London School of Economics
Department of Economics

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MSc Econometrics (Ec402)
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Problem Set #7

Instructions: To be discussed in week 9. **Please prepare answers to Question 1 below in PDF format, and submit via Moodle to receive feedback from your Class Teacher.**

Each class teacher has prepared a portal on Moodle. Please submit your PDF by Friday, 22 November (end of week 8). That way your class teacher will have time to review your submissions and return comments at the class of week 9.

1. Consider a linear regression model where the classic A1-A4 assumptions are believed to hold, with sample indexed by $s = 1, \cdots, S$. In particular, it is maintained that:

   $A2linear : y = X\beta^{true} + \epsilon,$

   $A3 : E(\epsilon|X) = E(\epsilon)$ and

   $A4 : \epsilon_s \tilde{} i.i.d.$

   An investigator wishes to construct Confidence Intervals for the β^{true} coefficients and functions of theirs, but is not sure which distributional $A5$ assumption is correct. The two competing ideas she considers are:

   A5.G ϵ_i is i.i.d. *Gaussian* with marginal probability density function (p.d.f.) - expectation 0 and scale v

   $$f_G(\epsilon_i) = \frac{1}{\sqrt{2\pi v^2}} \exp(-\frac{\epsilon_i^2}{2v^2})$$

   A5.L ϵ_i is i.i.d. *Logistic* with marginal probability density function (p.d.f.) - expectation 0 and scale v

   $$f_L(\epsilon_i) = \frac{\exp\left(-\frac{\epsilon_i}{v}\right)}{v\left(1+\exp\left(-\frac{\epsilon_i}{v}\right)\right)^2}$$

   Reminder: The parameter v is the *scale* parameter of each distribution — it is not necessarily equal to the variance of ϵ_s in all cases.

   Explain how the investigator should *best* construct CIs for the following quantities:

   (a) β_7^{true}, (b) $\beta_3^{true} + \beta_4^{true}$, and (c) $\beta_5^{true} \cdot \beta_6^{true}$.

   You must answer under the two alternative scenaria described here, namely:

   $Scenario1 : A1 + A2linear + A3 + A4 + A5G$

   $Scenario2 : A1 + A2linear + A3 + A4 + A5L$