时间序列建模分析及EVIEWS应用

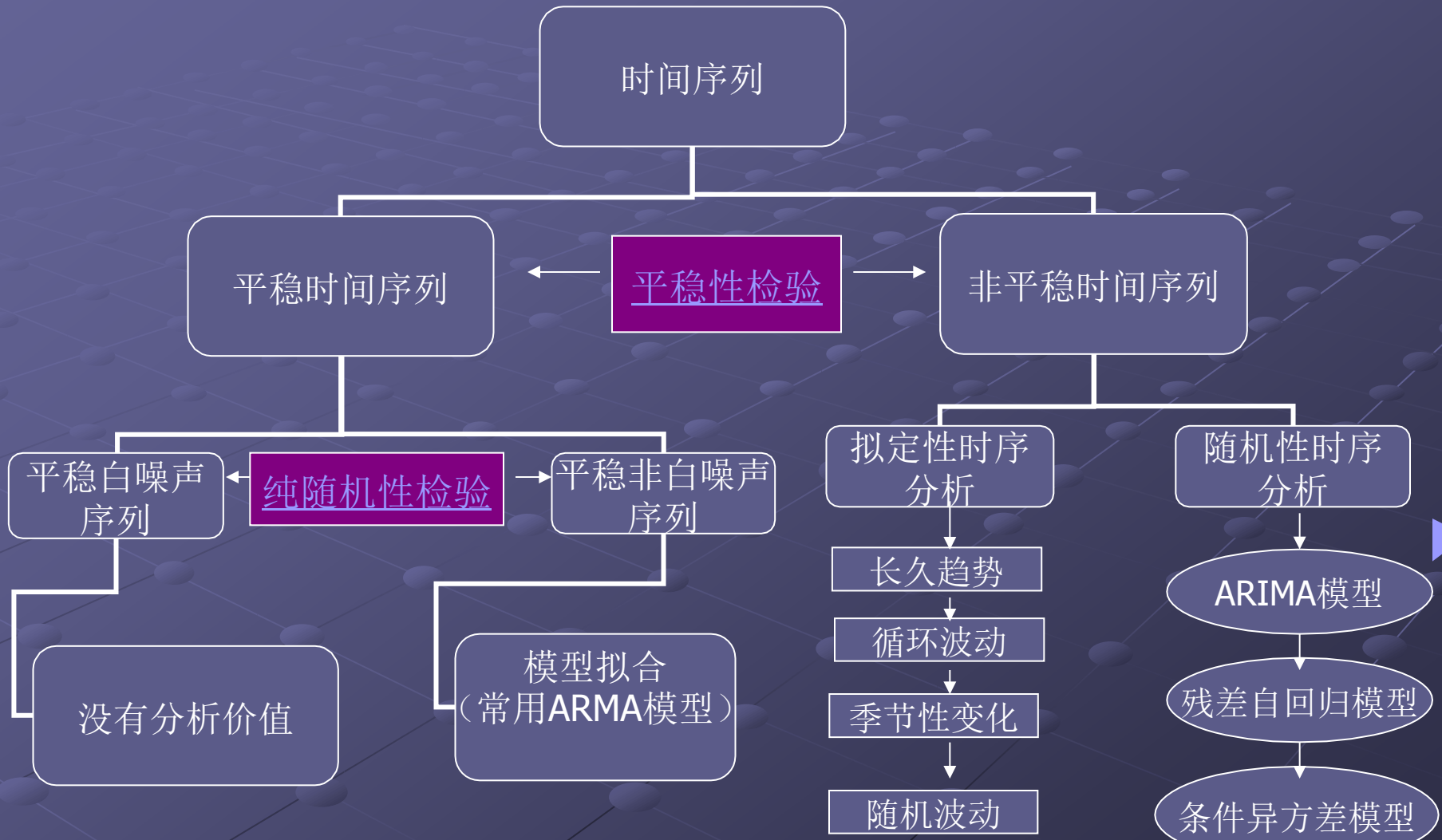
目录

时间序列的预处理：

拿到一种时间序列后，首先要对它的平稳性和纯随机性进行检验，这两个主要的检验称为序列的预处理。

根据检验的成果能够将序列分为不同的类型，对不同类型的序列采用不同的分析措施。

时间序列的基本类型：


时间序列
平稳时间序列
平稳性检验
非平稳时间序列
平稳白噪声序列
纯随机性检验
平稳非白噪声序列
拟定性时序分析
随机性时序分析
没有分析价值
模型拟合（常用ARMA模型）
长久趋势
循环波动
季节性变化
随机波动
ARIMA模型
残差自回归模型
条件异方差模型

平稳性检验措施：

- 图检验措施

⇩

主观色彩较强

- 构造检验统计量

时序图检验 → 有明显趋势或周期性，则为非平稳

自有关图检验 → 伴随延迟期数增长，自有关系数会不久衰减向零 → 平稳

自有关图检验 → 反之，自有关系数衰减向零的速度较慢 → 非平稳

单位根检验

纯随机性检验措施：

构造检验统计量

大样本场合

大，小样本场合

Q统计量

对Q统计量修正

LB统计量

检验成果

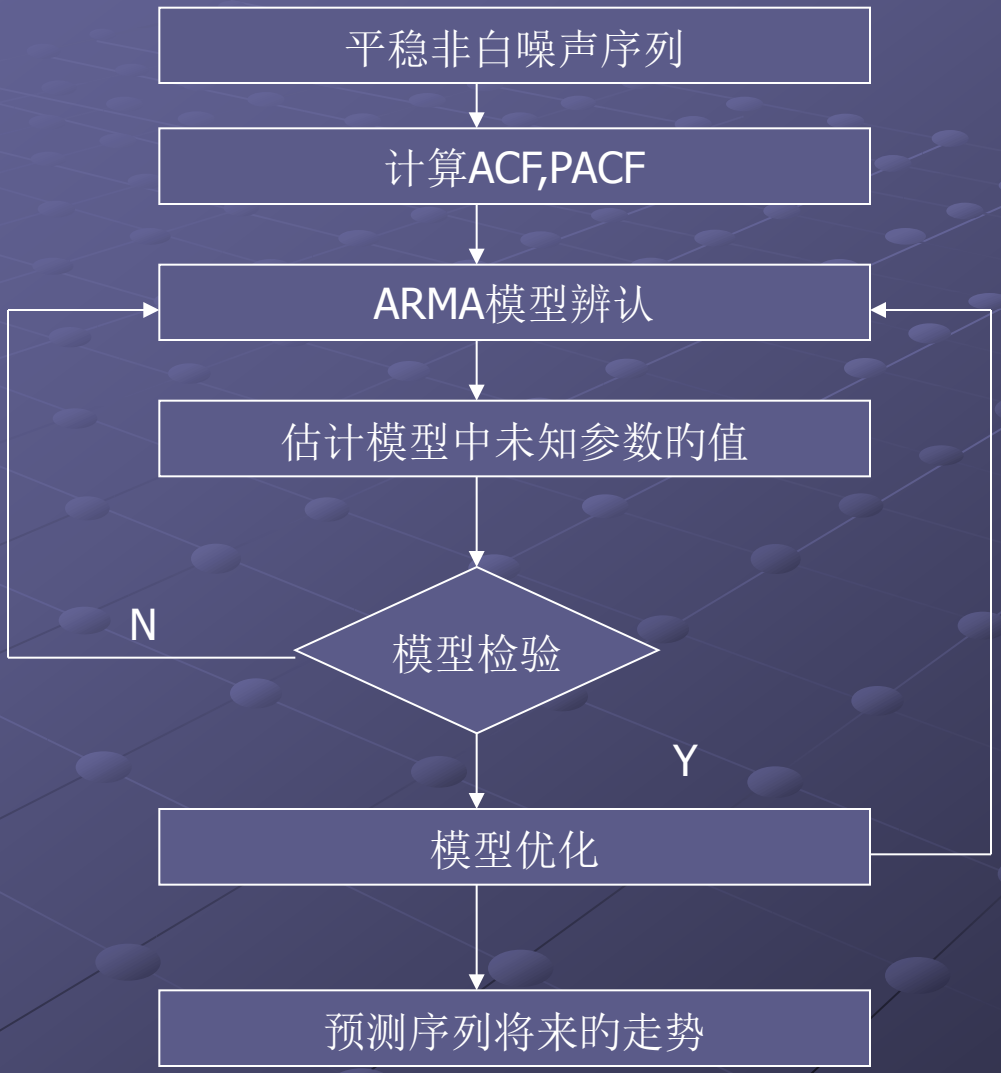
若P值非常小（<0.05）则以为该序列属于非白噪声序列

（有分析价值）

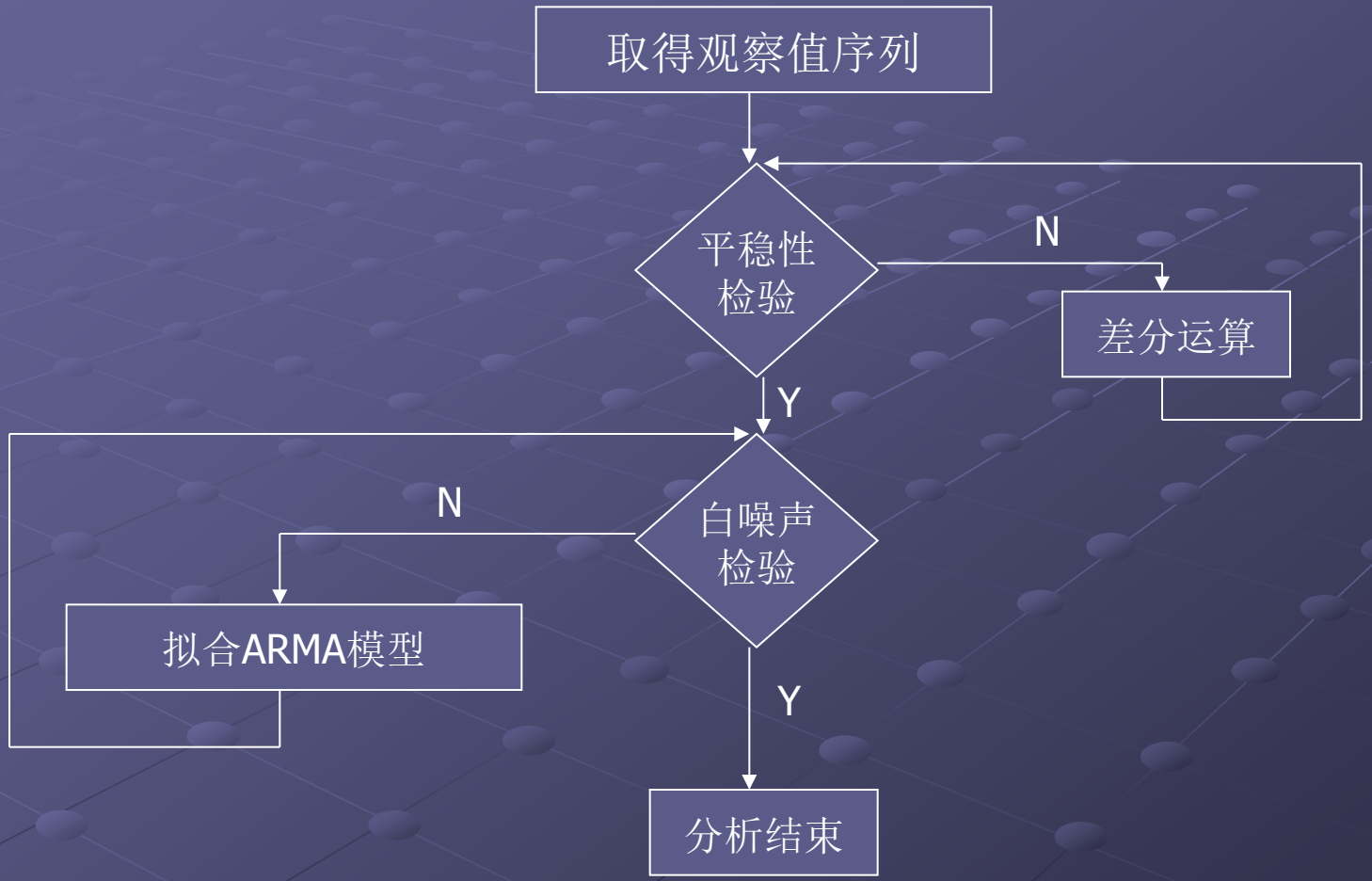
不然，以为该序列为纯随机序列

（无分析价值）

平稳非白噪声序列建模环节：

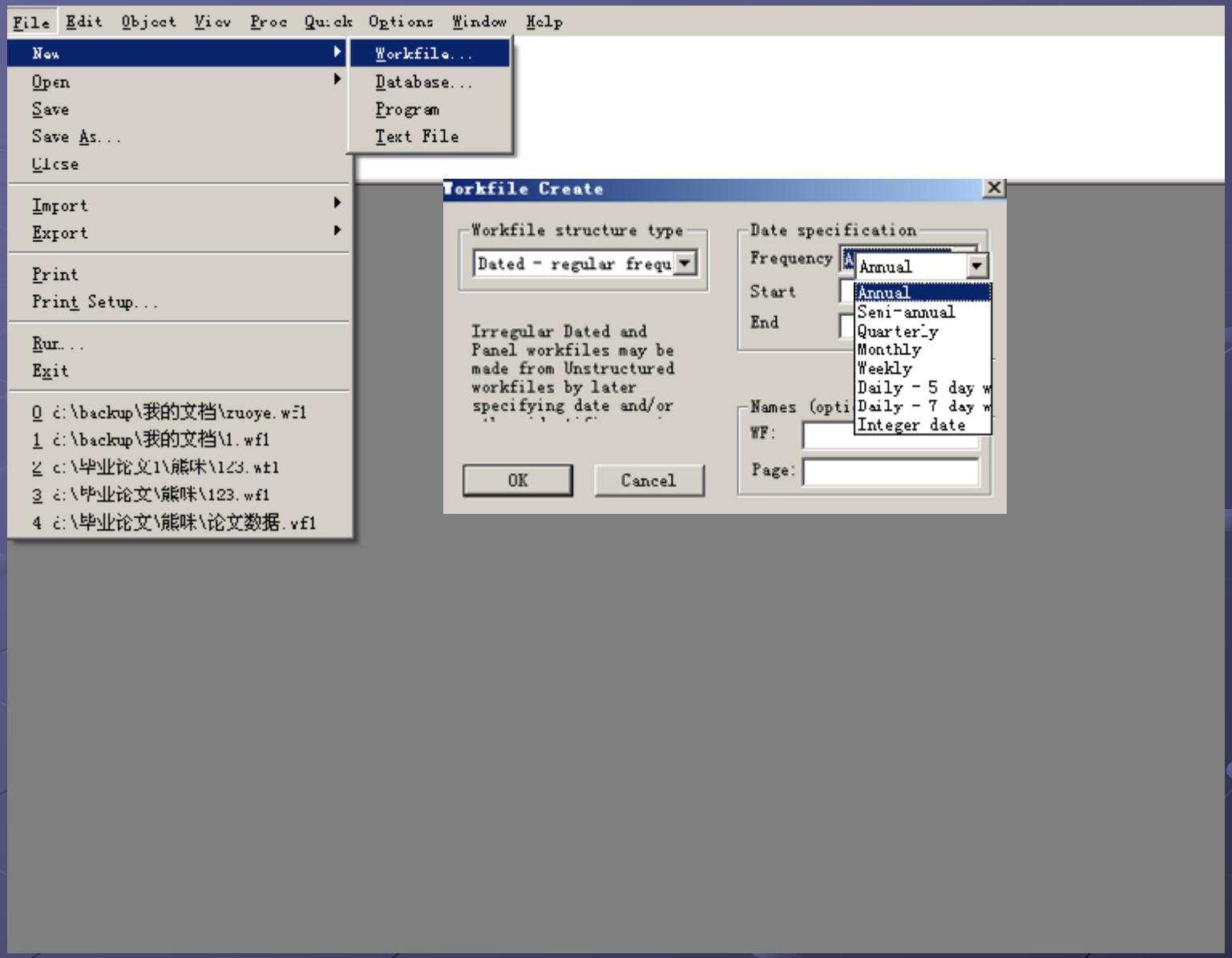


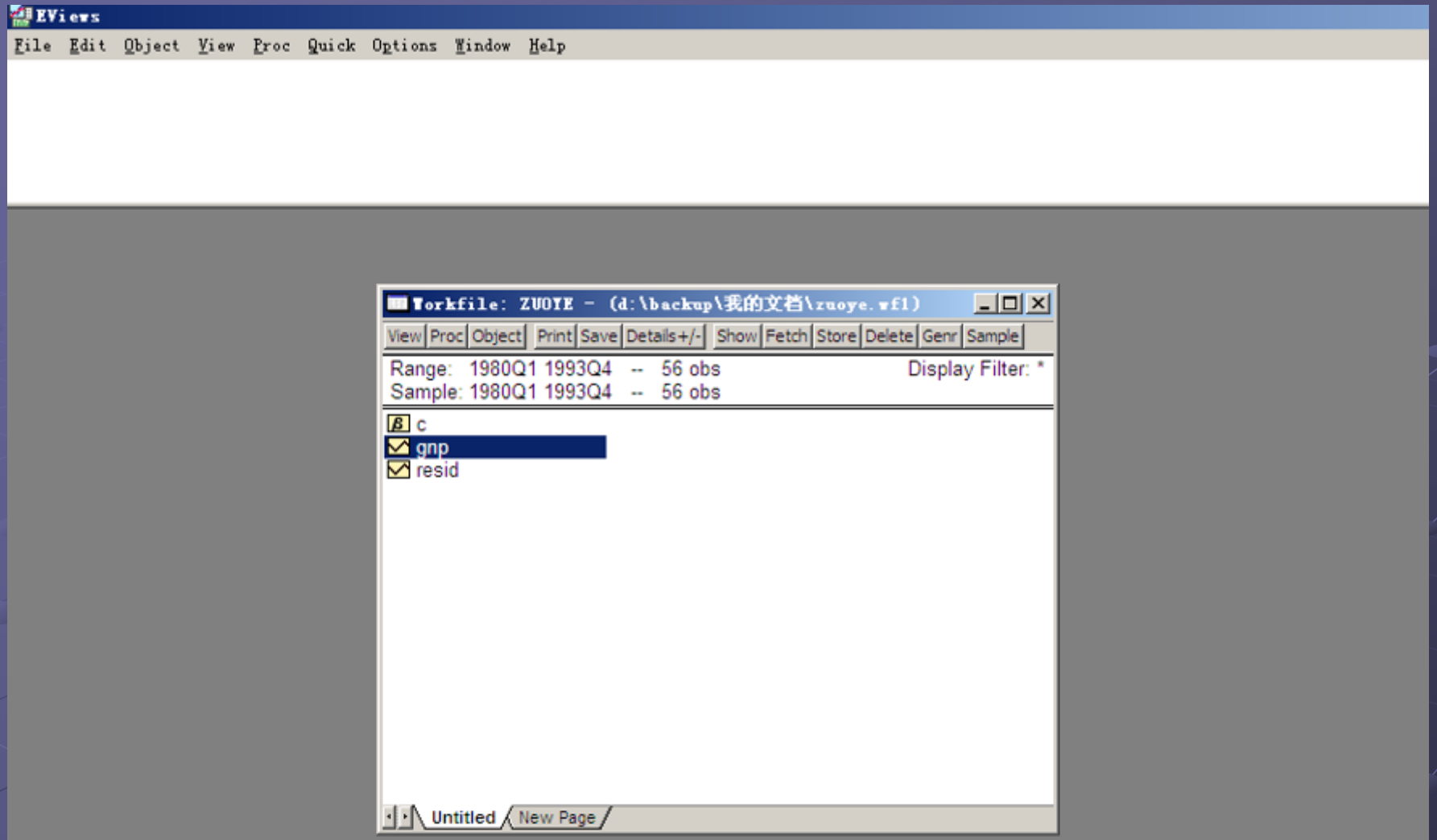
ARIMA模型建模流程：



EVIEWS 操作

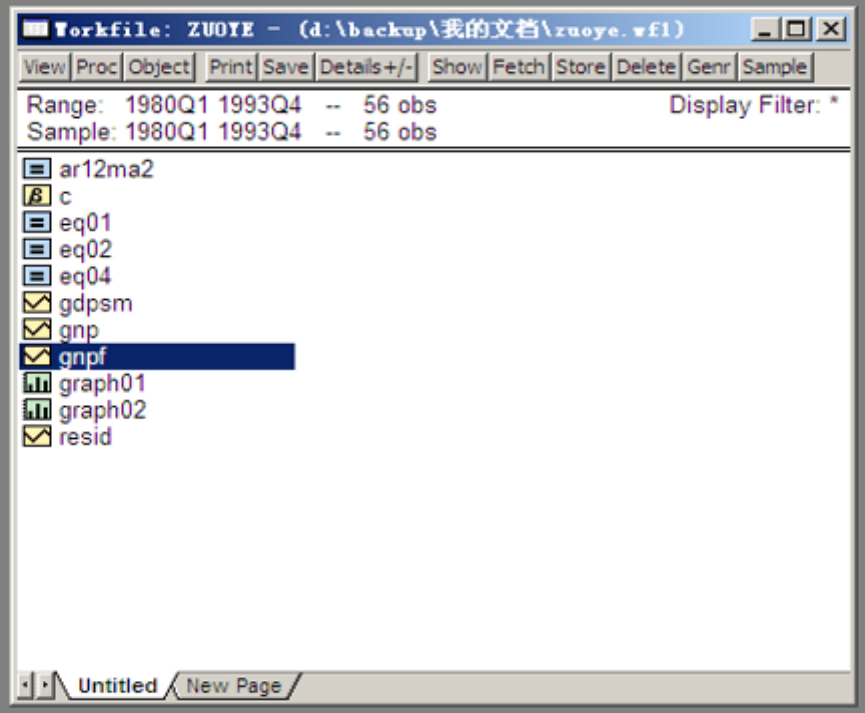
创建文件

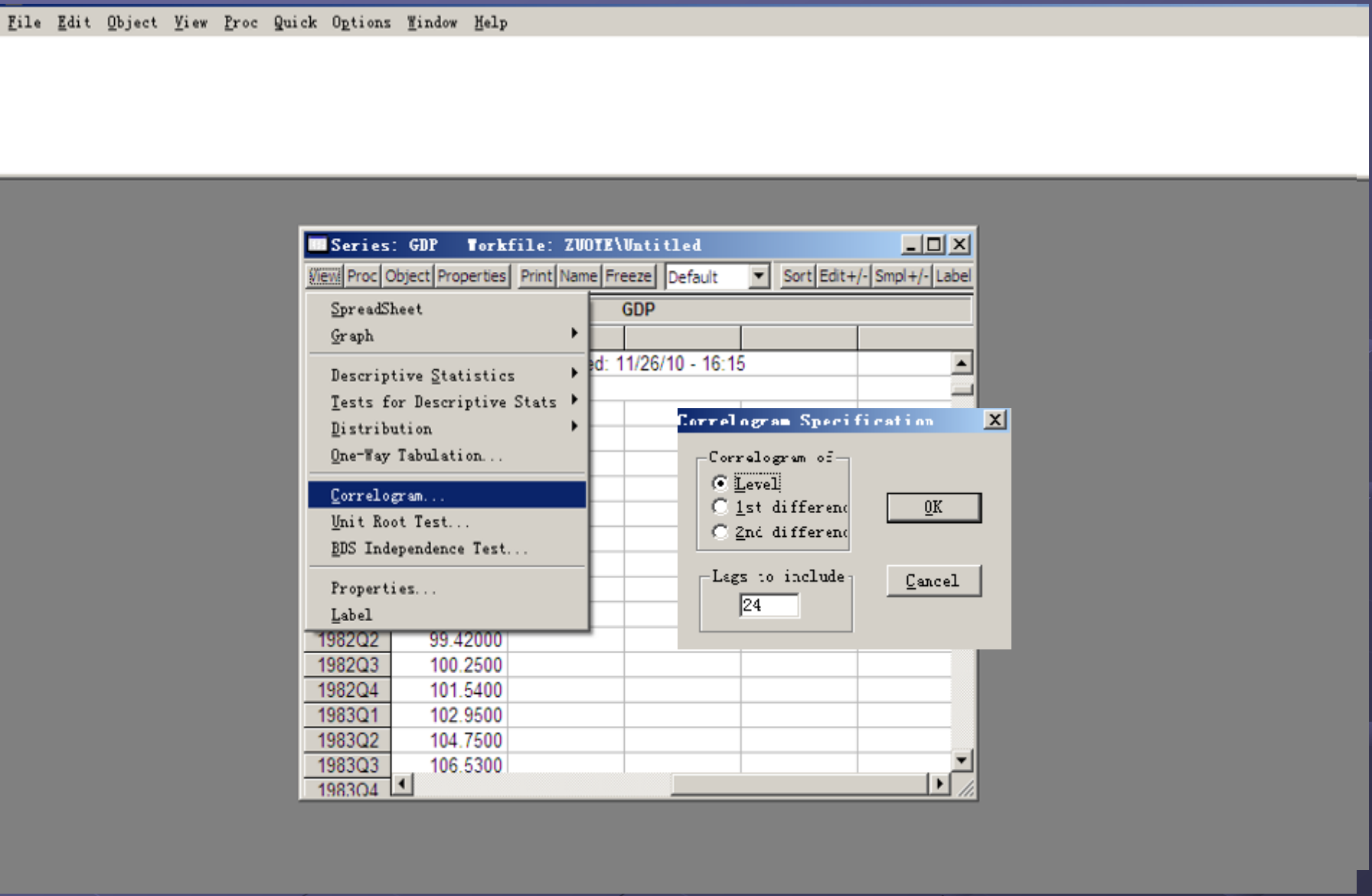

File Edit Object View Proc Quick Options Window Help
New
Open
Save
Save As...
Close
Import
Export
Print
Print Setup...
Run...
Exit
0 c:\backup\我的文档\zuoye.wf1
1 c:\backup\我的文档\1.wf1
2 c:\毕业论文1\熊咪\123.wf1
3 c:\毕业论文\熊咪\123.wf1
4 c:\毕业论文\熊咪\论文数据.wf1
Workfile...
Database...
Program
Text File
Workfile Create
Workfile structure type
Dated - regular frequ
Irregular Dated and Panel workfiles may be made from Unstructured workfiles by later specifying date and/or
OK
Cancel
Date specification
Frequency
Annual
Start
End
Annual
Semi-annual
Quarterly
Monthly
Weekly
Daily - 5 day w
Daily - 7 day w
Integer date
Names (opti
WF:
Page:

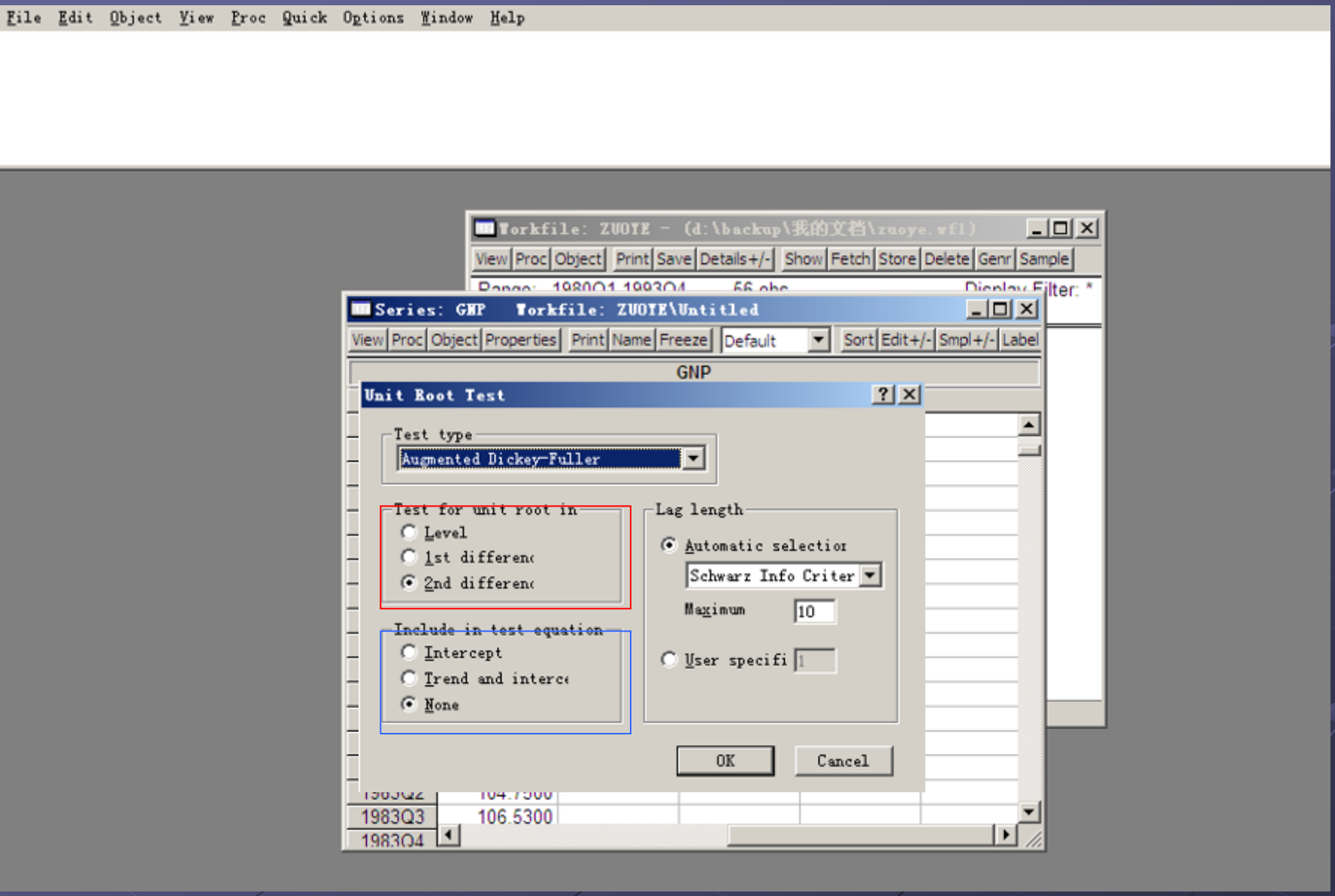

EViews
File Edit Object View Proc Quick Options Window Help
Workfile: ZUOYE - (d:\backup\我的文档\zuoye.wf1)
View Proc Object Print Save Details+/- Show Fetch Store Delete Genr Sample
Range: 1980Q1 1993Q4 -- 56 obs
Display Filter: *
Sample: 1980Q1 1993Q4 -- 56 obs
c
gnp
resid
Untitled
New Page

File Edit Object View Proc Quick Options Window Help

line gnp

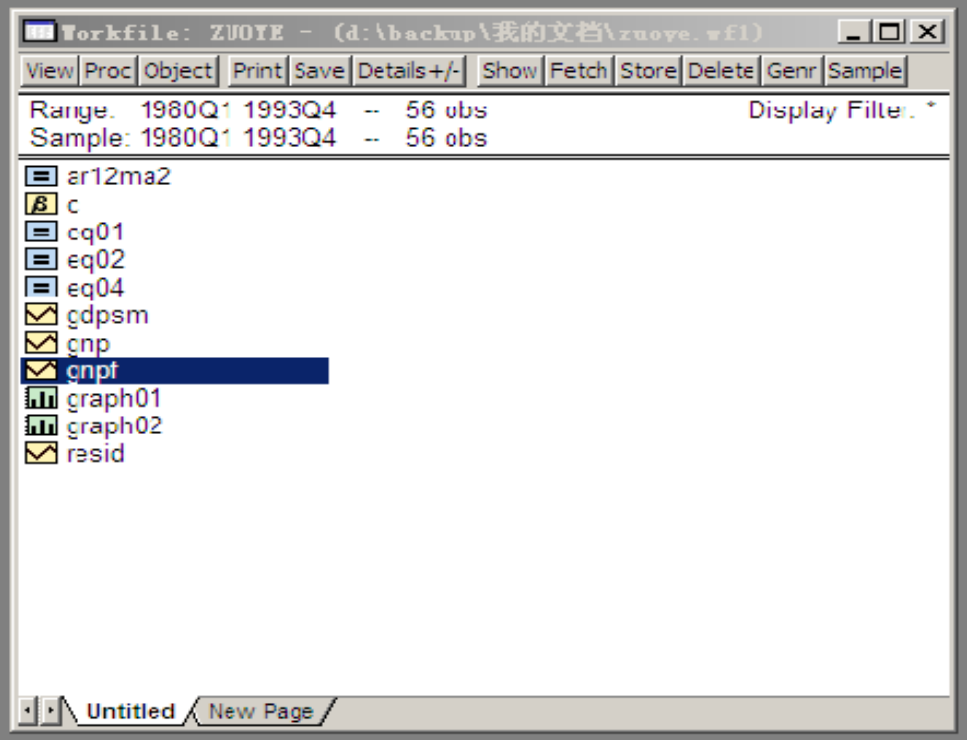



File Edit Object View Proc Quick Options Window Help
Series: GDP Workfile: ZUOYE\Untitled
View Proc Object Properties Print Name Freeze Default Sort Edit+/- Smpl+/- Label
SpreadSheet
Graph
Descriptive Statistics
Tests for Descriptive Stats
Distribution
One-Way Tabulation...
Correlogram...
Unit Root Test...
BDS Independence Test...
Properties...
Label
GDP
d: 11/26/10 - 16:15
Correlogram Specification
Correlogram of
Level
1st differenc
2nd differenc
OK
Cancel
Lags to include
24
1982Q2 99.42000
1982Q3 100.2500
1982Q4 101.5400
1983Q1 102.9500
1983Q2 104.7500
1983Q3 106.5300
1983Q4

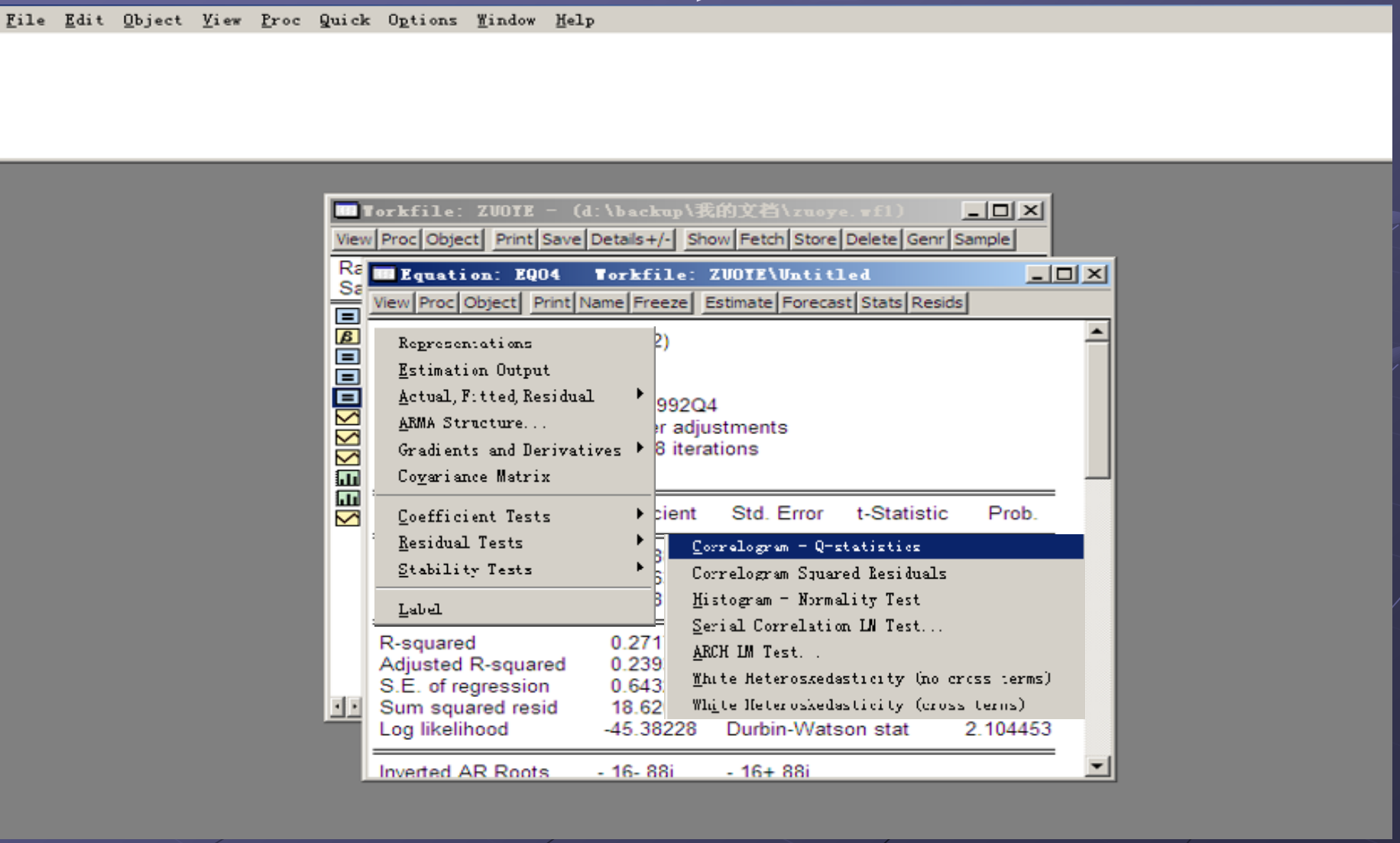

File Edit Object View Proc Quick Options Window Help
Workfile: ZUOYE - (d:\backup\我的文档\zuoye.wf1)
View Proc Object Print Save Details+/- Show Fetch Store Delete Genr Sample
Series: GNP Workfile: ZUOYE\Untitled
View Proc Object Properties Print Name Freeze Default Sort Edit+/- Smpl+/- Label
GNP
Unit Root Test
Test type
Augmented Dickey-Fuller
Test for unit root in
Level
1st differenc
2nd differenc
Lag length
Automatic selectior
Schwarz Info Criter
Maximum 10
User specifi 1
Include in test equation
Intercept
Trend and interc
None
OK
Cancel
1983Q3 106.5300
1983Q4

File Edit Object View Proc Quick Options Window Help

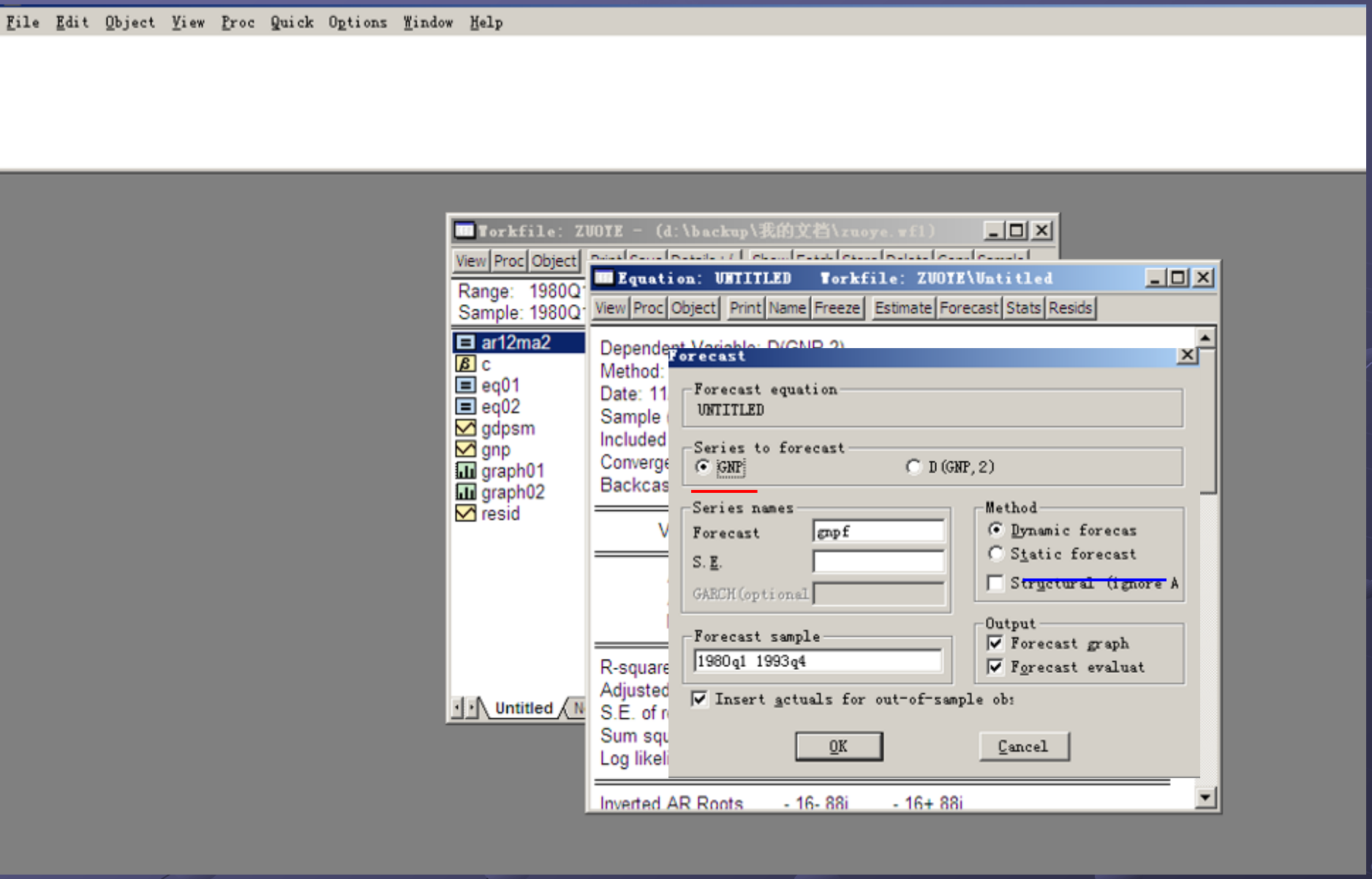
ls d(gnp,2) ar(1) ar(2) ma(2)



Q检验


File Edit Object View Proc Quick Options Window Help
Workfile: ZUOYE - (d:\backup\我的文档\zuoye.wf1)
View Proc Object Print Save Details+/- Show Fetch Store Delete Genr Sample
Equation: EQ04 Workfile: ZUOYE\Untitled
View Proc Object Print Name Freeze Estimate Forecast Stats Resids
Representations
Estimation Output
Actual, Fitted, Residual
ARMA Structure...
Gradients and Derivatives
Covariance Matrix
Coefficient Tests
Residual Tests
Stability Tests
Label
992Q4
r adjustments
8 iterations
cient Std. Error t-Statistic Prob.
Correlogram - Q-statistics
Correlogram Squared Residuals
Histogram - Normality Test
Serial Correlation LM Test...
ARCH LM Test...
White Heteroskedasticity (no cross terms)
White Heteroskedasticity (cross terms)
R-squared 0.271
Adjusted R-squared 0.239
S.E. of regression 0.643
Sum squared resid 18.62
Log likelihood -45.38228
Durbin-Watson stat 2.104453
Inverted AR Roots - 16- 88i - 16+ 88i

预测

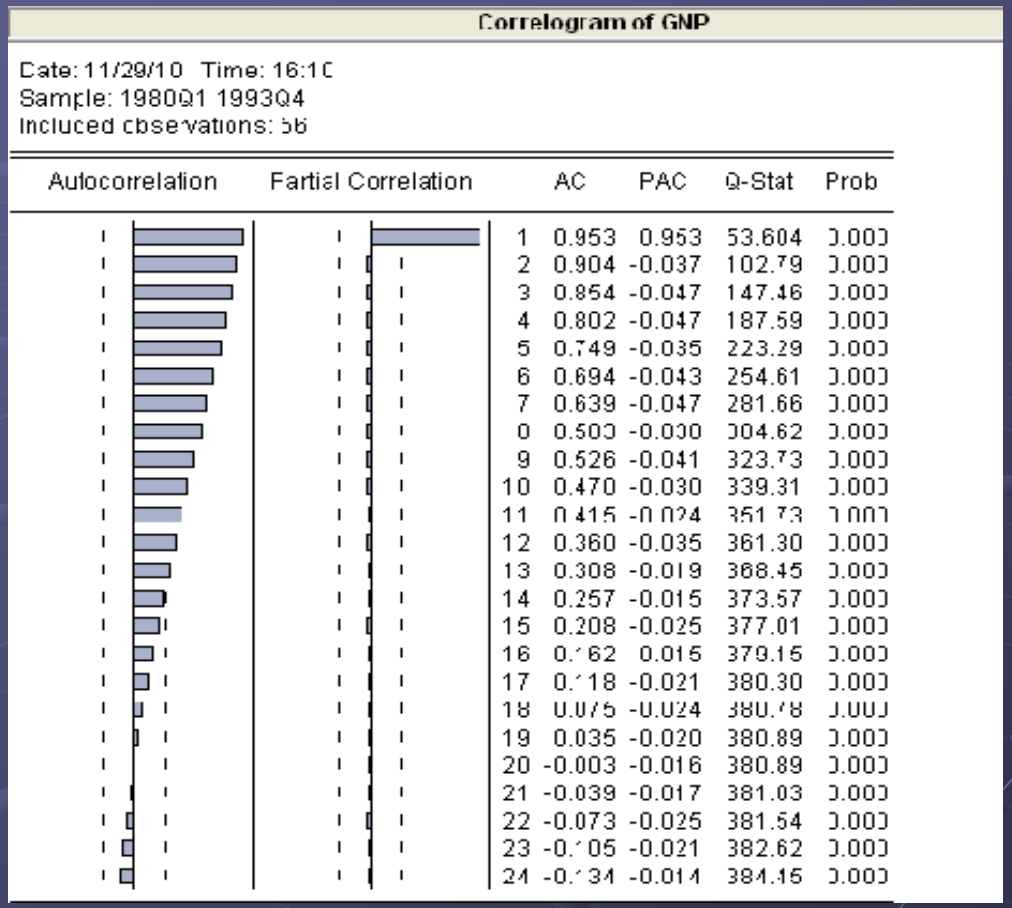

File Edit Object View Proc Quick Options Window Help
Workfile: ZUOYE - (d:\backup\我的文档\zuoye.wf1)
View Proc Object
Range: 1980Q
Sample: 1980Q
ar12ma2
c
eq01
eq02
gdpsm
gnp
graph01
graph02
resid
Untitled
Equation: UNTITLED Workfile: ZUOYE\Untitled
View Proc Object Print Name Freeze Estimate Forecast Stats Resids
Forecast
Forecast equation
UNTITLED
Series to forecast
GNP
D(GNP,2)
Series names
Forecast
gnpf
S.E.
GARCH(optional
Method
Dynamic forecas
Static forecast
Structural (ignore A
Forecast sample
1980q1 1993q4
Output
Forecast graph
Forecast evaluat
Insert actuals for out-of-sample ob
OK
Cancel
Inverted AR Roots

例：某国1980年至1993年GNP平减指数的季节时间序列，共56个观察值，见下表

表5.1　某国GNP平减指数季度资料

年/季	1	2	3	4
1980	89.89	91.07	91.79	93.03
1981	94.4	95.7	96.52	97.39
1982	98.72	99.42	100.25	101.54
1983	102.95	104.75	106.53	108.74
1984	110.72	113.48	116.42	119.79
1985	122.88	124.44	126.68	128.99
1986	130.12	131.3	132.89	134.99
1987	136.8	139.01	141.03	143.24
1988	145.12	148.89	152.02	155.38
1989	158.6	161.85	165.12	168.05
1990	171.94	176.46	180.24	185.13
1991	190.01	193.03	197.7	201.69
1992	203.98	206.77	208.53	210.27
1993	212.87	214.25	215.89	218.21

该序列时序图（1.1）和自有关图（1.2）如下：



图（1.1）

该图显示有明显的长久趋势

图（1.2）

自有关系数随延迟期数的增长，衰减向零的速度相当缓慢，且后期有反向递增趋势

序列非平稳

序列GNP的单位根检验成果：

Augmented Dickey-Fuller Unit Root Test on GNP

Null Hypothesis: GNP has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic based on SIC, MAXLAG=10)

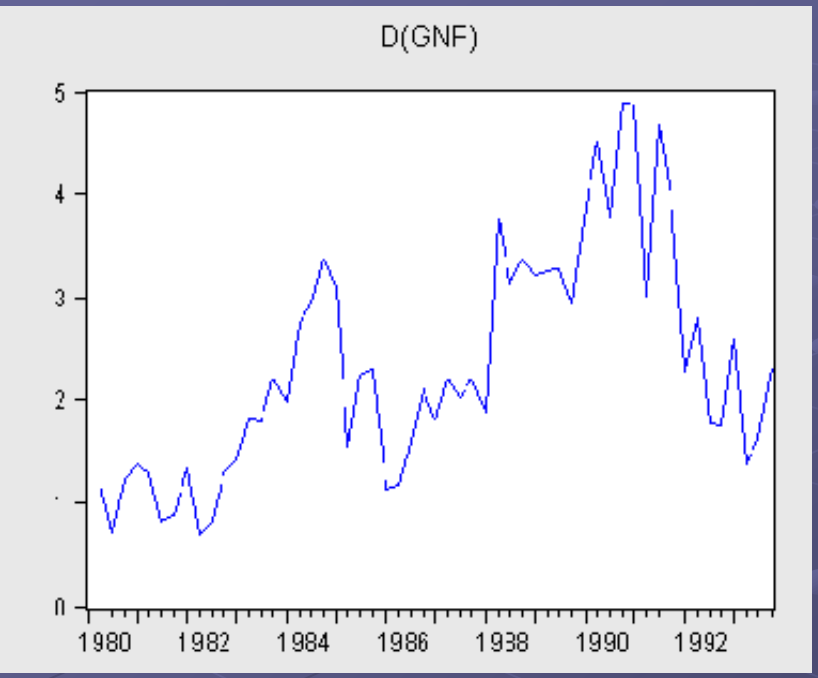
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.325604	0.9775
Test critical values:	1% level	-3.566430	
	5% level	-2.919952	
	10% level	-2.597905	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GNP)
Method: Least Squares
Date: 11/29/10 Time: 20:15
Sample (adjusted): 1981Q2 1993Q4
Included observations: 51 after adjustments

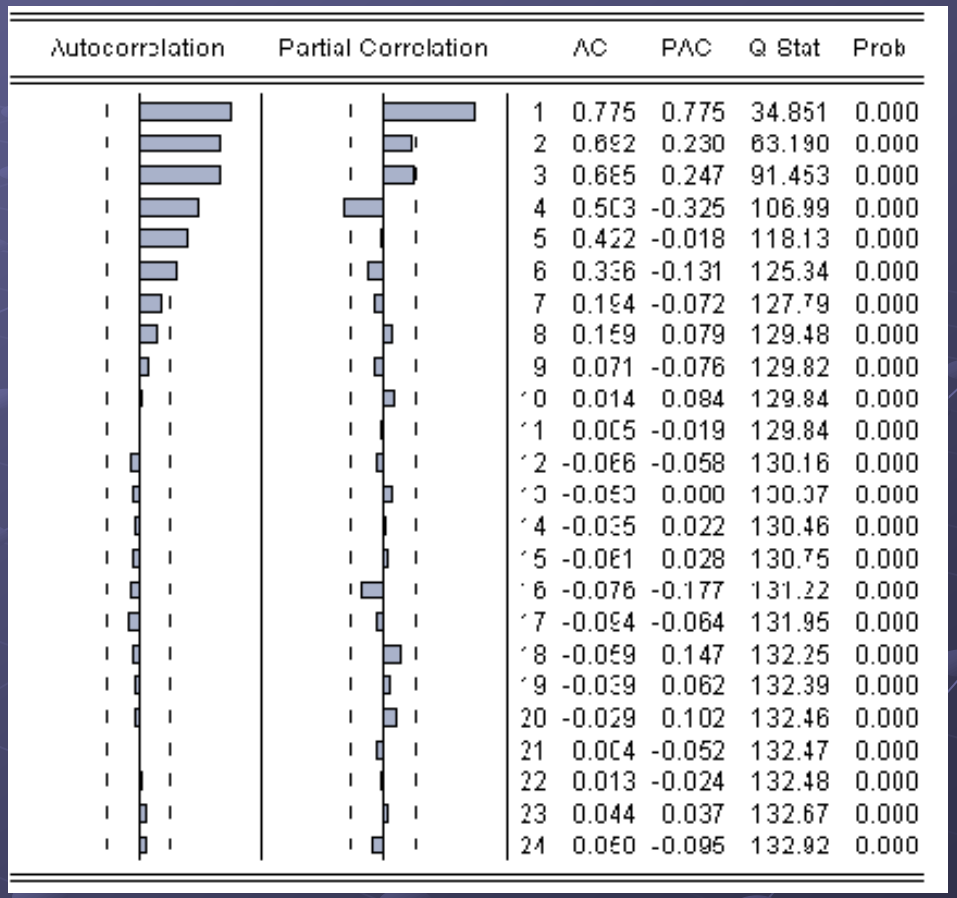
检验t统计量的值是0.325604，不小于各个明显性水平下的临界值，所以不能拒绝原假设。也就是说，序列GNP存在单位根，所以，是非平稳的。

一阶差分后的时序图与自有关图：



图（1.3）

时序图仍显示有长久趋势



		AC	PAC	Q Stat	Prob
1		0.775	0.775	34.851	0.000
2		0.692	0.230	63.190	0.000
3		0.685	0.247	91.453	0.000
4		0.503	-0.325	106.99	0.000
5		0.422	-0.018	118.13	0.000
6		0.336	-0.131	125.34	0.000
7		0.194	-0.072	127.79	0.000
8		0.159	0.079	129.48	0.000
9		0.071	-0.076	129.82	0.000
10		0.014	0.084	129.84	0.000
11		0.005	-0.019	129.84	0.000
12		-0.066	-0.058	130.16	0.000
13		-0.053	0.000	130.37	0.000
14		-0.035	0.022	130.46	0.000
15		-0.061	0.028	130.75	0.000
16		-0.076	-0.177	131.22	0.000
17		-0.094	-0.064	131.95	0.000
18		-0.059	0.147	132.25	0.000
19		-0.039	0.062	132.39	0.000
20		-0.029	0.102	132.46	0.000
21		0.004	-0.052	132.47	0.000
22		0.013	-0.024	132.48	0.000
23		0.044	0.037	132.67	0.000
24		0.060	-0.095	132.92	0.000

图（1.4）

自有关系数向零衰减的速度依然较慢

一阶差分序列
仍不平稳

一阶差分序列D(GNP)的单位根检验成果：

Augmented Dickey-Fuller Unit Root Test on D(GNP)

Null Hypothesis: D(GNP) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic based on SIC, MAXLAG=10)

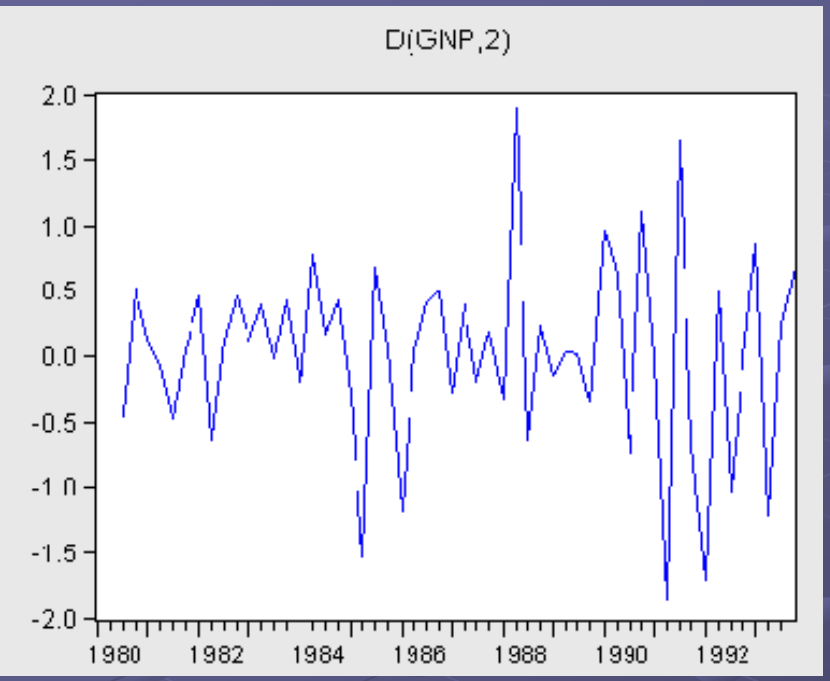
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.929760	0.3164
Test critical values:	1% level	-3.565430	
	5% level	-2.919952	
	10% level	-2.597905	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GNP,2)
Method: Least Squares
Date: 11/29/10 Time: 20:27
Sample (adjusted): 1981Q2 1993Q4
Included observations: 51 after adjustments

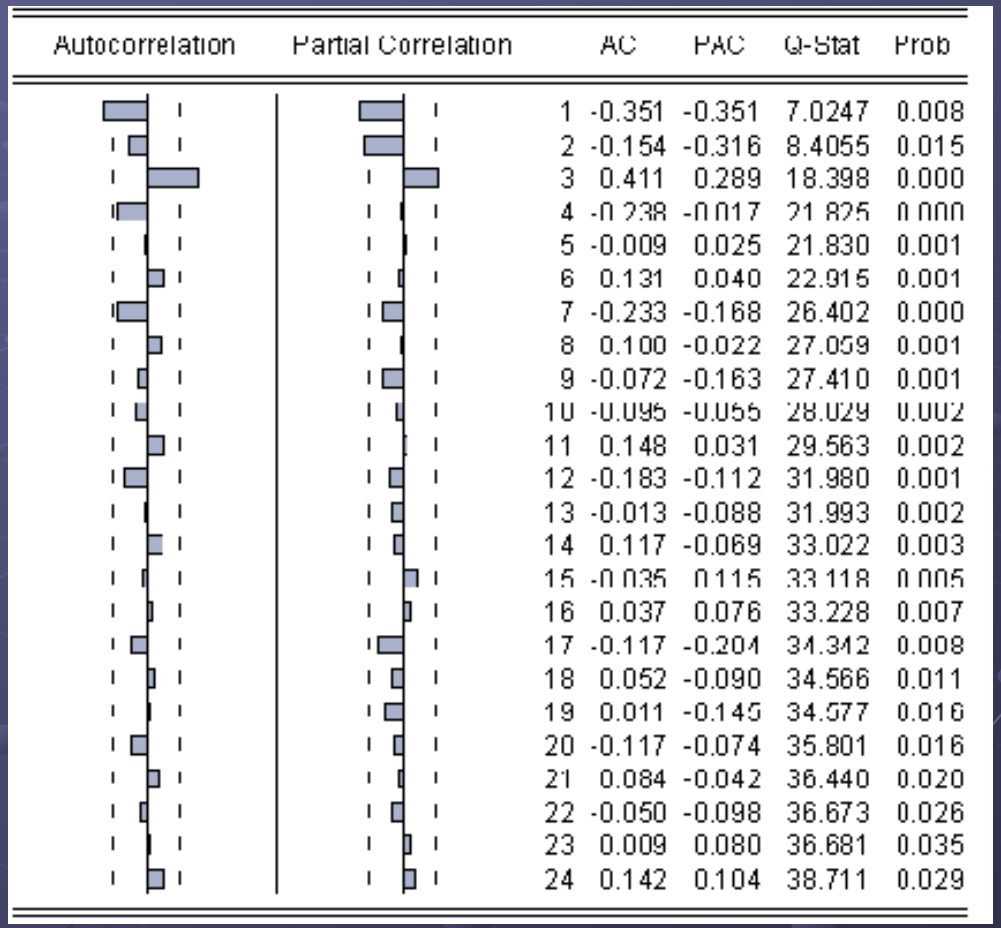
检验t统计量的值是-1.929760，不小于各个明显性水平下的临界值，所以不能拒绝原假设。也就是说，一阶差分序列D(GNP)存在单位根，所以，一阶差分序列也是非平稳的。

2阶差分时序图与自有关图：



图（1.5）

差分序列在零附近波动，
无明显趋势或周期



	AC	PAC	Q-Stat	Prob
1	-0.351	-0.351	7.0247	0.008
2	-0.154	-0.316	8.4055	0.015
3	0.411	0.289	18.398	0.000
4	-0.238	-0.017	21.825	0.000
5	-0.009	0.025	21.830	0.001
6	0.131	0.040	22.915	0.001
7	-0.233	-0.168	26.402	0.000
8	0.100	-0.022	27.059	0.001
9	-0.072	-0.163	27.410	0.001
10	-0.095	-0.055	28.029	0.002
11	0.148	0.031	29.563	0.002
12	-0.183	-0.112	31.980	0.001
13	-0.013	-0.088	31.993	0.002
14	0.117	-0.069	33.022	0.003
15	-0.035	0.115	33.118	0.005
16	0.037	0.076	33.228	0.007
17	-0.117	-0.204	34.342	0.008
18	0.052	-0.090	34.566	0.011
19	0.011	-0.145	34.577	0.016
20	-0.117	-0.074	35.801	0.016
21	0.084	-0.042	36.440	0.020
22	-0.050	-0.098	36.673	0.026
23	0.009	0.080	36.681	0.035
24	0.142	0.104	38.711	0.029

图（1.6）

自有关系数在零值附近波动

以为2阶差分
序列平稳

二阶差分序列的单位根检验：

Augmented Dickey-Fuller Unit Root Test on D(GNP,2)

Null Hypothesis: D(GNP,2) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.709559	0.0067
Test critical values:	1% level	-3.565430	
	5% level	-2.919952	
	10% level	-2.597905	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GNP,3)
Method: Least Squares
Date: 11/29/10 Time: 20:32
Sample (adjusted): 1981Q2 1993Q4
Included observations: 51 after adjustments

检验t统计量的值是-3.709559，不大于各个明显性水平下的临界值，所以拒绝原假设。也就是说，二阶差分序列不存在单位根。二阶差分序列平稳。

对平稳的2阶差分序列进行白噪声检验：

	AC	PAC	Q-Stat	Prob
1	-0.351	-0.351	7.0247	0.008
2	-0.154	-0.316	8.4355	0.015
3	0.411	0.239	18.398	0.000
4	-0.238	-0.017	21.325	0.000
5	-0.009	0.025	21.330	0.001
6	0.131	-0.040	22.315	0.001
7	-0.233	-0.138	26.402	0.000
8	0.170	-0.022	27.759	0.001
9	-0.072	-0.133	27.410	0.001
10	-0.035	-0.055	28.029	0.002
11	0.148	0.031	29.563	0.002
12	-0.133	-0.112	31.380	0.001
13	-0.013	-0.038	31.393	0.002
14	0.117	-0.039	33.022	0.003
15	-0.035	0.115	33.118	0.005
16	0.037	0.076	33.228	0.007
17	-0.117	-0.204	34.342	0.008
18	0.052	-0.030	34.566	0.011

在明显性水平为0.05的条件下，延迟期数为6和12时，Q统计量的P值均不大于0.05

2阶差分序列为非白噪声序列

结合前面分析，以为该序列为2阶差分平稳非白噪声序列，可考虑建立ARIMA模型

根据2阶差分序列的自有关图ACF和偏自有关图PACF的特点，判断阶数进行建模:

能够尝试用ARMA(2,2) ARMA(3,2) ARMA(3,3);也就是说，对原序列GNP尝试用ARIMA(2,2,2) ARIMA(3,2,2) ARIMA(3,2,3)进行拟合，首先建立ARIMA(2,2,2)如下：

模型ARiMA(2,2,2)：d(gnp,2) ar(1) ar(2) c ma(1) ma(2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013750	0.083271	0.165137	0.8696
AR(1)	-0.341270	0.121422	-2.810617	0.0074
AR(2)	-0.817271	0.108663	-7.521390	0.0000
MA(1)	0.025114	0.111654	0.224927	0.8231
MA(2)	0.871241	0.092503	9.418813	0.0000

R-squared	0.272622	Mean dependent var	0.010417
Adjusted R-squared	0.204959	S.D. dependent var	0.737549
S.E. of regression	0.657636	Akaike info criterion	2.098002
Sum squared resid	16.59686	Schwarz criterion	2.292919
Log likelihood	-45.35205	Hannan-Quinn criter.	2.171662
F-statistic	4.029115	Durbin-Watson stat	2.129585
Prob(F-statistic)	0.007316		

Inverted AR Roots	-.17-.89i	-.17+.89i
Inverted MA Roots	-.01+.93i	-.01-.93i

C与MA(1)系数的T检验显示：因为P值均不小于0.05，故接受原假设，即两者系数明显为零，所以剔除

模型一

剔除C与MA（1）：

Dependent Variable: D(GNP,2)
Method: Least Squares
Date: 11/29/10 Time: 22:29
Sample (adjusted): 1981Q1 1992Q4
Included observations: 48 after adjustments
Convergence achieved after 8 iterations
MA Backcast: 1980Q3 1980Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(1)	-0.328913	0.094940	-3.464427	0.0012
AR(2)	-0.800248	0.095542	-8.376053	0.0000
MA(2)	0.868001	0.090260	9.616677	0.0000

R-squared	0.271705	Mean dependent var	0.010417
Adjusted R-squared	0.239337	S.D. dependent var	0.737549
S.E. of regression	0.643261	Akaike info criterion	2.015929
Sum squared resid	18.62030	Schwarz criterion	2.132879
Log likelihood	-45.38228	Hannan-Quinn criter.	2.060124
Durbin-Watson stat	2.104314		

Inverted AR Roots	-.16+.83i	-.16-.83i

可供选用模型一

模型参数均经过检验

ARIMA(2,2,(2)) : d(gnp,2) ar(1) ar(2) ma(2)

建立ARIMA(3,2,2)如下：

Dependent Variable: D(GNP,2)
Method: Least Squares
Date: 11/29/10 Time: 22:46
Sample (adjusted): 1981Q2 1992Q4
Included observations: 47 after adjustments
Convergence achieved after 46 iterations
MA Backcast: 1980Q4 1981Q1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(1)	-0.616490	0.152291	-4.048120	0.0002
AR(2)	-0.969445	0.088101	-11.00374	0.0000
AR(3)	-0.196216	0.144377	-1.359050	0.1814
MA(1)	0.252096	0.046320	5.442512	0.0000
MA(2)	0.937418	0.027855	33.65316	0.0000

R-squared	0.297874	Mean dependent var	0.007872
Adjusted R-squared	0.231005	S.D. dependent var	0.745310
S.E. of regression	0.653680	Akaike info criterion	2.087583
Sum squared resid	17.94099	Schwarz criterion	2.284408
Log likelihood	-44.05821	Hannan-Quinn criter.	2.161650
Durbin-Watson stat	2.057704		

Inverted AR Roots	-.20-.92i	-.20+.92i	-.22
Inverted MA Roots	-.13+.96i	-.13-.96i	

AR(3)系数未经过检验，予以剔除

成果和前述模型相同

ARIMA(3,2,2):d(gnp,2) ar(1) ar(2) ar(3) ma(1) ma(2)

建立ARIMA(3,2,3):

命令为：d(gnp,2) ar(1) ar(2) ar(3) ma(1) ma(2) ma(3)

Dependent Variable: D(GNP,2)
Method: Least Squares
Date: 11/29/10 Time: 23:13
Sample (adjusted): 1981Q2 1992Q4
Included observations: 47 after adjustments
Convergence achieved after 231 iterations
MA Backcast: OFF (Roots of MA process too large)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(1)	-1.749951	0.195694	-5.876262	0.0000
AR(2)	-1.075097	0.200252	-5.368710	0.0000
AR(3)	-0.797820	0.137959	-5.783019	0.0000
MA(1)	1.216526	0.238068	5.109995	0.0000
MA(2)	0.747528	0.205269	3.641692	0.0008
MA(3)	1.229704	0.218440	5.140548	0.0000

R-squared	0.514857	Mean dependent var	0.007872
Adjusted R-squared	0.455727	S.D. dependent var	0.745310
S.E. of regression	0.549851	Akaike info criterion	1.760405
Sum squared resid	12.39578	Schwarz criterion	1.996594
Log likelihood	-35.36952	Hannan-Quinn criter.	1.849285
Durbin-Watson stat	1.984816		

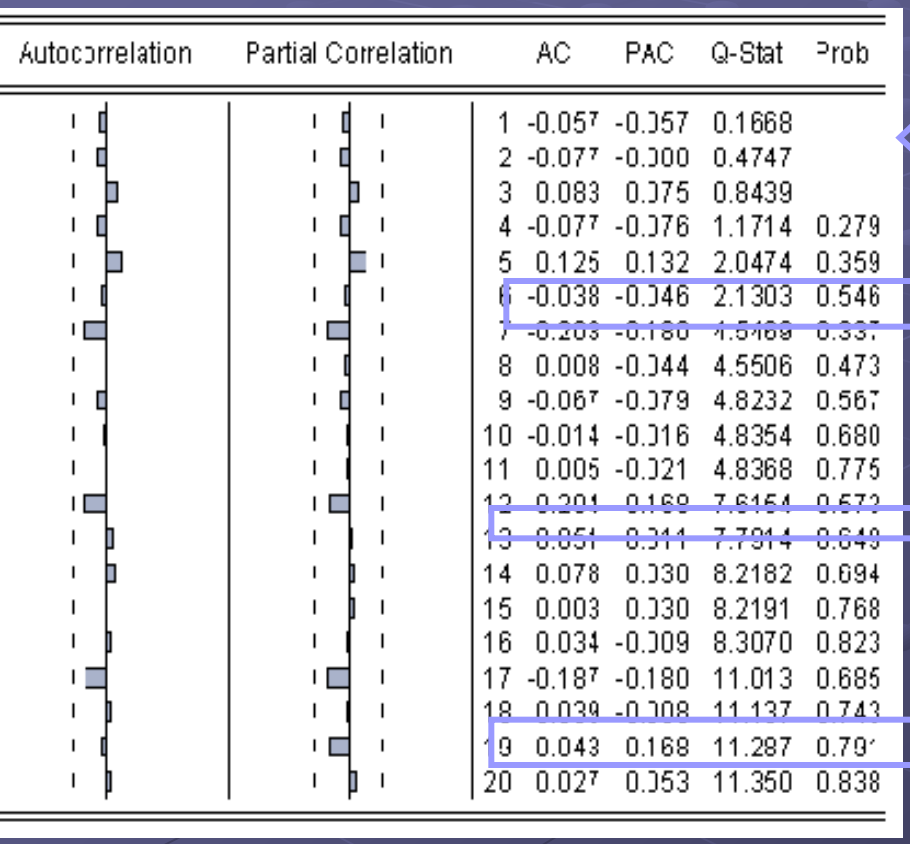
Inverted AR Roots	-.11+.92i	-.11-.92i	-.82
Inverted MA Roots	.04-.93i	.04+.93i	-1.30

Estimated MA process is noninvertible

可供选用模型二

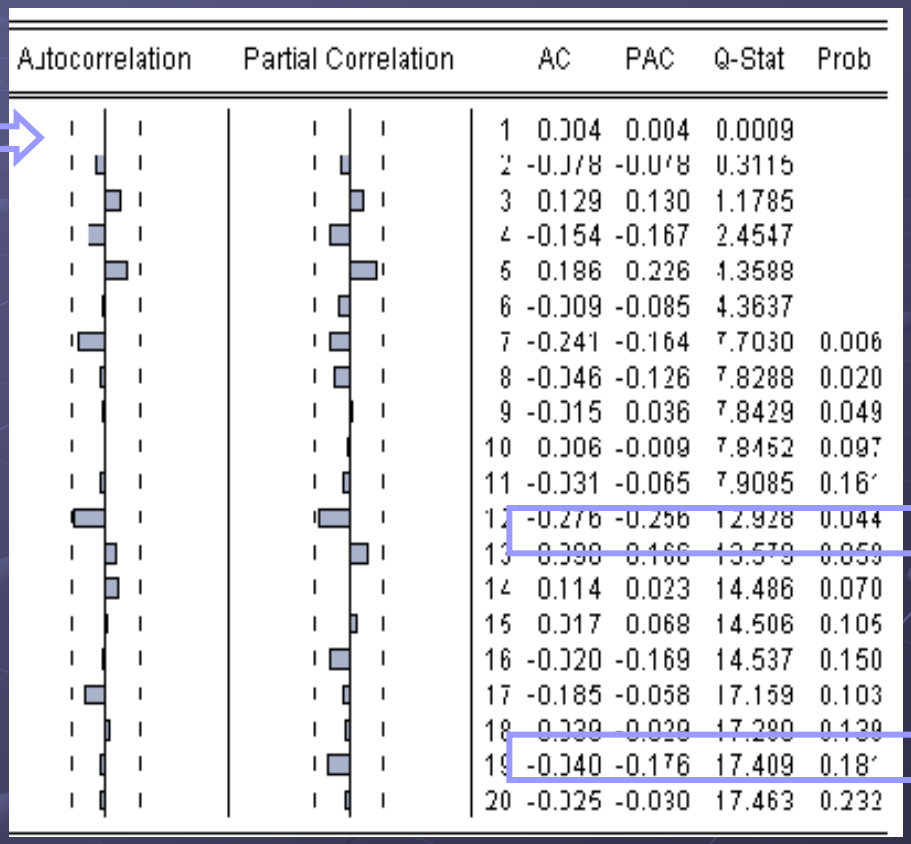
模型合用性检验：

模型ARIMA(2,2,(2))



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.057	-0.057	0.1668	
		2	-0.077	-0.080	0.4747	
		3	0.083	0.075	0.8439	
		4	-0.077	-0.076	1.1714	0.279
		5	0.125	0.132	2.0474	0.359
		6	-0.038	-0.046	2.1303	0.546
		7	-0.203	-0.180	4.5469	0.337
		8	0.008	-0.044	4.5506	0.473
		9	-0.067	-0.079	4.8232	0.567
		10	-0.014	-0.016	4.8354	0.680
		11	0.005	-0.021	4.8368	0.775
		12	0.201	0.169	7.6454	0.572
		13	0.051	0.011	7.7914	0.649
		14	0.078	0.030	8.2182	0.694
		15	0.003	0.030	8.2191	0.768
		16	0.034	-0.009	8.3070	0.823
		17	-0.187	-0.180	11.013	0.685
		18	0.039	-0.008	11.137	0.743
		19	0.043	0.168	11.287	0.791
		20	0.027	0.053	11.350	0.838

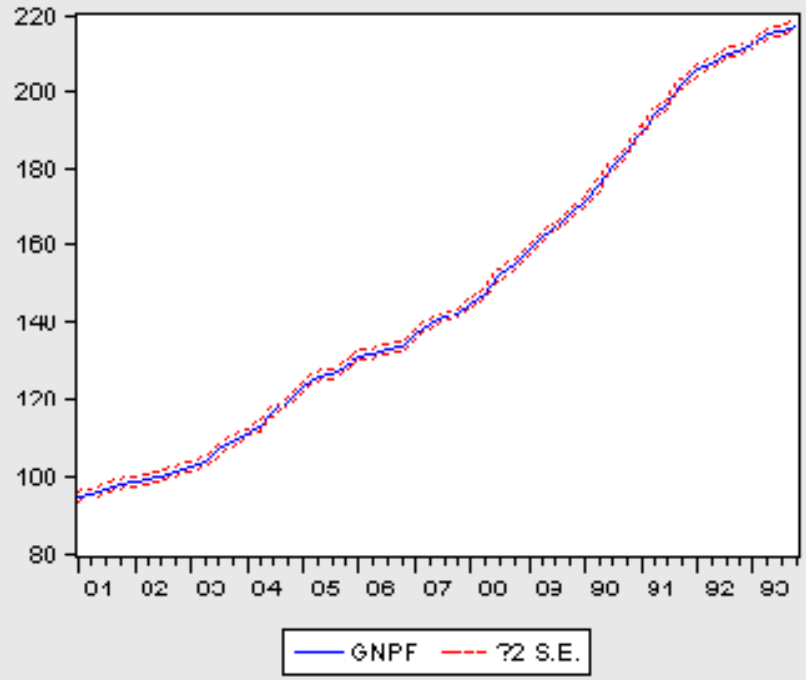
模型ARIMA(3,2,3)



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.004	0.004	0.0009	
		2	-0.078	-0.078	0.3115	
		3	0.129	0.130	1.1785	
		4	-0.154	-0.167	2.4547	
		5	0.186	0.226	4.3588	
		6	-0.009	-0.085	4.3637	
		7	-0.241	-0.164	7.7030	0.006
		8	-0.046	-0.126	7.8288	0.020
		9	-0.015	0.036	7.8429	0.049
		10	0.006	-0.009	7.8452	0.097
		11	-0.031	-0.065	7.9085	0.161
		12	-0.276	-0.256	12.928	0.044
		13	0.098	0.166	13.579	0.059
		14	0.114	0.023	14.486	0.070
		15	0.017	0.068	14.506	0.105
		16	-0.020	-0.169	14.537	0.150
		17	-0.185	-0.058	17.159	0.103
		18	0.038	0.029	17.280	0.139
		19	-0.040	-0.176	17.409	0.181
		20	-0.025	-0.030	17.463	0.232

经过对模型的合用性检验，左侧拟合模型中的残差白噪声检验显示延迟6阶，12阶，18阶的残差序列属于白噪声序列，模型ARIMA(2,2,(2))明显有效，对序列适应性更强。所以，选用该模型作为最终拟合模型。

模型预测成果：

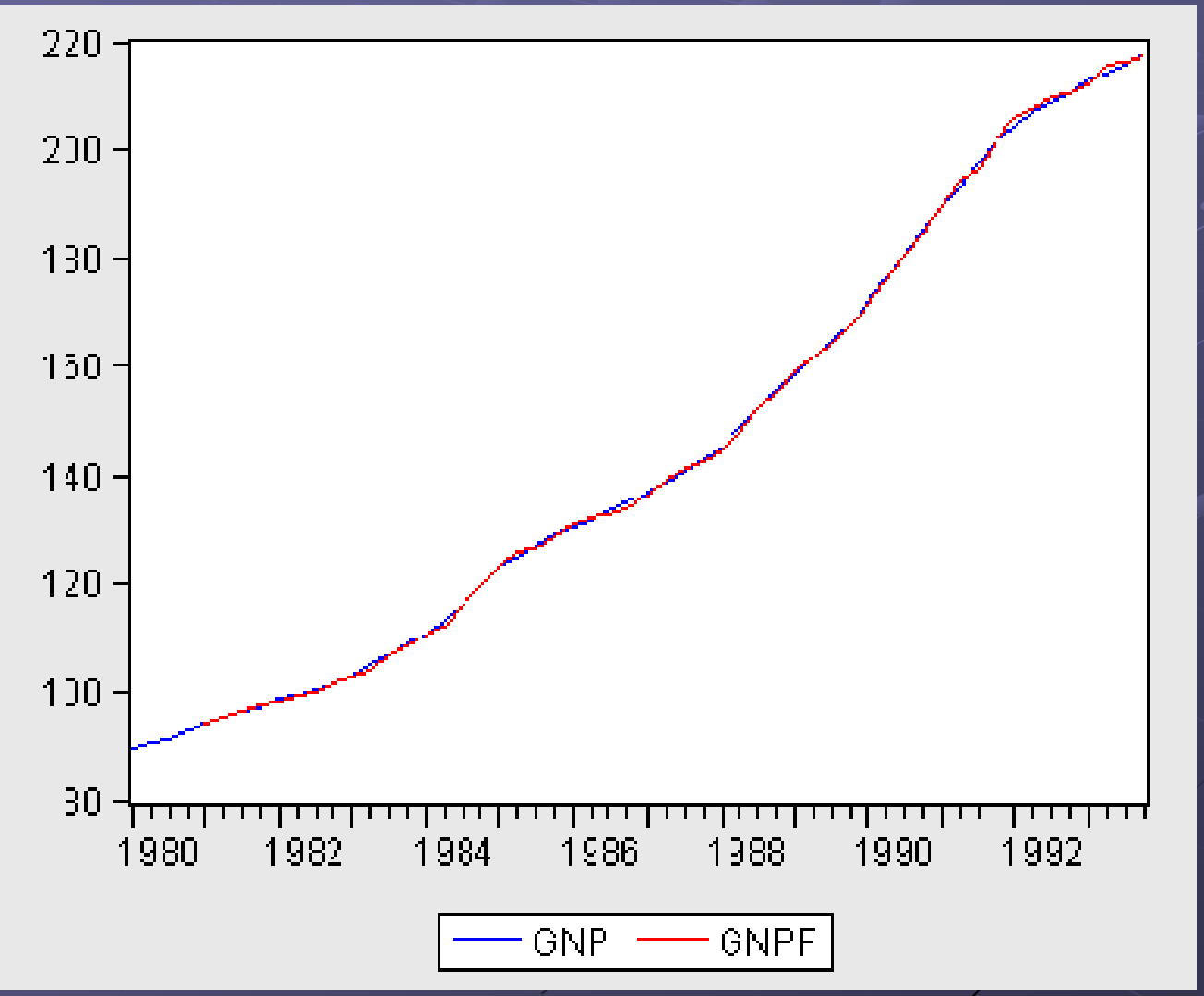


Forecast: GNPF	
Actual: GNP	
Forecast sample: 1980Q1 1993Q4	
Adjusted sample: 1981Q1 1993Q4	
Included observations: 52	
Root Mean Squared Error	0.647155
Mean Absolute Error	0.491889
Mean Abs. Percent Error	0.325723
Theil Inequality Coefficient	0.002111
Bias Proportion	0.000948
Variance Proportion	0.014221
Covariance Proportion	0.984831

GNP平减指数时间序列模型为：

$$(1-B)^2(1+0.328913B+0.806248B^2)X_t = \varepsilon_t - 0.868001\varepsilon_{t-1}$$

拟合曲线对比：



拟合曲线与原序列曲线十分接近，直观来看，拟合效果很好！

预测值的比较

	原始值	ARIMA(2,2,(2))	ARIMA(3,2,3)
93Q1	212.87	212.01	211.69
93Q2	214.87	215.51	216.01
93Q3	215.89	216.08	214.91
93Q4	218.21	217.32	219.06

季节时间序列建模案例

研究对象及目的

- 对我国1990年1月至1997年12月工业总产值的月度资料（1990年为不变价格）共有96个观察值进行时间序列拟合，并对1998年工业总产值进行预测。

1990年1月至1997年12月我国工业总产值　　单位：亿元

月/年	1990	1991	1992	1993	1994	1995	1996	1997
1	1421.4	1757.8	1984.2	2179.1	2903.3	2996.7	3476.6	3843.84
2	1367.4	1485.7	1812.4	2408.7	2513.8	2740.3	2970.3	3181.26
3	1719.7	1893.9	2274.7	2869.4	3409	3580.9	3942.6	4404.49
4	1759.6	1969.8	2328.9	2916.7	3499.5	3746.3	4067.6	4520.18
5	1795.7	2033.7	2373.1	3022.1	3642.6	3817.9	4746.899	4638.99
6	1848.1	2103	2515.8	3274.5	3871.4	4046.6	4417.299	4969.93
7	1637.3	1836.3	2288	2862.9	3373	3483.9	3806.8	4146.899
8	1670.9	1914.7	2321	2864.2	3463.4	3510.6	3746.3	4198.7
9	1760.1	2022.2	2441.1	2908	3663.74	3703.1	4011.1	4563.839
10	1789.5	2045.1	2502.6	2911.8	3753.38	3810.7	4129.6	4178.91
11	1888.6	2069.2	2608.8	3101.3	3973.17	4091	4372.899	5034.939
12	1981.4	2136	2823.8	3664.3	4469.02	4650.799	4991.5	5545.74