a) l_{i1} : $LR = -2(-149.521 - (-134.178)) = 30.69$ } $\chi^2(1)$ $\alpha = 5\%$
l_{i2} : $LR = -2(-139.747 - (-134.178)) = 11.14$ } $C_\alpha = 3.8$

l_{i1}, l_{i2}: $LR = -2(-152.763 - (-134.178)) = 37.17$ $\chi^2(2)$
$C_\alpha = 6.0$

$\Rightarrow$ l_{i1}, l_{i2} individually significant
and jointly significant

b) McFadden R^2 can be used: - explained variable the same
- number of coefficients the same

$$\text{McFadden } R^2 = 1 - \frac{\log(LL(b))}{\log(LL(b_1))} \qquad \log(LL(b_1)) = -152.763$$

first value $R^2 = 1 - (-134.178)/(-152.763) = 1 - 0.8783 = 0.1217$

	$l_{i2}(-1)$	$l_{i2}(-2)$
$l_{i1}(-1)$	0.1217	0.1220
$l_{i1}(-2)$	(0.1461)	0.1460

best performing model

c) $$\hat{P}_{growth} = \frac{e^{0.746 - 0.429 \times l_{i1}(-2) - 0.131 \times l_{i2}(-1)}}{1 + e^{0.746 - 0.429 \times l_{i1}(-2) - 0.131 \times l_{i2}(-1)}}$$

Quarter	GDPIMPR	PredProb	Pred01
2011Q1	1	0.242872	0
2011Q2	0	0.219600	0
2011Q3	0	0.084092	0
2011Q4	0	0.084092	0
2012Q1	1	0.159628	0
2012Q2	0	0.225832	0
2012Q3	1	0.376366	0
2012Q4	1	0.555273	1
2013Q1	1	0.596042	1
2013Q2	1	0.522734	1
2013Q3	1	0.555273	1
2013Q4	0	0.713614	1
2014Q1	0	0.739621	1
2014Q2	1	0.649081	1
2014Q3	1	0.764048	1
2014Q4	1	0.850051	1
2015Q1	1	0.850051	1
2015Q2	1	0.832577	1
2015Q3	1	0.713614	1
2015Q4	0	0.346151	0

↓

	Predicted		Total
	0	1	
Realization:0	5	2	7
Realization:1	3	10	13
Total:	8	12	20

relative ↓

	Predicted		Total
	0	1	
Realization:0	5/20	2/20	7/20
Realization:1	3/20	10/20	13/20
Total:	8/20	12/20	20/20

the hitrate = 5/20 + 10/20 = 0.75 => 75% of the cases the model gives the correct prediction

d)

Dependent variable: GrowthRate=Δ log GDP
Sample size: 240

	Coefficient	Standard error	t-value
Constant	0.090	0.037	2.400
LOGGDP(-1)	−0.019	0.008	−2.371
GrowthRate(-1)	0.613	0.050	12.236
T	6.23×10^{-5}	2.59×10^{-5}	2.407

compare

Critical value of Augmented Dickey Fuller test with constant and trend
$C_\alpha = -3.\Gamma$

=> H_0 of unit root not rejected => log GPD non-stationary

e)

	$l_{i2(-1)}$	$l_{i2(-2)}$
$l_{i(-1)}$	0.5080	0.5077
$l_{i(-2)}$	0.4772	0.4771

best performing model

Dependent variable: GrowthRate Sample size: 240			
	Coefficient	Standard error	t-value
C	**0.001737**	0.000320	5.433
GrowthRate(-1)	**0.461579**	0.048302	9.556
LI1(-1)	**-0.001023**	0.000130	-7.880
LI2(-1)	**-0.000149**	6.421×10^{-5}	-2.326

f)

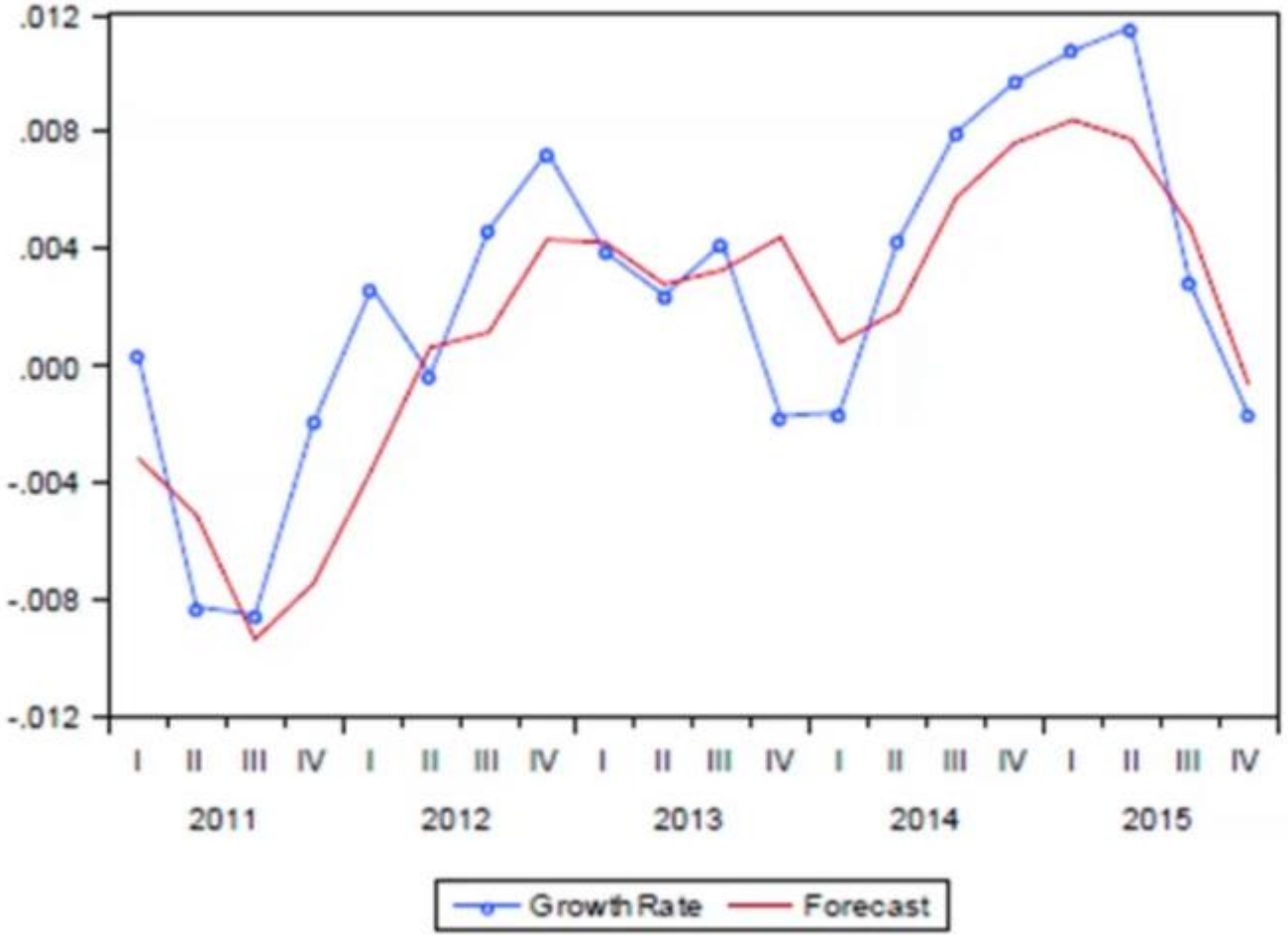
Dependent variable: RESID (Residuals from model in (e) with $k_1 = k_2 = 1$) Sample size: 239	
	Coefficient
C	−0.0001
GROWTHRATE(-1)	0.0291
LI1(-1)	3.14×10^{-5}
LI2(-1)	2.77×10^{-6}
RESID(-1)	−0.0500
R^2	0.0010

Breusch-Godfrey test statistic $240 \times 0.0010 = 0.24$ $\chi^2(1)$ $C_\alpha = 3.8$
$\alpha = 5\%$

=> Ho not rejected

of no residual serial correlation

g) RMSE = 0.008156 0.3% on quarterly basis



=> graph shows predictions are reasonably accurate