KJ SOMAIYA INSTITUTE OF MANAGEMENT STUDIES & RESEARCH
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PGDM/ IB/MMS (F/M/O/HR): VI -2017-19

ECONOMETRICS

(End trimester Examination)

April 20, 2019 **Max. Marks: 50** **Duration: 3 Hrs.**

Note:

Answer any **FIVE** of the following questions. All questions carry equal marks (5*10).

Q1 Population survey data is used in this equation to find out the determinants of hourly wages.

Dependent Variable- Wage: hourly wage
Gender coded 1 for female and 0 for male
Nonwhite – Race code 1 for nonwhite workers and 0 for white workers
Union – union status, coded 1 if in a union job, 0 otherwise
Education- number of years

a) **Write interpretation of the below mentioned regression results.**
b) **What other variables are missing from the model?**
c) **Can you take logs of the nominal variables such as gender, race and union status? Why or why not?**

Dependent Variable: WAGE
Method: Least Squares
Sample: 1 1289
Included observations: 1289

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.183338	1.015788	-7.071691	0.0000
FEMALE	-3.074875	0.364616	-8.433184	0.0000
NONWHITE	-1.565313	0.509188	-3.074139	0.0022
UNION	1.095976	0.506078	2.165626	0.0305
EDUCATION	1.370301	0.065904	20.79231	0.0000
EXPER	0.166607	0.016048	10.38205	0.0000

R-squared	0.323339	Mean dependent var	12.36585
Adjusted R-squared	0.320702	S.D. dependent var	7.896350
S.E. of regression	6.508137	Akaike info criterion	6.588627
Sum squared resid	54342.54	Schwarz criterion	6.612653
Log likelihood	-4240.370	Hannan-Quinn criter.	6.597646
F-statistic	122.6149	Durbin-Watson stat	1.897513
Prob(F-statistic)	0.000000		

Q2 Discuss the following results using the functional forms like linear, log linear and polynomial trend (Time).

Dependent Variable: LNRGDP
Method: Least Squares
Sample: 1 48
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.875662	0.009759	807.0064	0.0000
TIME	0.031490	0.000347	90.81649	0.0000

R-squared	0.994454	Mean dependent var	8.647156
Adjusted R-squared	0.994333	S.D. dependent var	0.442081
S.E. of regression	0.033280	Akaike info criterion	-3.926967
Sum squared resid	0.050947	Schwarz criterion	-3.849001
Log likelihood	96.24722	Hannan-Quinn criter.	-3.897504
F-statistic	8247.634	Durbin-Watson stat	0.347739
Prob(F-statistic)	0.000000		

Dependent Variable: RGDP
Method: Least Squares
Sample: 1 48
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1664.218	131.9990	12.60781	0.0000
TIME	186.9939	4.689886	39.87174	0.0000

R-squared	0.971878	Mean dependent var	6245.569
Adjusted R-squared	0.971267	S.D. dependent var	2655.520
S.E. of regression	450.1314	Akaike info criterion	15.09773
Sum squared resid	9320439.	Schwarz criterion	15.17570
Log likelihood	-360.3455	Hannan-Quinn criter.	15.12719
F-statistic	1589.756	Durbin-Watson stat	0.069409
Prob(F-statistic)	0.000000		

Dependent Variable: RGDP
Method: Least Squares
Sample: 1 48
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2651.381	69.49084	38.15439	0.0000
TIME	68.53436	6.542114	10.47587	0.0000
$TIME^2$	2.417542	0.129443	18.67647	0.0000

R-squared	0.996787	Mean dependent var	6245.569
Adjusted R-squared	0.996644	S.D. dependent var	2655.520
S.E. of regression	153.8419	Akaike info criterion	12.97019
Sum squared resid	1065030.	Schwarz criterion	13.08714
Log likelihood	-308.2845	Hannan-Quinn criter.	13.01438
F-statistic	6979.431	Durbin-Watson stat	0.462850
Prob(F-statistic)	0.000000		

Q3 Explain concept of multicollinearity using following four regression equation results. Prepare a column wise table of dependent variable and explanatory variables along with R^2 value to make comparison of the models.

Dependent Variable: EXPEND
Method: Least Squares
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	24.77473	6.752500	3.668972	0.0080
INCOME	0.941537	0.822898	1.144172	0.2902
WEALTH	-0.042435	0.080664	-0.526062	0.6151

R-squared	0.963504	Mean dependent var	111.0000
Adjusted R-squared	0.953077	S.D. dependent var	31.42893
S.E. of regression	6.808041	Akaike info criterion	6.917411
Sum squared resid	324.4459	Schwarz criterion	7.008186
Log likelihood	-31.58705	Hannan-Quinn criter.	6.817830
F-statistic	92.40196	Durbin-Watson stat	2.890614
Prob(F-statistic)	0.000009		

Dependent Variable: EXPEND
Method: Least Squares
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	24.45455	6.413817	3.812791	0.0051
INCOME	0.509091	0.035743	14.24317	0.0000

R-squared	0.962062	Mean dependent var	111.0000
Adjusted R-squared	0.957319	S.D. dependent var	31.42893
S.E. of regression	6.493003	Akaike info criterion	6.756184
Sum squared resid	337.2727	Schwarz criterion	6.816701
Log likelihood	-31.78092	Hannan-Quinn criter.	6.689797
F-statistic	202.8679	Durbin-Watson stat	2.680127
Prob(F-statistic)	0.000001		

Dependent Variable: EXPEND
Method: Least Squares
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	24.41104	6.874097	3.551164	0.0075
WEALTH	0.049764	0.003744	13.29166	0.0000

R-squared	0.956679	Mean dependent var	111.0000
Adjusted R-squared	0.951264	S.D. dependent var	31.42893
S.E. of regression	6.938330	Akaike info criterion	6.888856
Sum squared resid	385.1233	Schwarz criterion	6.949373
Log likelihood	-32.44428	Hannan-Quinn criter.	6.822469
F-statistic	176.6681	Durbin-Watson stat	2.417419
Prob(F-statistic)	0.000001		

Dependent Variable: WEALTH
Method: Least Squares
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.545455	29.47581	0.255988	0.8044
INCOME	10.19091	0.164262	62.04047	0.0000

R-squared	0.997926	Mean dependent var	1740.000
Adjusted R-squared	0.997667	S.D. dependent var	617.7312
S.E. of regression	29.83972	Akaike info criterion	9.806415
Sum squared resid	7123.273	Schwarz criterion	9.866932
Log likelihood	-47.03207	Hannan-Quinn criter.	9.740028
F-statistic	3849.020	Durbin-Watson stat	2.077534
Prob(F-statistic)	0.000000		

Q4 Answer the following questions.

a) **From the below mentioned output state the problem of Heteroskedasticity present in the equation. This is the equation for sales and research and development expenditure.**
b) **What are the tests performed to detect it? In each test what are dependent and independent variables**
c) **From the two plots can we infer that heteroskedasticity is present in this equation?**

Dependent Variable: RD
Method: Least Squares
Sample: 1 18
Included observations: 18

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	192.9931	990.9858	0.194749	0.8480
SALES	0.031900	0.008329	3.830033	0.0015

R-squared	0.478303	Mean dependent var	3056.856
Adjusted R-squared	0.445697	S.D. dependent var	3705.973
S.E. of regression	2759.153	Akaike info criterion	18.78767
Sum squared resid	1.22E+08	Schwarz criterion	18.88660
Log likelihood	-167.0891	Hannan-Quinn criter.	18.80132
F-statistic	14.66916	Durbin-Watson stat	3.015607
Prob(F-statistic)	0.001476		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	4.564374	Prob. F(1,16)	0.0484
Obs*R-squared	3.995197	Prob. Chi-Square(1)	0.0456
Scaled explained SS	7.039975	Prob. Chi-Square(1)	0.0080

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/28/19 Time: 10:59
Sample: 1 18
Included observations: 18

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-974469.1	4802343.	-0.202915	0.8418
SALES	86.23211	40.36253	2.136439	0.0484

R-squared	0.221955	Mean dependent var	6767046.
Adjusted R-squared	0.173328	S.D. dependent var	14706011
S.E. of regression	13370930	Akaike info criterion	35.75950
Sum squared resid	2.86E+15	Schwarz criterion	35.85843
Log likelihood	-319.8355	Hannan-Quinn criter.	35.77314

F-statistic	4.564374	Durbin-Watson stat	1.791548
Prob(F-statistic)	0.048439		

Heteroskedasticity Test: Glejser

F-statistic	4.380896	Prob. F(1,16)	0.0526
Obs*R-squared	3.869120	Prob. Chi-Square(1)	0.0492
Scaled explained SS	5.654785	Prob. Chi-Square(1)	0.0174

Test Equation:
Dependent Variable: ARESID
Method: Least Squares
Sample: 1 18
Included observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	578.5710	678.6950	0.852476	0.4065
SALES	0.011939	0.005704	2.093059	0.0526

R-squared	0.214951	Mean dependent var	1650.432
Adjusted R-squared	0.165886	S.D. dependent var	2069.046
S.E. of regression	1889.657	Akaike info criterion	18.03062
Sum squared resid	57132868	Schwarz criterion	18.12955
Log likelihood	-160.2756	Hannan-Quinn criter.	18.04426
F-statistic	4.380896	Durbin-Watson stat	1.743294
Prob(F-statistic)	0.052633		

Heteroskedasticity Test: White

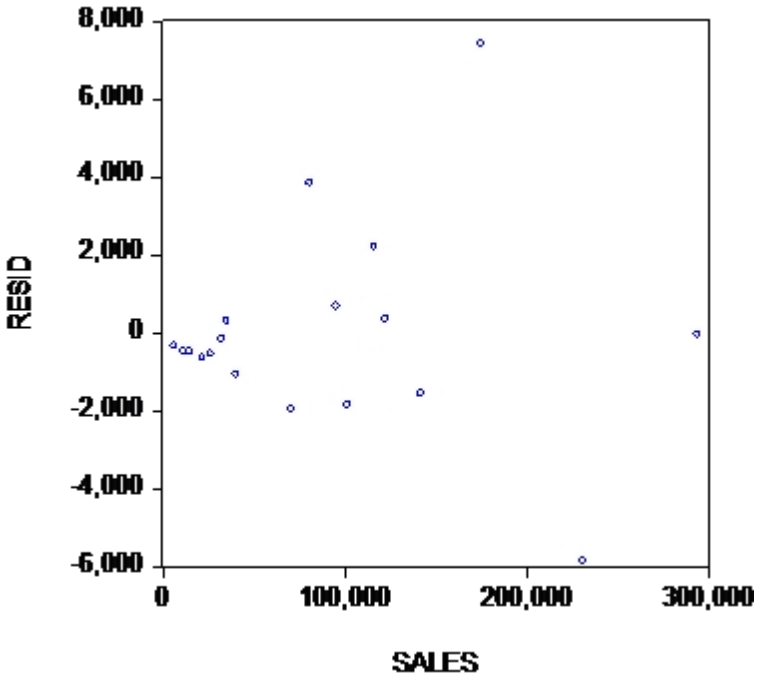
F-statistic	3.057178	Prob. F(2,15)	0.0770
Obs*R-squared	5.212492	Prob. Chi-Square(2)	0.0738
Scaled explained SS	9.184982	Prob. Chi-Square(2)	0.0101

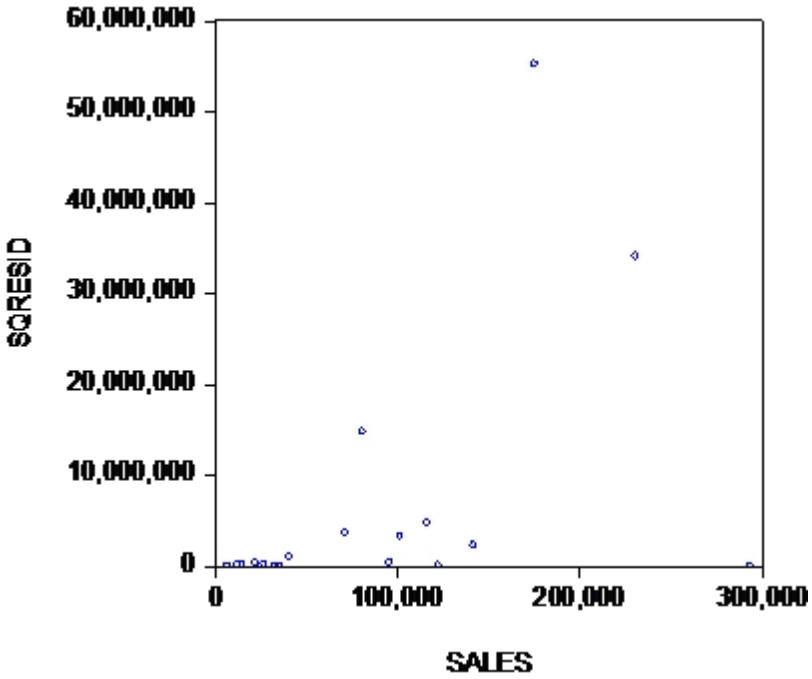
Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1 18
Included observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6219665.	6459809.	-0.962825	0.3509
SALES^2	-0.000537	0.000449	-1.194952	0.2507
SALES	229.3508	126.2197	1.817077	0.0892

R-squared	0.289583	Mean dependent var	6767046.
Adjusted R-squared	0.194861	S.D. dependent var	14706011
S.E. of regression	13195639	Akaike info criterion	35.77968
Sum squared resid	2.61E+15	Schwarz criterion	35.92808

Log likelihood	-319.0171	Hannan-Quinn criter.	35.80014
F-statistic	3.057178	Durbin-Watson stat	1.694567
Prob(F-statistic)	0.076975		





Q5 Below mentioned is the seasonal adjustment of sales data using Dummy Variable model. Interpret the results of the equation. Also comment on the graph given below.

Least Squares - SALES C D2 D3 D4

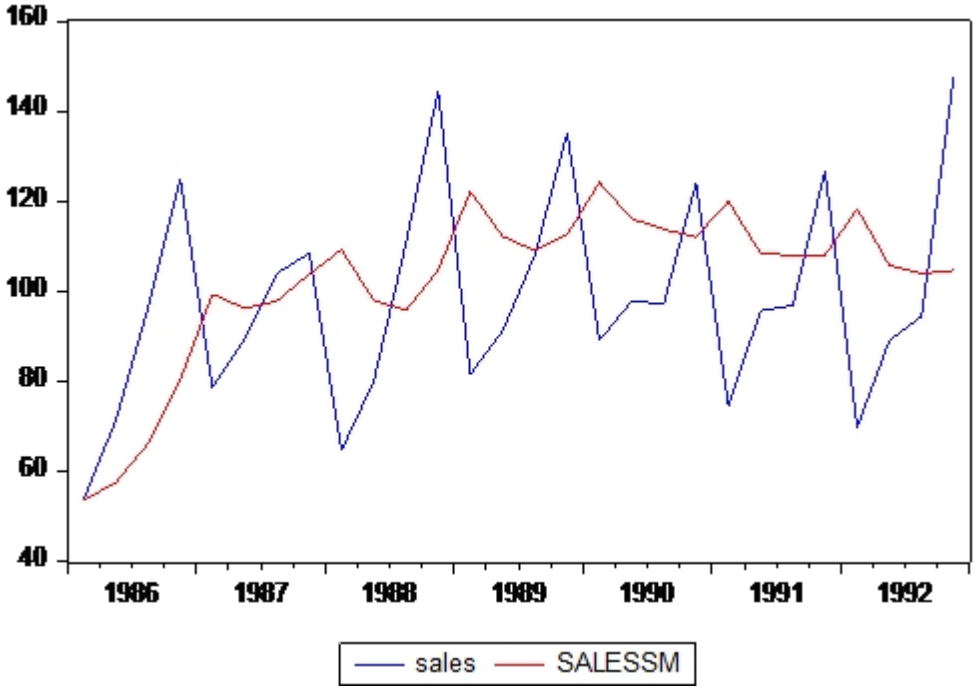
Estimation Equation:
==========
SALES = C(1) + C(2)*D2 + C(3)*D3 + C(4)*D4

Substituted Coefficients:
==========
SALES = 73.1834275382 + 14.6922863552*D2 + 27.9647167751*D3 + 57.1147161211*D4

Dependent Variable: SALES
Method: Least Squares
Sample: 1986Q1 1992Q4
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	73.18343	3.977483	18.39943	0.0000
D2	14.69229	5.625010	2.611957	0.0153
D3	27.96472	5.625010	4.971496	0.0000
D4	57.11472	5.625010	10.15371	0.0000

R-squared	0.823488	Mean dependent var	98.12636
Adjusted R-squared	0.801424	S.D. dependent var	23.61535
S.E. of regression	10.52343	Akaike info criterion	7.676649
Sum squared resid	2657.822	Schwarz criterion	7.866964
Log likelihood	-103.4731	Hannan-Quinn criter.	7.734830
F-statistic	37.32278	Durbin-Watson stat	1.024353
Prob(F-statistic)	0.000000		

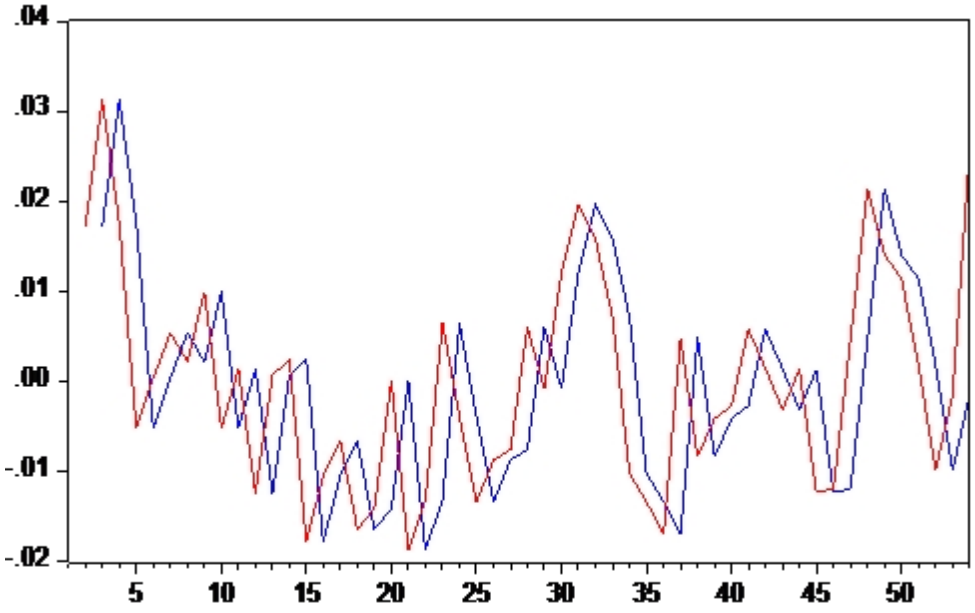


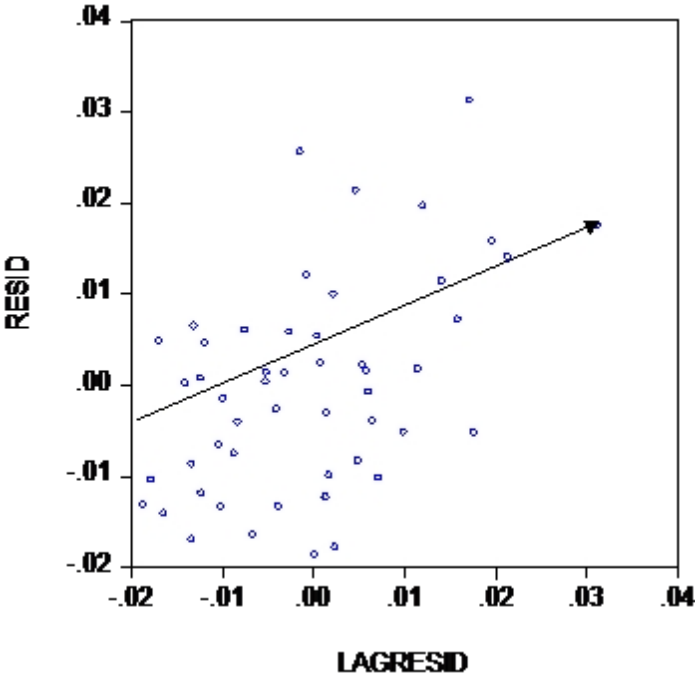
Q6 Explain the term Autocorrelation using the following output. Also discuss the serial correlation test output.

Dependent Variable: LNCONSUMP
Method: Least Squares
Sample (adjusted): 2 54
Included observations: 53 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.420014	0.041818	-10.04385	0.0000
LNDPI	0.809253	0.017941	45.10674	0.0000
LNWEALTH	0.192239	0.018052	10.64936	0.0000
RINTEREST	-0.000732	0.001132	-0.647169	0.5205

R-squared	0.999527	Mean dependent var	7.843870
Adjusted R-squared	0.999498	S.D. dependent var	0.541833
S.E. of regression	0.012140	Akaike info criterion	-5.912103
Sum squared resid	0.007222	Schwarz criterion	-5.763401
Log likelihood	160.6707	Hannan-Quinn criter.	-5.854919
F-statistic	34510.41	Durbin-Watson stat	0.961643
Prob(F-statistic)	0.000000		





Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.337642	Prob. F(2,47)	0.0441
Obs*R-squared	6.591302	Prob. Chi-Square(2)	0.0370

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 2 54
Included observations: 53
Presample missing value lagged residuals set to zero.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LNDPI	-0.003456	0.013312	-0.259629	0.7963
LNWEALTH	0.007458	0.020262	0.368089	0.7145
RINCOME	-1.84E-06	7.62E-06	-0.241763	0.8100
C	-0.039135	0.135199	-0.289461	0.7735
RESID(-1)	0.383354	0.150526	2.546759	0.0142
RESID(-2)	-0.183361	0.151268	-1.212161	0.2315

R-squared	0.124364	Mean dependent var	-2.85E-16
Adjusted R-squared	0.031211	S.D. dependent var	0.009116
S.E. of regression	0.008973	Akaike info criterion	-6.482974
Sum squared resid	0.003784	Schwarz criterion	-6.259922
Log likelihood	177.7988	Hannan-Quinn criter.	-6.397199
F-statistic	1.335057	Durbin-Watson stat	1.962141
Prob(F-statistic)	0.266036		

Q7 Using Distributed lag models interpret the following output both short and long-term elasticity.

Equation refers to money supply (M1) and interest rate R and income GDP.

Dependent Variable: LNM1
Method: Least Squares
Sample: 1 39
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.540960	0.905985	-9.427260	0.0000
R	-0.005572	0.002066	-2.697092	0.0106
LNGDP	1.469062	0.069453	21.15174	0.0000

R-squared	0.955591	Mean dependent var	10.26467
Adjusted R-squared	0.953123	S.D. dependent var	0.154574
S.E. of regression	0.033467	Akaike info criterion	-3.882713
Sum squared resid	0.040321	Schwarz criterion	-3.754746
Log likelihood	78.71290	Hannan-Quinn criter.	-3.836799
F-statistic	387.3187	Durbin-Watson stat	0.386220
Prob(F-statistic)	0.000000		

Dependent Variable: LNM1
Method: Least Squares
Sample: 1 39
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNR	-0.409557	0.073436	-5.577070	0.0000
C	11.25199	0.177995	63.21506	0.0000

R-squared	0.456711	Mean dependent var	10.26467
Adjusted R-squared	0.442027	S.D. dependent var	0.154574
S.E. of regression	0.115463	Akaike info criterion	-1.429806
Sum squared resid	0.493276	Schwarz criterion	-1.344496
Log likelihood	29.88123	Hannan-Quinn criter.	-1.399198
F-statistic	31.10371	Durbin-Watson stat	0.256110
Prob(F-statistic)	0.000002		

Specify Short-run elasticity from the below results.

Dependent Variable: LNM1
Method: Least Squares
Sample: 1 39
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNR	-0.225787	0.034661	-6.514112	0.0000
LAGM1	0.841525	0.006540	128.6654	0.0000

R-squared	0.867937	Mean dependent var	10.26467
Adjusted R-squared	0.864368	S.D. dependent var	0.154574
S.E. of regression	0.056927	Akaike info criterion	-2.844167
Sum squared resid	0.119906	Schwarz criterion	-2.758856
Log likelihood	57.46126	Hannan-Quinn criter.	-2.813558
Durbin-Watson stat	0.336261		

Q8 From the below mentioned Panel data output discuss the results of three models.

Charity dependent variable
Independent variables Age, income, price, marital status and number of dependents

Dependent Variable: SALES_GROWTH
Method: Panel Least Squares
Sample: 2010 2015
Periods included: 6
Cross-sections included: 15
Total panel (balanced) observations: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3711.934	3792.580	0.978736	0.3304
INVENTORY	14.94625	2.584103	5.783920	0.0000
DISTRIBUTION_EXP		3.753267	1.574814	2.383309 0.0193

R-squared	0.421588	Mean dependent var	22866.53
Adjusted R-squared	0.408291	S.D. dependent var	34922.16
S.E. of regression	26863.03	Akaike info criterion	23.26765
Sum squared resid	6.28E+10	Schwarz criterion	23.35098
Log likelihood	-1044.044	Hannan-Quinn criter.	23.30126
F-statistic	31.70593	Durbin-Watson stat	0.431682
Prob(F-statistic)	0.000000		

Dependent Variable: SALES_GROWTH
Method: Panel Least Squares
Date: 03/28/19 Time: 11:55
Sample: 2010 2015
Periods included: 6
Cross-sections included: 15

Total panel (balanced) observations: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12215.80	5651.086	2.161673	0.0339
INVENTORY	-0.527167	4.230580	-0.124609	0.9012
DISTRIBUTION_EXP		14.43695	4.438419	3.252725 0.0017

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.701577	Mean dependent var	22866.53
Adjusted R-squared	0.636169	S.D. dependent var	34922.16
S.E. of regression	21064.49	Akaike info criterion	22.91699
Sum squared resid	3.24E+10	Schwarz criterion	23.38918
Log likelihood	-1014.265	Hannan-Quinn criter.	23.10741
F-statistic	10.72618	Durbin-Watson stat	0.478016
Prob(F-statistic)	0.000000		

Dependent Variable: SALES_GROWTH
Method: Panel EGLS (Cross-section random effects)
Sample: 2010 2015
Periods included: 6
Cross-sections included: 15
Total panel (balanced) observations: 90
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8455.571	5444.993	1.552908	0.1241
INVENTORY	8.524291	3.110751	2.740268	0.0074
DISTRIBUTION_EXP		6.625395	2.175495	3.045465 0.0031

Effects Specification

	S.D.	Rho
Cross-section random	14811.59	0.3308
Idiosyncratic random	21064.49	0.6692

Weighted Statistics

R-squared	0.212674	Mean dependent var	11481.36
Adjusted R-squared	0.194575	S.D. dependent var	24900.63
S.E. of regression	22347.19	Sum squared resid	4.34E+10
F-statistic	11.75032	Durbin-Watson stat	0.476281
Prob(F-statistic)	0.000030		

Unweighted Statistics

R-squared	0.376090	Mean dependent var	22866.53
Sum squared resid	6.77E+10	Durbin-Watson stat	0.305573

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	12.918129	2	0.0016

Cross-section random effects test comparisons:

Variable	**Fixed**	**Random**	**Var(Diff.)**	**Prob.**
INVENTORY	-0.527167	8.524291	8.221038	0.0016
DISTRIBUTION_EXP		14.436953	6.625395	14.966779	0.0435

Cross-section random effects test equation:
Dependent Variable: SALES_GROWTH
Method: Panel Least Squares
Sample: 2010 2015
Periods included: 6
Cross-sections included: 15
Total panel (balanced) observations: 90

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	12215.80	5651.086	2.161673	0.0339
INVENTORY	-0.527167	4.230580	-0.124609	0.9012
DISTRIBUTION_EXP		14.43695	4.438419	3.252725	0.0017

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.701577	Mean dependent var	22866.53
Adjusted R-squared	0.636169	S.D. dependent var	34922.16
S.E. of regression	21064.49	Akaike info criterion	22.91699
Sum squared resid	3.24E+10	Schwarz criterion	23.38918

Log likelihood	-1014.265	Hannan-Quinn criter.	23.10741
F-statistic	10.72618	Durbin-Watson stat	0.478016
Prob(F-statistic)	0.000000		