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## 1 | Testing the Classical Linear Assumptions

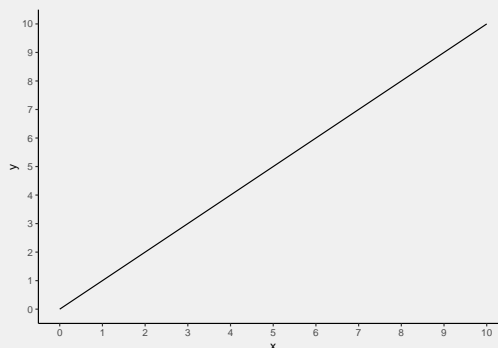
see RScript.

## 2 | The Gauss-Markov Theorem

2. According to Malinvaud, the assumption that  $E(u_i|X_i) = 0$  is quite important. To see this, consider the PRF:  $Y = \beta_1 + \beta_2 X_i + u_i$ . Now consider two situations: (1)  $\beta_1 = 0$ ,  $\beta_2 = 1$  and  $E(u_i) = 0$ ; and (2)  $\beta_1 = 1$ ,  $\beta_2 = 0$  and  $E(u_i) = X_i - 1$ . Now take the expectation of the PRF conditional upon  $X$  in those two cases, and see if you agree with Malinvaud about the significance of the assumption  $E(u_i|X_i) = 0$ .

### 2.1 Situation 1

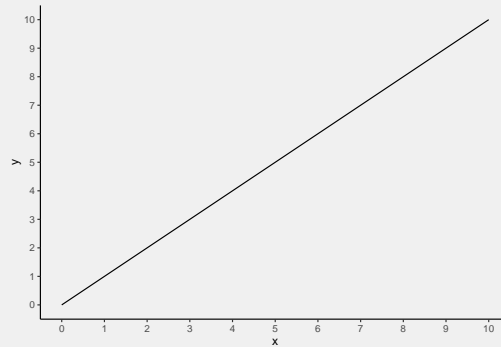
$$\begin{aligned} Y &= \beta_0 + \beta_1 X_i + \epsilon_i \\ &= 0 + X_i + 0 \\ &= X_i \end{aligned} \tag{1}$$



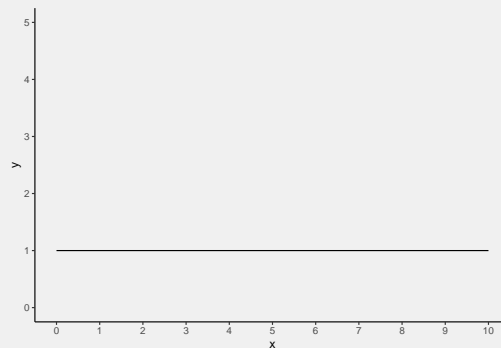
## 2.2 Situation 2

$$\begin{aligned} Y &= \beta_0 + \beta_1 X_i + \epsilon_i \\ &= 1 + 0 + X_i - 1 \\ &= X_i \end{aligned} \tag{2}$$

So what we get is:



What we **should** get is:



## 2.3 Conclusion

- The second PRF is the same as the first, even though – according to the betas – it should be a flat line
- This is only possible, because the error term is not zero and has an interdependence with  $X_i$ .