

Why GLS? A picture:

Consider $\underline{X} = \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix}$, i.e. 1 measurement, no intercept.

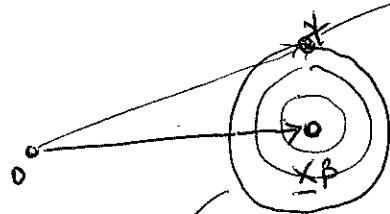
The $\underline{X}\beta$ vector can be visualized:



← the conditional expected value of y :
 $E(y|X) = \underline{X}\beta$.

OLS picture

$$y \sim N(\underline{X}\beta, \sigma^2)$$

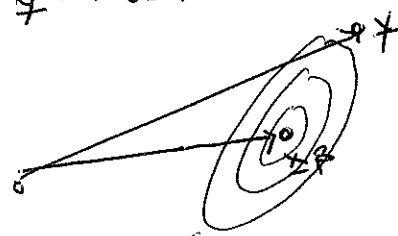


if we observe y here,
 we project straight
 down.

level curves
 of MVN
 w/ no covariance

GLS picture

$$y \sim N(\underline{X}\beta, \Sigma)$$



level curves of MVN with
covariance.



under this framework,
 if we observe y
 & are looking for projection,
 \hat{y} , we should ~~also~~ project
 along the principal axis
 of the ellipsoid:

