var.robust=solve(t(X)%*%X)%*%((G/(G-1))*s0_robust)%*%solve(t(X)%*%X)
sqrt(diag(est.var.robust))
?????why?????
s0_robust=matrix(0,K,K)
XX=matrix(0,K,K)
ind=1
for(iin1:G){
ng=length(PICTURE[unique(PICTURE)[i]])
if(ng==1){
xe=resi[ind:(ind+ng-1)]*X[ind:(ind+ng-1),]
}elsexe=colSums(resi[ind:(ind+ng-1)]*X[ind:(ind+ng-1),])
temp1=xe%*%t(xe)
s0_robust=s0_robust+temp1
X_temp=as.matrix(X[ind:(ind+ng-1),])
temp2=X_temp%*%t(X_temp)
XX=XX+temp2
ind=ind+ng
}
```

```
est.var.robust=solve(XX)%*%((G/(G-1))*s0_robu
st)%*%solve(XX)
sqrt(diag(est.var.robust))
##################11.5
dat81=read.table("TableF8-1.csv",header=T,sep=",
")
attach(dat81)
m1=lm(LWAGE~EXP+I(EXP^2)+WKS+OCC+I
ND+SOUTH+SMSA+MS+UNION)
summary(m1)
resi0=residuals(m1)
N=NROW(dat81)
T=7
Ni=NROW(dat81)/T
X=cbind(EXP,I(EXP^2),WKS,OCC,IND,SOUTH,
SMSA,MS,UNION)
X1=cbind(1,X)
Z=cbind(1,ED,FEM,BLK)
K=NCOL(X)
s0_white=matrix(0,K,K)
for(iin1:N){
temp=resi0[i]^2*(X[i,]%*%(t(X[i,])))
s0_white=s0_white+temp
}
I_variable=matrix(0,nrow(dat81),Ni)
Temp=1
for(iin1:(Ni)){
I_variable[Temp:(Temp+T-1),i]=1
Temp=Temp+T
}
#I_variable=I_variable[,-1]
m2=lm(LWAGE~EXP+I(EXP^2)+WKS+OCC+I
ND+SOUTH+SMSA+MS+UNION+I_variable)
summary(m2)
D=I_variable
MD=diag(N)-D%*%solve(t(D)%*%D)%*%t(D)
b_within=solve(t(X)%*%MD%*%X)%*%t(X)%
*%MD%*%LWAGE
ee=t(MD%*%LWAGE-MD%*%X%*%b_within)
%*%(MD%*%LWAGE-MD%*%X%*%b_within
)
s2=ee/(N-K-ncol(D))
est.var=s2[1,1]*solve(t(X)%*%MD%*%X)
sd=sqrt(diag(est.var))


#####11.11_fixed
s0_robust=matrix(0,K,K)
Xd=MD%*%XolSums(resi[ind:(ind+T-1)]*Xd[ind:(i
nd+T-1),]
resi=MD%*%LWAGE-MD%*%X%*%b_within
XX=matrix(0,K,K)
ind=1
for(iin1:Ni){
xe=c)
temp1=xe%*%t(xe)
s0_robust=s0_robust+temp1
temp2=t(Xd[ind:(ind+T-1),])%*%Xd[ind:(ind+T-1),]
XX=XX+temp2
ind=ind+T
}
#est.var.robust=solve(XX)%*%s0_robust%*%solve(
XX)##need corrections!see footnote
est.var.robust=solve(XX)%*%((N-1)*Ni/((Ni-1)*(N-
K-Ni))*s0_robust)%*%solve(XX)
sqrt(diag(est.var.robust))
#####
a=solve(t(D)%*%D)%*%t(D)%*%(LWAGE-X%*%
b_within)
alpha=rep(a,each=T)
m3=lm(alpha~Z-1)
summary(m3)
m4=lm(a~Z[seq(1,4159,7),]-1)
summary(m4)
hn=residuals(m4)
h=D%*%hn
m5=lm(LWAGE~X+Z[,-1]+h)
summary(m5)
###########11.6
m6=lm(LWAGE~X)
summary(m6)
e2=residuals(m6)
s22=t(e2)%*%e2/(N-K-1)
sigu2=s22-s2
i=matrix(1,T,1)
theta=1-sqrt(s2[1,1])/sqrt(s2[1,1]+T*sigu2[1,1])
SIGMA=s2[1,1]*diag(T)+sigu2[1,1]*i%*%t(i)
SIGMA_inv=solve(SIGMA)
OMEGA_INV=diag(Ni)%x%SIGMA_inv
bgls=solve(t(X1)%*%OMEGA_INV%*%X1)%*%t(
X1)%*%OMEGA_INV%*%LWAGE
#ev=eigen(SIGMA)
#tt=t(ev$vec%*%diag(ev$val^(-0.5))%*%t(ev$vec))
#t(tt)%*%tt
P=chol(OMEGA_INV)
Xstar=P%*%X1
```

```
M=diag(N)-Xstar%*%solve(t(Xstar)%*%Xstar)%
*%t(Xstar)
Ystar=P%*%LWAGE
e_star=Ystar-Xstar%*%bgls
s_star=t(e_star)%*%e_star/(N-K-1)
sd_gls=sqrt(diag(s_star[1,1]*solve(t(X1)%*%OM
EGA_INV%*%X1)))
m7=lm(Ystar~Xstar-1)
summary(m7)
resip=residuals(m7)
############9-33/11.11
s0_robust2=matrix(0,K+1,K+1)
XX=matrix(0,K+1,K+1)
ind=1
for(iin1:Ni){
xe=colSums(resip[ind:(ind+T-1)]*Xstar[ind:(ind+
T-1),])
temp1=xe%*%t(xe)
s0_robust2=s0_robust2+temp1
temp2=t(Xstar[ind:(ind+T-1),])%*%Xstar[ind:(ind
+T-1),]
XX=XX+temp2
ind=ind+T
}
est.var.robust2=solve(XX)%*%s0_robust2%*%so
lve(XX)
sqrt(diag(est.var.robust2))
############################
ev=eigen(SIGMA)
P2=t(ev$vec%*%diag(ev$val^(-0.5))%*%t(ev$ve
c))
P2=diag(Ni)%x%P2
(P2%*%X1)[1,]
Xtheta=(X1+theta*(MD%*%X1-X1))#/sqrt(s2[1,
1])
Ytheta=(LWAGE+theta*(MD%*%LWAGE-LWA
GE))#/sqrt(s2[1,1])
mm1=lm(Ytheta~Xtheta-1)
r1=residuals(mm1)
s0_robust2=matrix(0,K+1,K+1)
XX=matrix(0,K+1,K+1)
ind=1
for(iin1:Ni){
xe=colSums(r1[ind:(ind+T-1)]*Xtheta[ind:(ind+T-
1),])
temp1=xe%*%t(xe)
s0_robust2=s0_robust2+temp1
temp2=t(Xtheta[ind:(ind+T-1),])%*%Xtheta[ind:(i
nd+T-1),]
XX=XX+temp2
ind=ind+T
}
est.var.robust2=solve(XX)%*%s0_robust2%*%solve
(XX)
sqrt(diag(est.var.robust2))
##
e2_bar=rep(0,Ni)
ind=1
for(iin1:Ni){
temp=e2[ind:(ind+T-1)]
e2_bar[i]=mean(temp)
ind=ind+T
}
Te2=sum((T*e2_bar)^2)
LM=N/(2*T-1)*(Te2/t(e2)%*%e2-1)^2
#################
install.packages("plm")
library(plm)
ID=rep(seq(1,Ni,1,),each=T)
YEAR=rep(seq(1,7,1),Ni)
dat81$ID=ID
dat81$YEAR=YEAR
m8=plm(LWAGE~EXP+I(EXP^2)+WKS+OCC+IN
D+SOUTH+SMSA+MS+UNION,data=dat81,
index=c("ID","YEAR"),effect="individual",model="
pooling")
summary(m8)
############11.8
H=t(b_within-bgls[-1])%*%solve(est.var-vcov(m7)[-
1,-1])%*%(b_within-bgls[-1])***hausman
qchisq(0.95,9)
*pi
n=10000000
r=1
x=runif(n,-1,1)
y=runif(n,-1,1)
ED=sqrt(x^2+y^2)
count=length(ED[ED<=1])#count/n=pi/4
pi_estimate=count/n*4
pi_estimate
```