%%

%% test\_gaussianity

%% JARQUE-BERA TEST FOR GAUSSIANITY [from Luetkepohl 2005, New introduction to multiple time series analysis, pag 175] see pag 129 ljb test

% null hypothesis: joint gaussianity

% if ptot<alpha, reject -> non gaussian

function [ptot,ps,pk,lambdas,lambdak,crittresh,stringout,stringflag]=test\_gaussianity(U,alpha);

% %%% input:

% u: matrice dei residui (in riga!!!)

% alpha=0.05; %significance

% u=u'; %residui in riga dim(u)= T x k; dim(u')=k x T (i.e., 3 x 100)

%% test interno

% clear;close all;clc;

% alpha=0.05;

% T= 500; K=3; % size voluto

% % Nonlinearity exponent, selected to lie in [0.5, 0.8] or [1.2, 2.0]. (<1 gives subgaussian, >1 gives supergaussian)

% q = rand(K,1)\*1.1+0.5;

% ind = find(q>0.8);

% q(ind) = q(ind)+0.4;

% % This generates the disturbance variables, which are mutually independent, and non-gaussian

% U = randn(K,T); % gaussiani

% % U = sign(U).\*(abs(U).^(q\*ones(1,T))); % non gaussiani, commenta se li voglio gaussiani

%% vectors for Jarque-Bera analysis

T=size(U,2); K=size(U,1); % notazione di Lutkepohl

Um=mean(U')'; % media di U

Su=zeros(K,K); % covarianza di U

for t=1:T

 Su=Su+(U(:,t)-Um)\*(U(:,t)-Um)';

end

Su=Su./(T-1);

Ps=chol(Su)';

for t=1:T

 V(:,t)=inv(Ps)\*(U(:,t)-Um);

end

b1=zeros(K,1); b2=b1;

for k=1:K

 b1(k)=sum(V(k,:).^3) / T;

 b2(k)=sum(V(k,:).^4) / T;

end

%% statistica di Jarque-Bera (estensione a multivariate series)

lambdas=T\*b1'\*b1/6;

lambdak=T\*(b2-3\*ones(K,1))'\*(b2-3\*ones(K,1))/24;

dg=K;

% critlo=chi2inv(alpha,dg);

% crithi=chi2inv(1-alpha/2,dg);

crittresh=chi2inv(1-alpha,dg);

% ipotesi nulla: è gaussiana (third moment=0, fourth moment=3)

ps=1-chi2cdf(lambdas,dg); %se alpha/2<pp<1-alpha/2, don't reject -> OK is gaussian!

pk=1-chi2cdf(lambdak,dg);

ptot=1-chi2cdf(lambdas+lambdak,2\*dg); %statistica totale (joint test)

if ptot<alpha % originally 0.05

 stringout='rejection: signals are NOT GAUSSIAN';

 stringflag=1;

else

 stringout='non-rejection: signals are GAUSSIAN';

 stringflag=0;

end

% ps

% pk

% ptot