

Quiz 1 — OLS and testing

Questions	Answers
<p>1. Assume $D \in \{0, 1\}$, and suppose we observe an i.i.d. sample (Y_i, D_i), $i = 1, \dots, n$. When we regress Y on $(1, D, D^2)$:</p>	<p>☐ the standard errors are larger than when we regress Y on $(1, D)$ only.</p> <p>☐ the R^2 is strictly larger than when we regress Y on $(1, D)$ only.</p> <p>☐ the OLS estimator cannot be computed.</p> <p>☐ the average effect of D on the prediction of Y is not constant in general.</p>
<p>2. Consider two samples: (Y_i, D_i) with $D_i \in \mathbb{R}$, and $(\tilde{Y}_i, \tilde{D}_i)$ with $\tilde{Y}_i = Y_i$ and $\tilde{D}_i = c D_i$ for some constant $c \neq 0$. Let $\hat{\tilde{\beta}}$ be the coefficient of $\tilde{D}$ in the regression of $\tilde{Y}$ on $(1, \tilde{D})$, and $\hat{\beta}$ the coefficient of D in the regression of Y on $(1, D)$ (assume $\hat{\beta}$ is well defined). Then:</p>	<p>☐ $\hat{\tilde{\beta}} = c \hat{\beta}$.</p> <p>☐ $\hat{\tilde{\beta}} = \hat{\beta}/c$.</p> <p>☐ $\hat{\tilde{\beta}} = \hat{\beta}$.</p> <p>☐ $\hat{\tilde{\beta}}$ cannot be computed, because $\tilde{D}$ is linearly dependent on D.</p>
<p>3. Let $Y = \beta_0 D + \varepsilon$, with $\mathbb{E}[\varepsilon D] = 0$, $\mathbb{E}[\varepsilon^2 D] = D^2$ and $\mathbb{V}(D) > 0$. We observe an i.i.d. sample (Y_i, D_i), $i = 1, \dots, n$. The OLS coefficient of D in the regression of Y on $(1, D)$:</p>	<p>☐ cannot be computed.</p> <p>☐ can be computed but is not consistent for β_0.</p> <p>☐ is consistent for β_0 but not asymptotically normal.</p> <p>☐ is consistent for β_0 and asymptotically normal.</p>
<p>4. Let (Y_i, D_i, G_i), $i = 1, \dots, n$, be an i.i.d. sample. Let $(\hat{\alpha}, \hat{\beta}_D, \hat{\beta}_G)$ be the OLS coefficients of the regression of Y on $(1, D, G)$, assumed to exist. Let $\hat{\beta}_D^s$ be the coefficient of D in the regression of Y on $(1, D)$, and $\hat{\beta}_G^s$ the coefficient of G in the regression of Y on $(1, G)$. Then:</p>	<p>☐ if $\widehat{\text{Cov}}(D, G) > 0$, then $\hat{\beta}_D^s > \hat{\beta}_D$.</p> <p>☐ if $\widehat{\text{Cov}}(D, G) > 0$, then $\hat{\beta}_D^s < \hat{\beta}_D$.</p> <p>☐ if $\widehat{\text{Cov}}(D, G) = 0$, then $\hat{\beta}_D^s = \hat{\beta}_D$.</p> <p>☐ if $\widehat{\text{Cov}}(D, G) = 0$, then $\hat{\beta}_G^s = \hat{\beta}_G$.</p>

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<p>5. Let $Y = \alpha + \beta_D D + \beta_G G + \varepsilon$, where β_D and β_G are the unique coefficients such that $\mathbb{E}[\varepsilon] = \mathbb{E}[\varepsilon D] = \mathbb{E}[\varepsilon G] = 0$. We test $H_0 : \beta_D = \beta_G = 0$ against H_1: “$\beta_D \neq 0$ and/or $\beta_G \neq 0$” at the 5% asymptotic level. Then:</p>	<p>☐ we must also assume that ε is normally distributed to conduct the test.</p> <p>☐ we first test $\beta_D = 0$ at the 5% level, then $\beta_G = 0$ at the 5% level, and reject H_0 if at least one is rejected.</p> <p>☐ if $\text{Cov}(D, G) = 0$, we can already deduce that H_0 does not hold.</p> <p>☐ we will use quantiles of the χ^2 distribution with 2 degrees of freedom.</p>
<p>6. Let $Y = \alpha + \beta_D D + \varepsilon$, with $\mathbb{V}(D) > 0$ and $\mathbb{E}[\varepsilon] = \mathbb{E}[\varepsilon D] = 0$. Assume we know for sure that $\beta_D \leq 0$. We test $H_0 : \beta_D = 0$ against $H_1 : \beta_D < 0$ at the 5% nominal level. Let q_γ be the γ-quantile of the standard normal distribution, $\hat{\beta}_D$ the OLS estimator of β_D and se_D its standard error. Then:</p>	<p>☐ reject H_0 if $\hat{\beta}_D/se_D \leq -q_{0.975}$.</p> <p>☐ reject H_0 if $\hat{\beta}_D/se_D \geq q_{0.975}$.</p> <p>☐ reject H_0 if $\hat{\beta}_D/se_D \leq -q_{0.95}$.</p> <p>☐ reject H_0 if $\hat{\beta}_D/se_D \geq q_{0.95}$.</p>
<p>7. Let $Y = \gamma_0 + \delta_0 D + \eta$, where $\mathbb{E}[\eta D] \neq 0$. Assume D and η are bounded and $\mathbb{V}(D) > 0$. We observe an i.i.d. sample (Y_i, D_i), $i = 1, \dots, n$. Let $\hat{\beta}$ be the OLS coefficient of D in the regression of Y on $(1, D)$. Then:</p>	<p>☐ $\hat{\beta}$ has no limit in probability.</p> <p>☐ $\hat{\beta}$ converges in probability to $\mathbb{E}[XX']^{-1}\mathbb{E}[XY]$, with $X = (1, D)'$.</p> <p>☐ $\hat{\beta}$ is consistent for δ_0.</p> <p>☐ the asymptotic variance of $\hat{\beta}$ is infinite.</p>