

## The maximum number of omitted variables, Problem 00.2.2

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# PROBLEMS AND SOLUTIONS

## PROBLEMS

00.2.2. *The Maximum Number of Omitted Variables*, proposed by Dmitri L. Danilov and Jan R. Magnus. Consider the standard partitioned regression model  $y = X_1\beta_1 + X_2\beta_2 + u$ , where  $X \equiv (X_1 : X_2)$  is a nonstochastic  $n \times k$  matrix with full column rank  $k = k_1 + k_2$ . We are interested in estimating  $\beta_1$  and consider  $\beta_2$  as a nuisance parameter. Let  $r = \text{rank}(X_1'X_2)$ . Show that we may assume, without loss of generality, that  $k_2 = r$  and, hence, in particular that  $k_2 \leq k_1$ . Can we still make this simplifying assumption when drawing inferences about  $\beta_1$ ?

In the special case where  $r = 0$  and where consequently  $X_2$  is orthogonal to  $X_1$ , we may delete  $X_2$  altogether, a well-known result.

In another special case where  $k_1 = 1$  (one “focus” parameter and the rest nuisance parameters), it is sufficient to consider just *one* nuisance parameter.