**PROGRAM-PGDM/ PGDM (IB)-2013-15**

**DM-601/IB-603**

**Elements of Basic Econometrics**

**Trimester- VI, End-Term Examination: February, 2015**

**Time Allowed: 2 Hrs & 30 Min.** **Max. Marks: 50**

**Roll Number: _____**

**Instructions-Students are required to write Roll number on every page of the question paper; writing anything except the roll no. will be treated as use of Unfair Means. In case of rough work, please use answer sheet.**

**(Students are allowed to use Excel or any other computer program for answering questions involving application of model/method to data).**

**The paper comprises three sections: A, B and C. Three out of 5 questions are to be answered from section A. Each question carries 5 marks=3x5=15. Two out of 3 questions are to be answered from section B. Each question carries 10 marks: 2x10=20. Section C has one compulsory question of 15 marks.**

## SECTION-A

**Answer any three of the following 5 questions.**

1. **Explain the meaning of OLS and its three basic assumptions in about 250 words.**
2. **What is Auto-correlation? Explain in about 250 words the causes of the presence of significant auto-correlation in a time series regression model.**
3. **Explain the meaning of Hetero-scedasticity. How is it detected and how is significant hetero-scedasticty removed?**
4. **What do you understand by the unit root problem in a time series based regression model? How is its presence in the data detected?**
5. **Explain briefly the single equation and system's approach to estimate SEM.**

## SECTION –B

**Answer any two of the following three questions.**

6. **Given the following simultaneous equations model:**

$$EXP = \beta_1 + \beta_2 PR + \beta_3 INC + \beta_4 POP + u1$$

$$PR = \delta_1 + \delta_2 EXP + \delta_3 PS + u_2$$

**Explain the identification status of each of the above two equations of the model. EXP is public expenditure, PR shows public revenue, INC depicts income and POP is population. PS represent public savings. EXP are jointly determined variables and all other variables are predetermined.**

**7. Given the following data,**

| Year | GDP | GDCF | Consumption |
|---|---|---|---|
| 1993 | 7745.45 | 1784.37 | 5269.68 |
| 1994 | 8913.55 | 1977.85 | 5961.08 |
| 1995 | 10455.9 | 2585.61 | 6935.7 |
| 1996 | 12267.25 | 3100.45 | 7870.29 |
| 1997 | 14192.77 | 3361.25 | 9166.8 |
| 1998 | 15723.94 | 4020.92 | 10831.52 |
| 1999 | 18033.78 | 4365.21 | 11703.02 |
| 2000 | 20231.3 | 5388.34 | 13668.57 |
| 2001 | 21774.13 | 5282.99 | 14842.96 |
| 2002 | 23558.45 | 5711.46 | 16491.14 |
| 2003 | 25363.27 | 6277.43 | 17846.99 |
| 2004 | 28415.03 | 7624.16 | 19085.84 |
| 2005 | 32422.09 | 10640.41 | 20790.87 |
| 2006 | 36933.69 | 12797.54 | 21781.68 |
| 2007 | 42947.06 | 15314.33 | 24136.15 |
| 2008 | 49870.9 | 19007.62 | 27632.73 |
| 2009 | 56300.63 | 19313.8 | 30863.28 |
| 2010 | 64778.27 | 23631.32 | 36986.83 |
| 2011 | 77953.13 | 28716.49 | 41146.95 |
| 2012 | 89749.47 | 31414.65 | 49236.64 |

**Determine the degree and direction of inter-relations between GDP, and Gross Domestic Capital Formation in Indian economy on the basis of the model given below:**

$Y_t=\beta_0+ \beta_1 Y_{t-1}+ \beta_2 X_t+U_t$

**Where t stands for time, Y for gross domestic capital formation, and X for GDP. U represents random errors of estimation. Use Engel-Granger test to examine whether the variables are well co-integrated in the estimate of above model.**

8. From the above data,

Estimate the below given regression model:

$$Y_t=\beta_0+ \beta_1X_{1t} + \beta_1X_{2t} +U_t$$

Y displays GDP, $X_1$ shows investment, and $X_2$ represents consumption, t stands for time and U represents random errors of estimation. Derive both OLS and GLS estimates of the functions. GLS estimates may be based on the use of auto-correlation coefficient for the transformation of the given data.

## SECTION-C

The question in this section carries 15 marks.

9. The following data relate to employment , GDP and gross domestic capital formation in Indian economy over the years from 1992 to 2012:

| Year | GDP | GDCF | Employment |
|---|---|---|---|
| 1992 | 6738.75 | 1469.07 | 346802576 |
| 1993 | 7745.45 | 1784.37 | 355116385 |
| 1994 | 8913.55 | 1977.85 | 363000334 |
| 1995 | 10455.9 | 2585.61 | 369789237 |
| 1996 | 12267.25 | 3100.45 | 377265860 |
| 1997 | 14192.77 | 3361.25 | 384187272 |
| 1998 | 15723.94 | 4020.92 | 391155410 |
| 1999 | 18033.78 | 4365.21 | 398160552 |
| 2000 | 20231.3 | 5388.34 | 405190192 |
| 2001 | 21774.13 | 5282.99 | 417144863 |
| 2002 | 23558.45 | 5711.46 | 428601673 |
| 2003 | 25363.27 | 6277.43 | 440212534 |
| 2004 | 28415.03 | 7624.16 | 451934600 |
| 2005 | 32422.09 | 10640.41 | 464498005 |
| 2006 | 36933.69 | 12797.54 | 465456462 |
| 2007 | 42947.06 | 15314.33 | 466033315 |
| 2008 | 49870.9 | 19007.62 | 466233702 |
| 2009 | 56300.63 | 19313.8 | 466896011 |
| 2010 | 64778.27 | 23631.32 | 466390538 |
| 2011 | 77953.13 | 28716.49 | 475806212 |
| 2012 | 89749.47 | 31414.65 | 484343281 |

GDP and GDCF are expressed in lakh crore INR and employment in numbers.

Estimate the following regression function to determine the influence of employment and gross domestic capital formation on GDP:

$\ln Y_t = \alpha_0 + \alpha_1 \ln X_{1t} + \alpha_2 \ln X_{2t} + U_t$

Answer the following questions:

(i) What is the degree of auto-correlation in the above estimated function?

(ii) Explain the meanings of the values of the coefficients of regression in the above model: $\alpha_0$, $\alpha_1$ and $\alpha_2$.

(iii) What meanings do you attach to the coefficient of determination, $R^2$ of the above model?.

(iv) Detect multi-co-linearity in the above model on the basis of step-wise regression of variables of the model.

(v) Why is $Y^*_t$ is regressed on $X^*_t$ in a time series model of the above type? Elucidate your answer.

**Table D.5A** Durbin–Watson $d$ Statistic: Significance Points of $d_L$ and $d_U$ at 0.05 Level of Significance

| | $k' = 1$ | | $k' = 2$ | | $k' = 3$ | | $k' = 4$ | | $k' = 5$ | | $k' = 6$ | | $k' = 7$ | | $k' = 8$ | | $k' = 9$ | | $k' = 10$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $n$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ |
| 6 | 0.610 | 1.400 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 7 | 0.700 | 1.356 | 0.467 | 1.896 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 8 | 0.763 | 1.332 | 0.559 | 1.777 | 0.368 | 2.287 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 9 | 0.824 | 1.320 | 0.629 | 1.699 | 0.455 | 2.128 | 0.296 | 2.588 | — | — | — | — | — | — | — | — | — | — | — | — |
| 10 | 0.879 | 1.320 | 0.697 | 1.641 | 0.525 | 2.016 | 0.376 | 2.414 | 0.243 | 2.822 | — | — | — | — | — | — | — | — | — | — |
| 11 | 0.927 | 1.324 | 0.658 | 1.604 | 0.595 | 1.928 | 0.444 | 2.283 | 0.316 | 2.645 | 0.203 | 3.005 | — | — | — | — | — | — | — | — |
| 12 | 0.971 | 1.331 | 0.812 | 1.579 | 0.658 | 1.864 | 0.512 | 2.177 | 0.379 | 2.506 | 0.268 | 2.832 | 0.171 | 3.149 | — | — | — | — | — | — |
| 13 | 1.010 | 1.340 | 0.861 | 1.562 | 0.715 | 1.816 | 0.574 | 2.094 | 0.445 | 2.390 | 0.328 | 2.692 | 0.230 | 2.985 | 0.147 | 3.266 | — | — | — | — |
| 14 | 1.045 | 1.350 | 0.905 | 1.551 | 0.767 | 1.779 | 0.632 | 2.030 | 0.505 | 2.296 | 0.389 | 2.572 | 0.286 | 2.848 | 0.200 | 3.111 | 0.127 | 3.360 | — | — |
| 15 | 1.077 | 1.361 | 0.946 | 1.543 | 0.814 | 1.750 | 0.685 | 1.977 | 0.562 | 2.220 | 0.447 | 2.472 | 0.343 | 2.727 | 0.251 | 2.979 | 0.175 | 3.216 | 0.111 | 3.438 |
| 16 | 1.106 | 1.371 | 0.982 | 1.539 | 0.857 | 1.728 | 0.734 | 1.935 | 0.615 | 2.157 | 0.502 | 2.388 | 0.398 | 2.624 | 0.304 | 2.860 | 0.222 | 3.090 | 0.155 | 3.304 |
| 17 | 1.133 | 1.381 | 1.015 | 1.536 | 0.897 | 1.710 | 0.779 | 1.900 | 0.664 | 2.104 | 0.554 | 2.318 | 0.451 | 2.537 | 0.356 | 2.757 | 0.272 | 2.975 | 0.198 | 3.184 |
| 18 | 1.158 | 1.391 | 1.046 | 1.535 | 0.933 | 1.696 | 0.820 | 1.872 | 0.710 | 2.060 | 0.603 | 2.257 | 0.502 | 2.461 | 0.407 | 2.667 | 0.321 | 2.873 | 0.244 | 3.073 |
| 19 | 1.180 | 1.401 | 1.074 | 1.536 | 0.967 | 1.685 | 0.859 | 1.848 | 0.752 | 2.023 | 0.649 | 2.206 | 0.549 | 2.396 | 0.456 | 2.589 | 0.369 | 2.783 | 0.290 | 2.974 |
| 20 | 1.201 | 1.411 | 1.100 | 1.537 | 0.998 | 1.676 | 0.894 | 1.828 | 0.792 | 1.991 | 0.692 | 2.162 | 0.595 | 2.339 | 0.502 | 2.521 | 0.416 | 2.704 | 0.336 | 2.885 |
| 21 | 1.221 | 1.420 | 1.125 | 1.538 | 1.026 | 1.669 | 0.927 | 1.812 | 0.829 | 1.964 | 0.732 | 2.124 | 0.637 | 2.290 | 0.547 | 2.460 | 0.461 | 2.633 | 0.380 | 2.806 |
| 22 | 1.239 | 1.429 | 1.147 | 1.541 | 1.053 | 1.664 | 0.958 | 1.797 | 0.863 | 1.940 | 0.769 | 2.090 | 0.677 | 2.246 | 0.588 | 2.407 | 0.504 | 2.571 | 0.424 | 2.734 |
| 23 | 1.257 | 1.437 | 1.168 | 1.543 | 1.078 | 1.660 | 0.986 | 1.785 | 0.895 | 1.920 | 0.804 | 2.061 | 0.715 | 2.208 | 0.628 | 2.360 | 0.545 | 2.514 | 0.465 | 2.670 |
| 24 | 1.273 | 1.446 | 1.188 | 1.546 | 1.101 | 1.656 | 1.013 | 1.775 | 0.925 | 1.902 | 0.837 | 2.035 | 0.751 | 2.174 | 0.666 | 2.318 | 0.584 | 2.464 | 0.506 | 2.613 |
| 25 | 1.288 | 1.454 | 1.206 | 1.550 | 1.123 | 1.654 | 1.038 | 1.767 | 0.953 | 1.886 | 0.868 | 2.012 | 0.784 | 2.144 | 0.702 | 2.280 | 0.621 | 2.419 | 0.544 | 2.560 |
| 26 | 1.302 | 1.461 | 1.224 | 1.553 | 1.143 | 1.652 | 1.062 | 1.759 | 0.979 | 1.873 | 0.897 | 1.992 | 0.816 | 2.117 | 0.735 | 2.246 | 0.657 | 2.379 | 0.581 | 2.513 |
| 27 | 1.316 | 1.469 | 1.240 | 1.556 | 1.162 | 1.651 | 1.084 | 1.753 | 1.004 | 1.861 | 0.925 | 1.974 | 0.845 | 2.093 | 0.767 | 2.216 | 0.691 | 2.342 | 0.616 | 2.470 |
| 28 | 1.328 | 1.476 | 1.255 | 1.560 | 1.181 | 1.650 | 1.104 | 1.747 | 1.028 | 1.850 | 0.951 | 1.958 | 0.874 | 2.071 | 0.798 | 2.188 | 0.723 | 2.309 | 0.650 | 2.431 |
| 29 | 1.341 | 1.483 | 1.270 | 1.563 | 1.198 | 1.650 | 1.124 | 1.743 | 1.050 | 1.841 | 0.975 | 1.944 | 0.900 | 2.052 | 0.826 | 2.164 | 0.753 | 2.278 | 0.682 | 2.396 |
| 30 | 1.352 | 1.489 | 1.284 | 1.567 | 1.214 | 1.650 | 1.143 | 1.739 | 1.071 | 1.833 | 0.998 | 1.931 | 0.926 | 2.034 | 0.854 | 2.141 | 0.782 | 2.251 | 0.712 | 2.363 |
| 31 | 1.363 | 1.496 | 1.297 | 1.570 | 1.229 | 1.650 | 1.160 | 1.735 | 1.090 | 1.825 | 1.020 | 1.920 | 0.950 | 2.018 | 0.879 | 2.120 | 0.810 | 2.226 | 0.741 | 2.333 |
| 32 | 1.373 | 1.502 | 1.309 | 1.574 | 1.244 | 1.650 | 1.177 | 1.732 | 1.109 | 1.819 | 1.041 | 1.909 | 0.972 | 2.004 | 0.904 | 2.102 | 0.836 | 2.203 | 0.769 | 2.306 |
| 33 | 1.383 | 1.508 | 1.321 | 1.577 | 1.258 | 1.651 | 1.193 | 1.730 | 1.127 | 1.813 | 1.061 | 1.900 | 0.994 | 1.991 | 0.927 | 2.085 | 0.861 | 2.181 | 0.795 | 2.281 |
| 34 | 1.393 | 1.514 | 1.333 | 1.580 | 1.271 | 1.652 | 1.208 | 1.728 | 1.144 | 1.808 | 1.080 | 1.891 | 1.015 | 1.979 | 0.950 | 2.069 | 0.885 | 2.162 | 0.821 | 2.257 |
| 35 | 1.402 | 1.519 | 1.343 | 1.584 | 1.283 | 1.653 | 1.222 | 1.726 | 1.160 | 1.803 | 1.097 | 1.884 | 1.034 | 1.967 | 0.971 | 2.054 | 0.908 | 2.144 | 0.845 | 2.236 |
| 36 | 1.411 | 1.525 | 1.354 | 1.587 | 1.295 | 1.654 | 1.236 | 1.724 | 1.175 | 1.799 | 1.114 | 1.877 | 1.053 | 1.957 | 0.991 | 2.041 | 0.930 | 2.127 | 0.868 | 2.216 |
| 37 | 1.419 | 1.530 | 1.364 | 1.590 | 1.307 | 1.655 | 1.249 | 1.723 | 1.190 | 1.795 | 1.131 | 1.870 | 1.071 | 1.948 | 1.011 | 2.029 | 0.951 | 2.112 | 0.891 | 2.198 |
| 38 | 1.427 | 1.535 | 1.373 | 1.594 | 1.318 | 1.656 | 1.261 | 1.722 | 1.204 | 1.792 | 1.146 | 1.864 | 1.088 | 1.939 | 1.029 | 2.017 | 0.970 | 2.098 | 0.912 | 2.180 |
| 39 | 1.435 | 1.540 | 1.382 | 1.597 | 1.328 | 1.658 | 1.273 | 1.722 | 1.218 | 1.789 | 1.161 | 1.859 | 1.104 | 1.932 | 1.047 | 2.007 | 0.990 | 2.085 | 0.932 | 2.164 |
| 40 | 1.442 | 1.544 | 1.391 | 1.600 | 1.338 | 1.659 | 1.285 | 1.721 | 1.230 | 1.786 | 1.175 | 1.854 | 1.120 | 1.924 | 1.064 | 1.997 | 1.008 | 2.072 | 0.952 | 2.149 |
| 45 | 1.475 | 1.566 | 1.430 | 1.615 | 1.383 | 1.666 | 1.336 | 1.720 | 1.287 | 1.776 | 1.238 | 1.835 | 1.189 | 1.895 | 1.139 | 1.958 | 1.089 | 2.022 | 1.038 | 2.088 |
| 50 | 1.503 | 1.585 | 1.462 | 1.628 | 1.421 | 1.674 | 1.378 | 1.721 | 1.335 | 1.771 | 1.291 | 1.822 | 1.246 | 1.875 | 1.201 | 1.930 | 1.156 | 1.986 | 1.110 | 2.044 |
| 55 | 1.528 | 1.601 | 1.490 | 1.641 | 1.452 | 1.681 | 1.414 | 1.724 | 1.374 | 1.768 | 1.334 | 1.814 | 1.294 | 1.861 | 1.253 | 1.909 | 1.212 | 1.959 | 1.170 | 2.010 |
| 60 | 1.549 | 1.616 | 1.514 | 1.652 | 1.480 | 1.689 | 1.444 | 1.727 | 1.408 | 1.767 | 1.372 | 1.808 | 1.335 | 1.850 | 1.298 | 1.894 | 1.260 | 1.939 | 1.222 | 1.984 |
| 65 | 1.567 | 1.629 | 1.536 | 1.662 | 1.503 | 1.696 | 1.471 | 1.731 | 1.438 | 1.767 | 1.404 | 1.805 | 1.370 | 1.843 | 1.336 | 1.882 | 1.301 | 1.923 | 1.266 | 1.964 |
| 70 | 1.583 | 1.641 | 1.554 | 1.672 | 1.525 | 1.703 | 1.494 | 1.735 | 1.464 | 1.768 | 1.433 | 1.802 | 1.401 | 1.837 | 1.369 | 1.873 | 1.337 | 1.910 | 1.305 | 1.948 |
| 75 | 1.598 | 1.652 | 1.571 | 1.680 | 1.543 | 1.709 | 1.515 | 1.739 | 1.487 | 1.770 | 1.458 | 1.801 | 1.428 | 1.834 | 1.399 | 1.867 | 1.369 | 1.901 | 1.339 | 1.935 |
| 80 | 1.611 | 1.662 | 1.586 | 1.688 | 1.560 | 1.715 | 1.534 | 1.743 | 1.507 | 1.772 | 1.480 | 1.801 | 1.453 | 1.831 | 1.425 | 1.861 | 1.397 | 1.893 | 1.369 | 1.925 |
| 85 | 1.624 | 1.671 | 1.600 | 1.696 | 1.575 | 1.721 | 1.550 | 1.747 | 1.525 | 1.774 | 1.500 | 1.801 | 1.474 | 1.829 | 1.448 | 1.857 | 1.422 | 1.886 | 1.396 | 1.916 |
| 90 | 1.635 | 1.679 | 1.612 | 1.703 | 1.589 | 1.726 | 1.566 | 1.751 | 1.542 | 1.776 | 1.518 | 1.801 | 1.494 | 1.827 | 1.469 | 1.854 | 1.445 | 1.881 | 1.420 | 1.909 |
| 95 | 1.645 | 1.687 | 1.623 | 1.709 | 1.602 | 1.732 | 1.579 | 1.755 | 1.557 | 1.778 | 1.535 | 1.802 | 1.512 | 1.827 | 1.489 | 1.852 | 1.465 | 1.877 | 1.442 | 1.903 |
| 100 | 1.654 | 1.694 | 1.634 | 1.715 | 1.613 | 1.736 | 1.592 | 1.758 | 1.571 | 1.780 | 1.550 | 1.803 | 1.528 | 1.826 | 1.506 | 1.850 | 1.484 | 1.874 | 1.462 | 1.898 |
| 150 | 1.720 | 1.746 | 1.706 | 1.760 | 1.693 | 1.774 | 1.679 | 1.788 | 1.665 | 1.802 | 1.651 | 1.817 | 1.637 | 1.832 | 1.622 | 1.847 | 1.608 | 1.862 | 1.594 | 1.877 |
| 200 | 1.758 | 1.778 | 1.748 | 1.789 | 1.738 | 1.799 | 1.728 | 1.810 | 1.718 | 1.820 | 1.707 | 1.831 | 1.697 | 1.841 | 1.686 | 1.852 | 1.675 | 1.863 | 1.665 | 1.874 |