回归分析

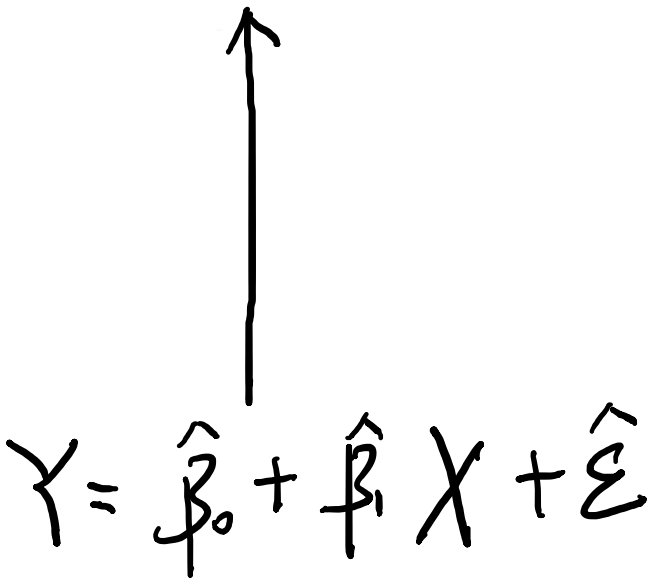
回归诊断

研究中国人 身高和体重是否呈现 线性关系：

如果是能否建出 回归模型 体重为Y变量，身高是X变量

$$Y = \beta_0 + \beta_1 X + \epsilon,$$

$$\varepsilon \sim Normal\ (0, \sigma^2)$$
$$cor(\varepsilon_i, \varepsilon_j) = 0$$



残差图：

$$\varepsilon \sim Normal\,(0, \sigma^2)$$
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样本预测值$\hat{y}_i$为x轴，$\hat{\varepsilon}_i$为y轴 画的散点图

必须满足的三个性质：

随机性、正态性、等方差性

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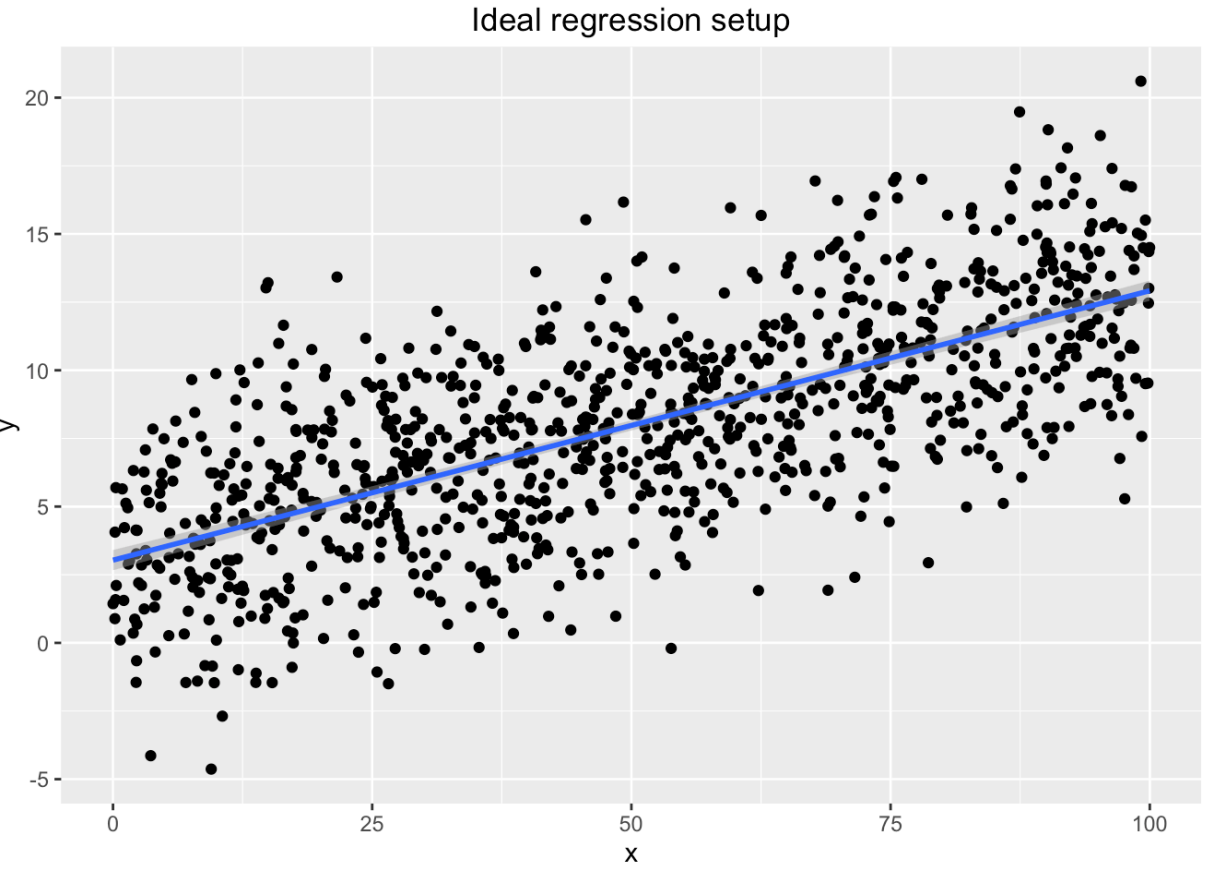

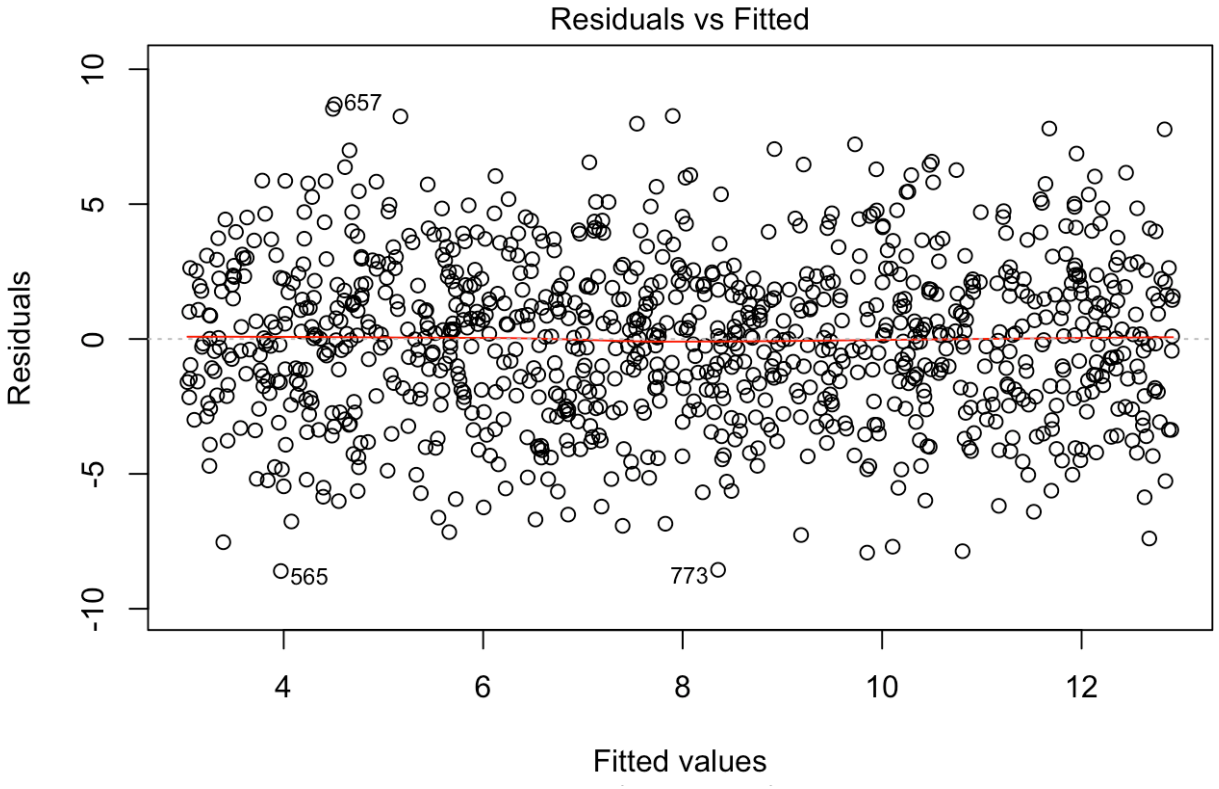

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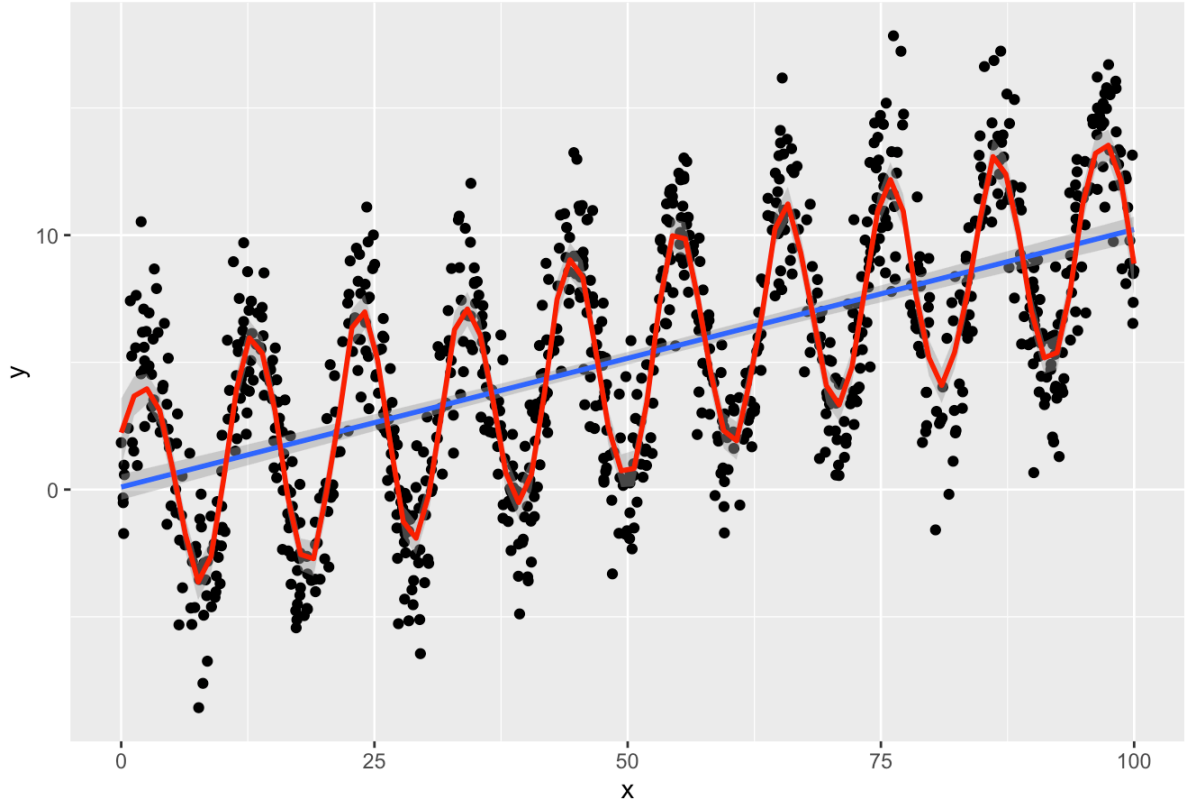

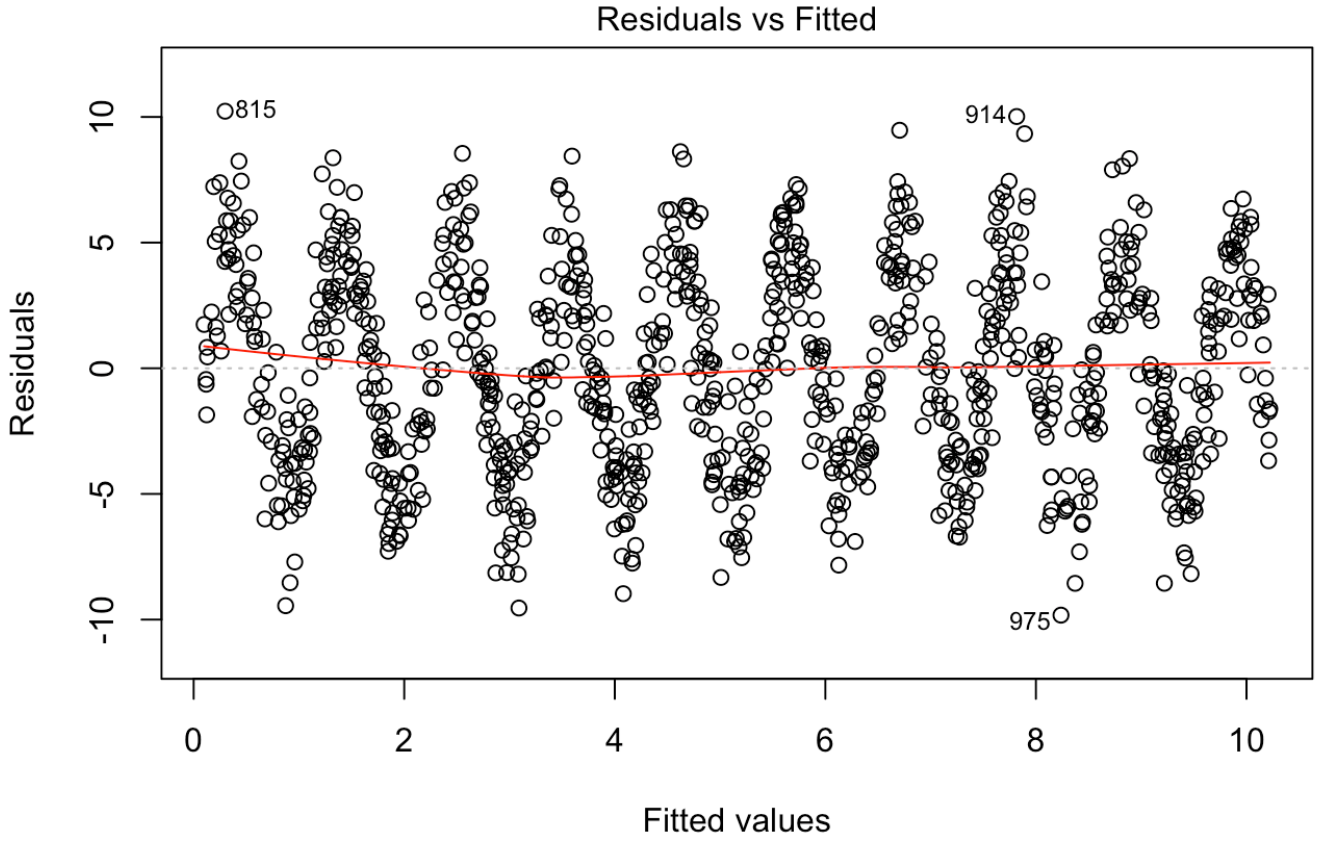

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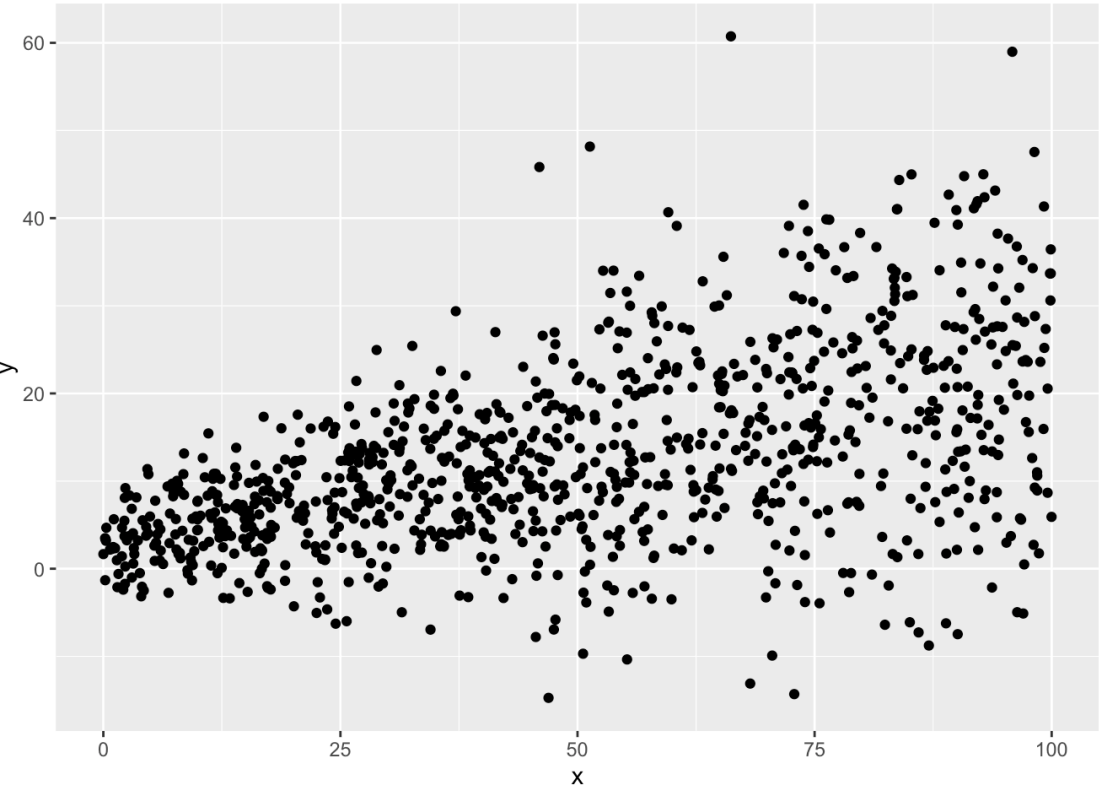

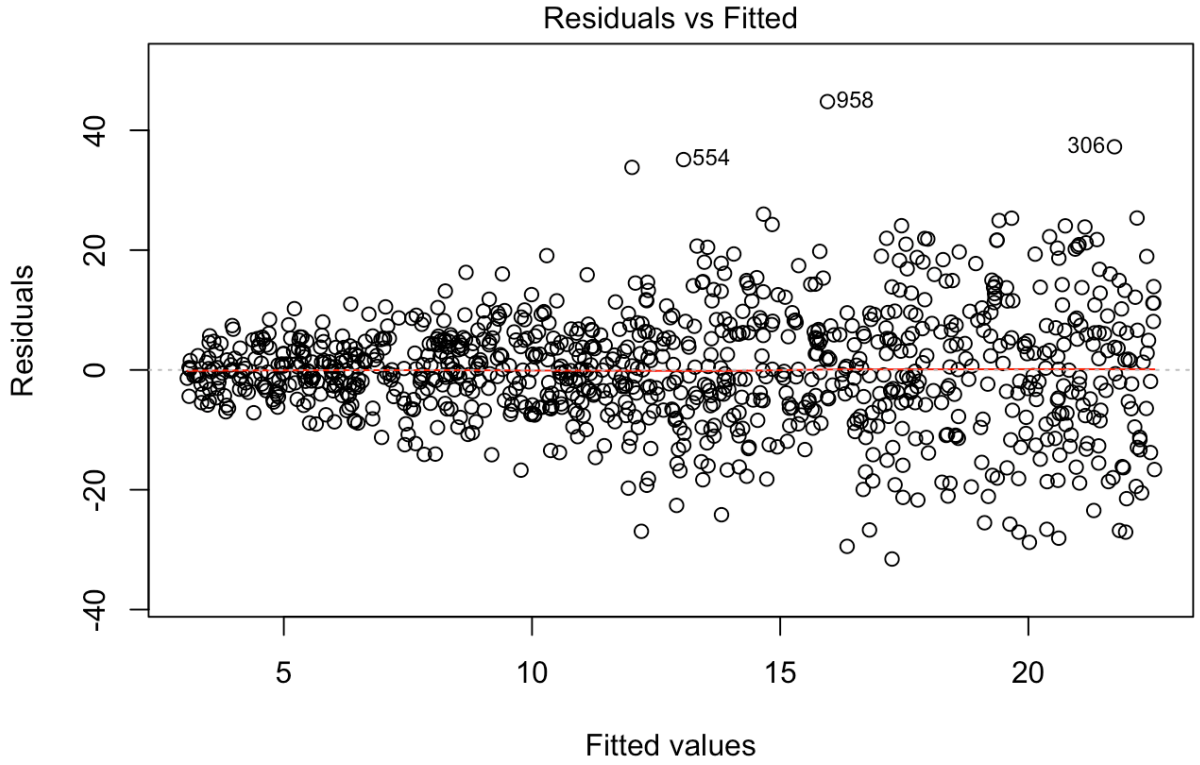

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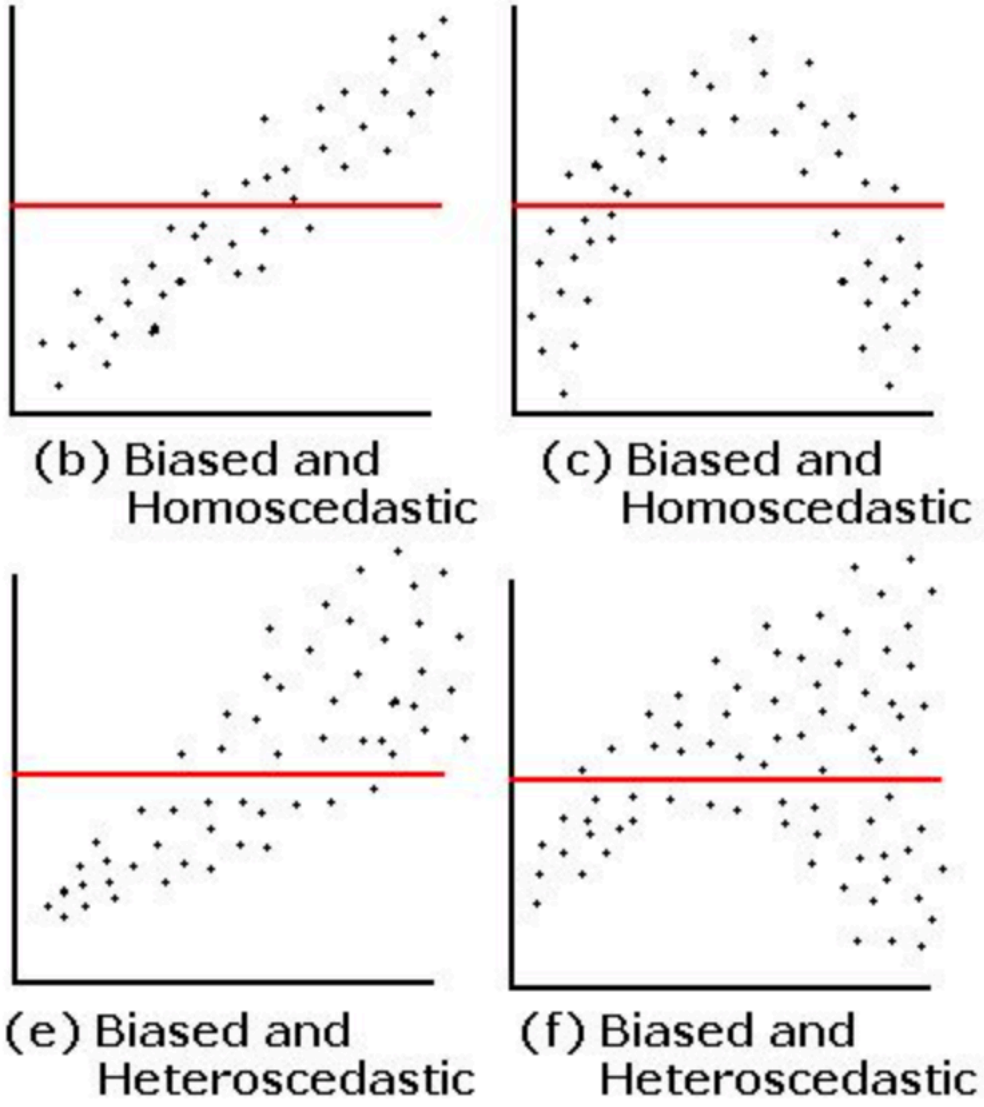
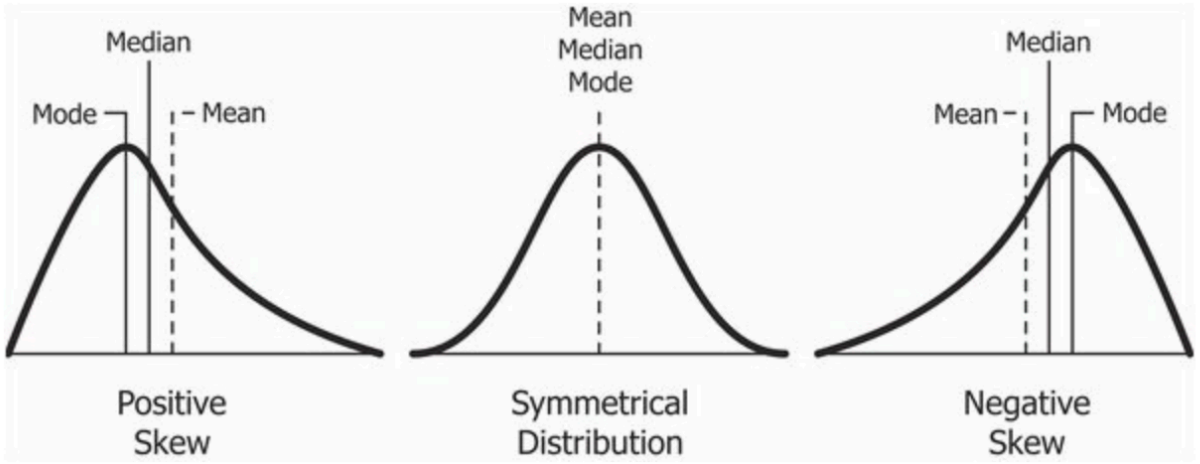
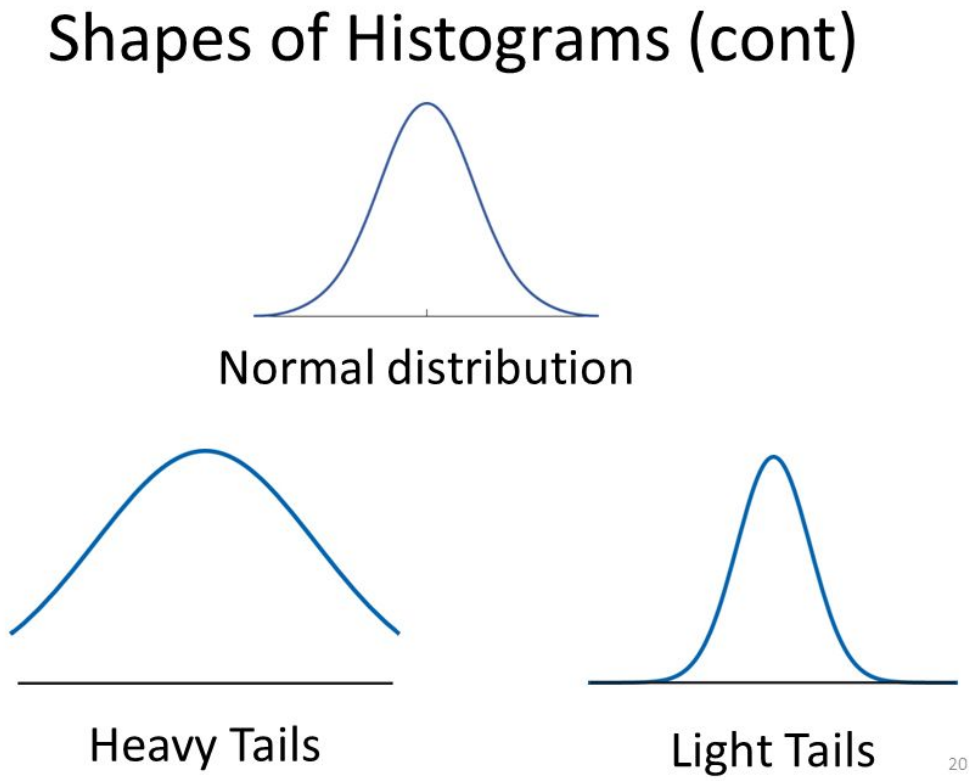


线性关系

1）应采用非线性回归模型
2）高度相关的自变量引起了共线性；
3）模型缺少重要的自变量；

Q-Q图（quantile-quantile plot）





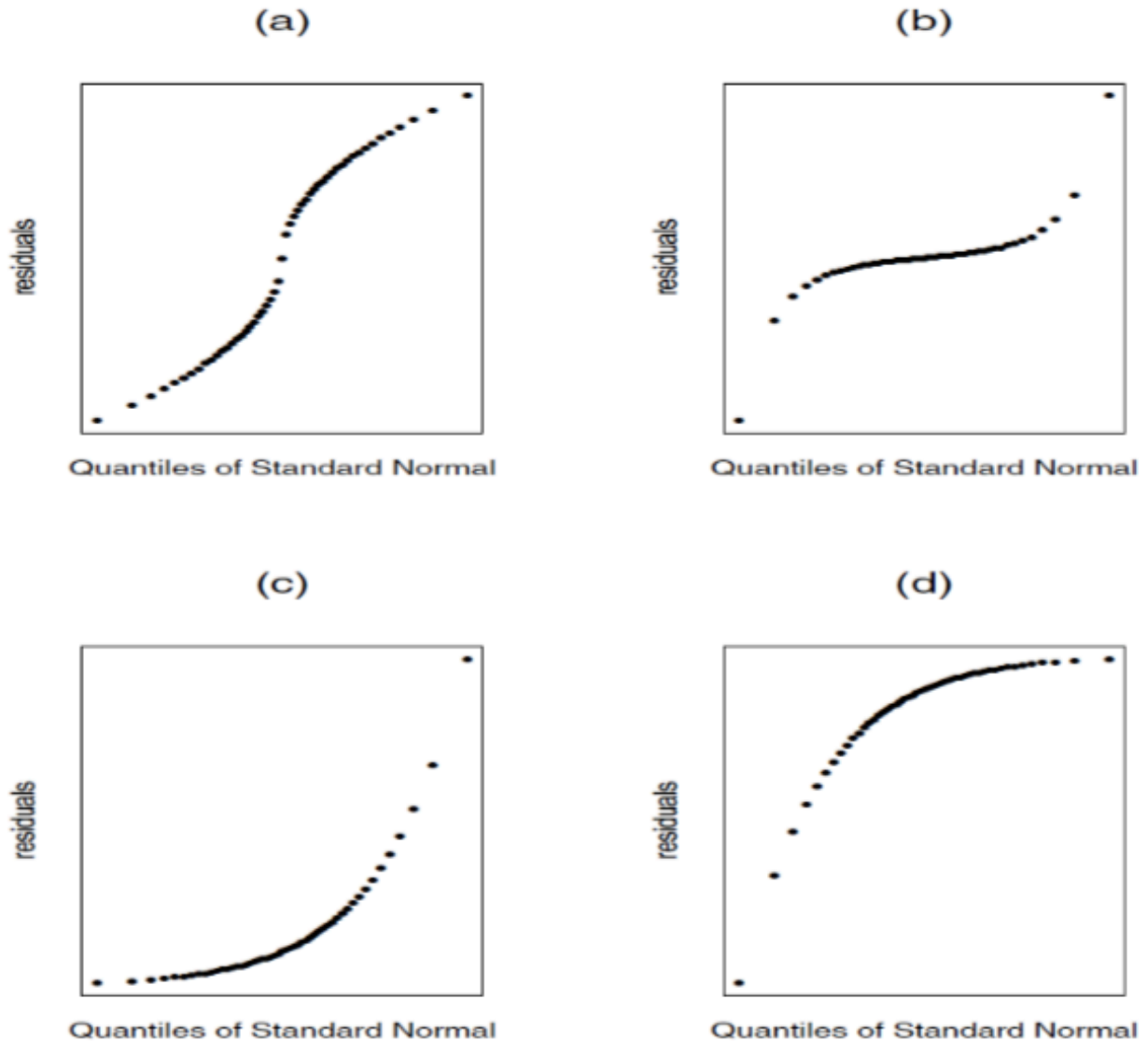
Q-Q图（quantile-quantile plot）

- 根据残差自由度算出$t_{(\text{df.residual} = n-2)}$分布对应n个样本的分位数

$$\text{theoretical quantile} = \phi^{-1}_{df=n-2}\left(\frac{0.5}{n}\right), \phi^{-1}_{df=n-2}\left(\frac{1.5}{n}\right) \cdots\cdots, \phi^{-1}_{df=n-2}\left(\frac{n-0.5}{n}\right)$$

- 把样本因变量y排序

- theoretical quantile 为x轴，样本因变量(Y变量)排序过后为y轴，做散点图



- light tailed (a), heavy tailed (b), positively skewed (c), negatively skewed (d).