

Lasso Regression

Least Absolute Shrinkage and Selection Operator

Least Squares produces estimates by minimizing

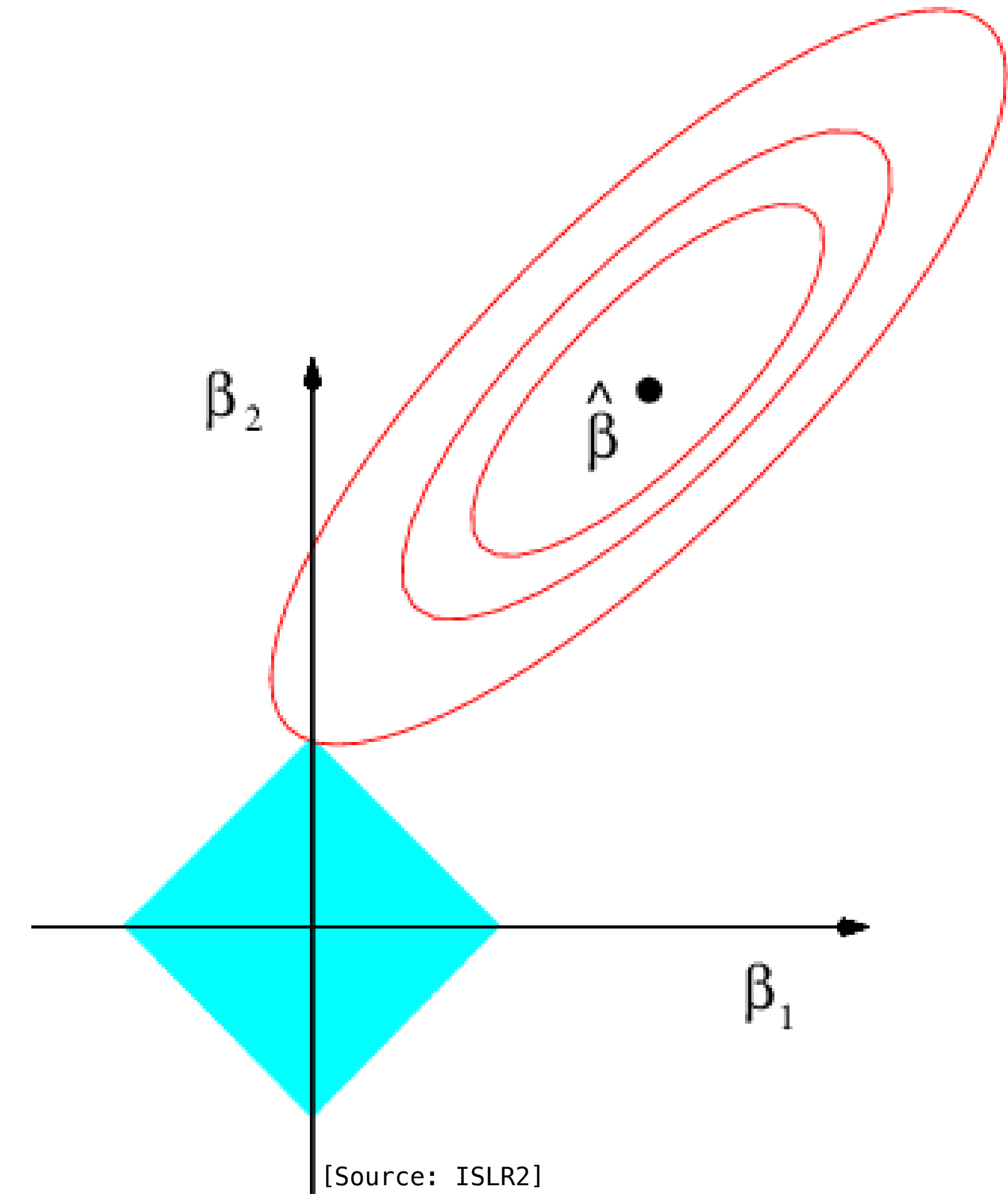
$$\text{RSS} = \sum_{i=1}^n (y_i - \hat{\beta}_0 - \sum_{j=1}^p \hat{\beta}_{j_1} x_{ij})^2$$

Lasso regression instead minimizes

$$\underbrace{\sum_{i=1}^n (y_i - \hat{\beta}_0 - \sum_{j=1}^p \hat{\beta}_{j_1} x_{ij})^2}_{\text{model fit}} + \underbrace{\lambda \sum_{j=1}^p |\beta_j|}_{\text{penalty}} = \text{RSS} + \lambda \sum_{j=1}^p |\beta_j|$$

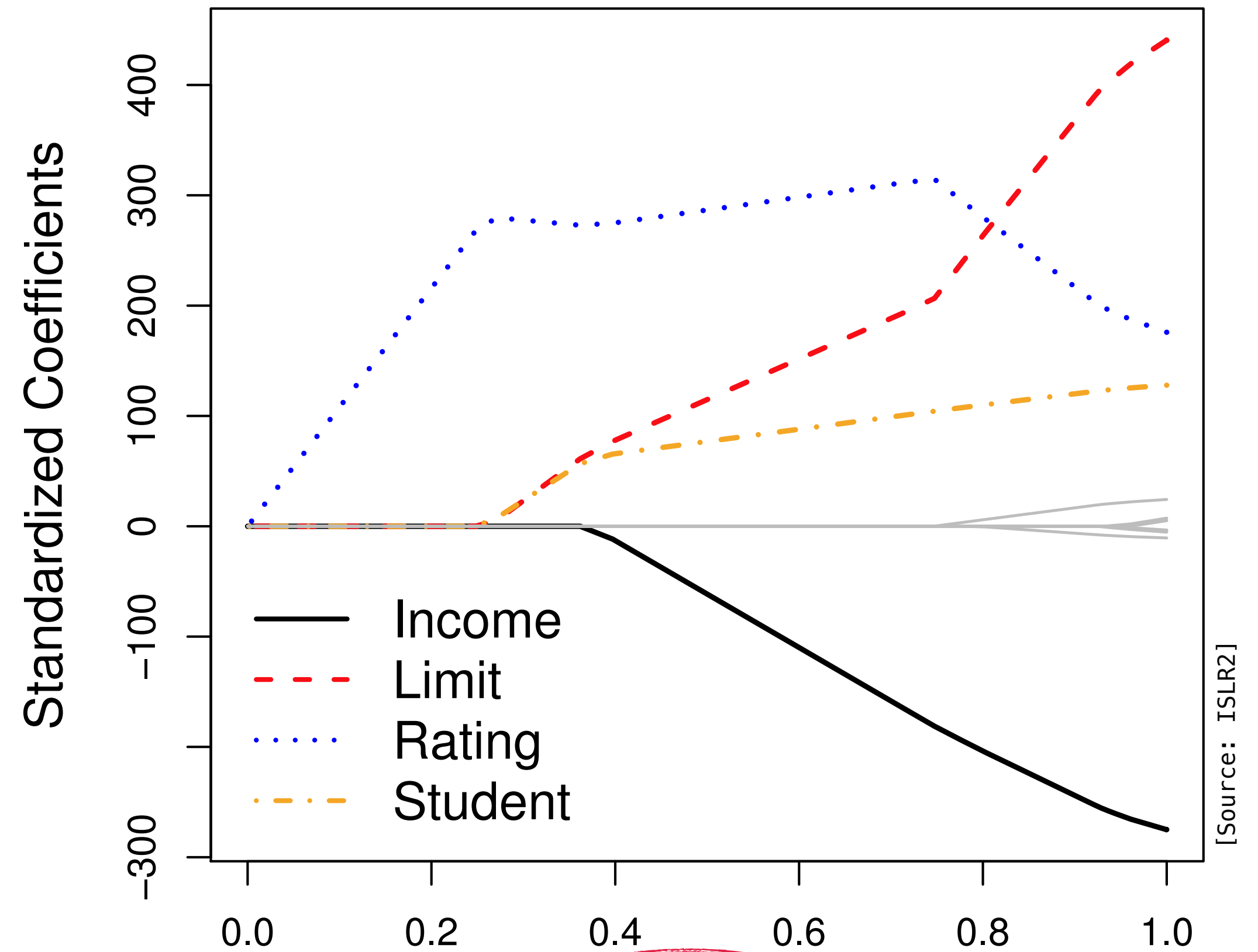
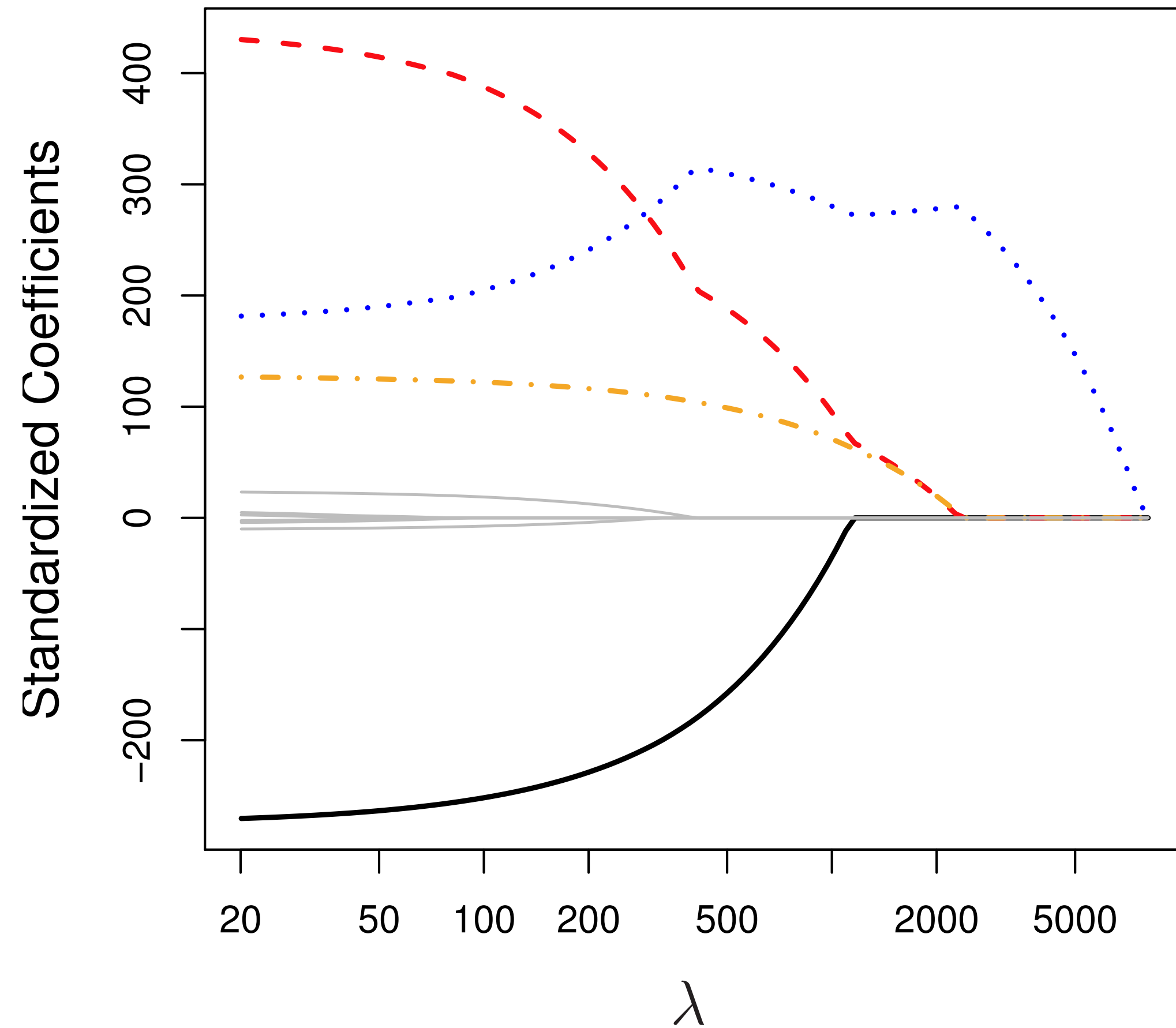
where $\lambda \geq 0$ is **the tuning parameter** controlling trade off between model fit and size of coefficients ($\lambda \rightarrow \infty, \hat{\beta}_j = 0$)

lasso uses ℓ_1 penalty



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Regularization Paths



$$\ell_1 \text{ norm} = \|\beta\|_1 = \sum_{j=1}^p |\beta_j|$$