Computational Exercise 1

Figure 1 plots the distributions for the two estimators for the three different values of R^2 while Figure 2 contains the Matlab output for the 25th, 50th and 75th percentiles of these distributions. It is first worth to notice that all the pictures for the OLS estimator clearly show that it is biased, as the plotted distributions are never centered around the true value 1. This is because the error term e and u are correlated being generated from the same bivariate normal distribution with correlation σ_{eu}, implying thus an endogeneity issue between x and e in the first equation of the model (x and e are correlated as they are functions of u). Therefore, a natural solution for this endogeneity issue is the 2SLS estimator. Looking at the second panel in the first row of the picture it is clear that the distribution of $\hat{\beta}_{2SLS}$ is centered around the true parameter (this is can also be seen from the first line of the table containing the percentile values). Note that higher values of R^2 in the first stage regression imply higher correlation between z and x: as the correlation increases, z is a better instrument for x and, vice versa, as the correlation decreases z is a weak instrument for x. In other words, while z is exogenous, if it has low explanatory power for x it will provide less precise estimates (even if it will still be consistent) because the coefficient estimated from the first stage regression (of which $\hat{\beta}$ is function) is more imprecise. This is clearly reflected in the pictures for $\hat{\beta}_{2SLS}$ in the second and third lines: while it would seem at first that the estimator is performing better as R^2 diminishes, there are actually extreme outilers (in the last picture the range is [-15000;5000]). This is clear by looking at the percentiles for the 2SLS estimator in the last two cases: even if they are centered at 1, the range increases as R^2 decreases, implying a more dispersed distribution.

Figure 1: $\hat{\beta}_{OLS}$ and $\hat{\beta}_{2SLS}$ for different values of R^2

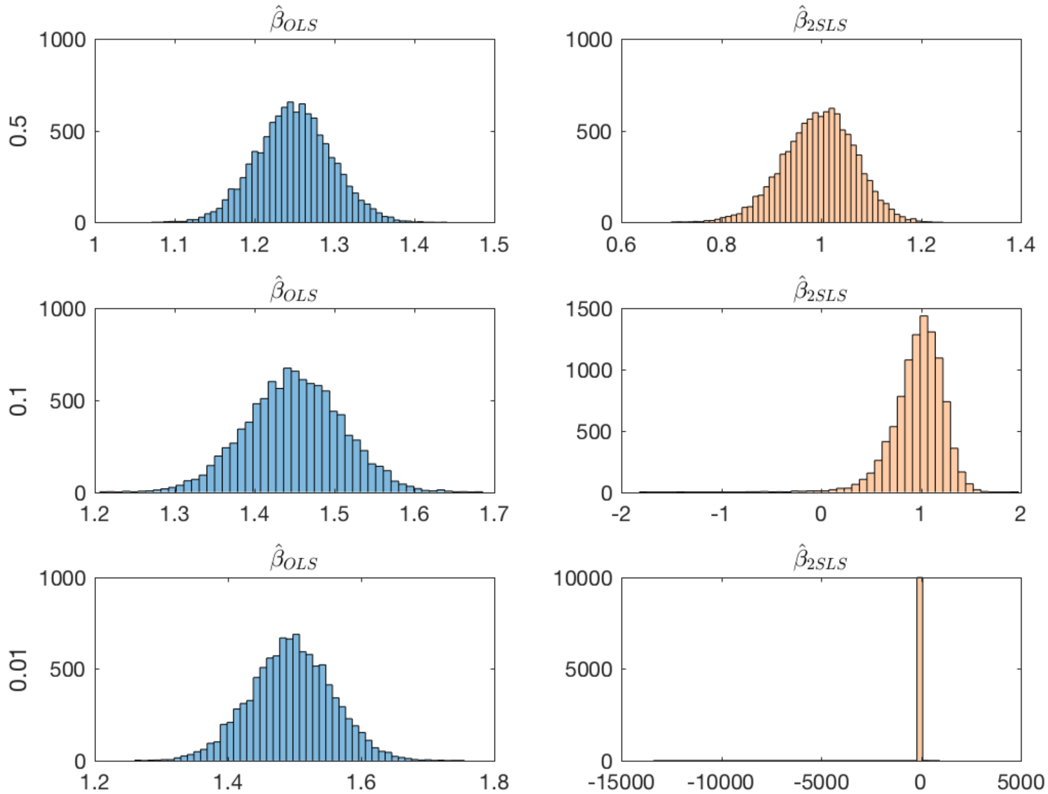

Figure 2: Percentiles for $\hat{\beta}_{OLS}$ and $\hat{\beta}_{2SLS}$

	qtiles_OLS			qtiles_2SLS		
Quantile	0.25	0.5	0.75	0.25	0.5	0.75
R^2=0.5	1.2184	1.2495	1.2804	0.94936	0.99891	1.0454
R^2=0.1	1.4101	1.4498	1.4897	0.84562	1.002	1.1409
R^2=0.01	1.4545	1.4954	1.5368	0.56034	1.0891	1.5101