PO12Q - Introduction to Quantitative Political Analysis II: Worksheet Week 10 - Solutions

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1 | Testing the Classical Linear Assumptions

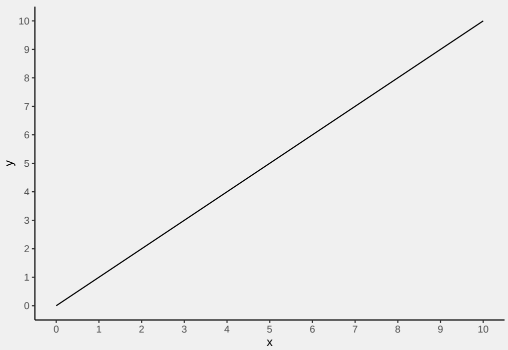
see RScript.

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

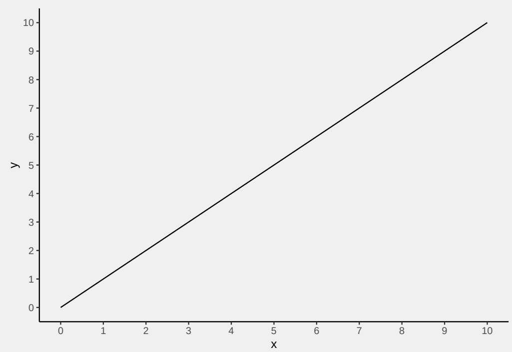
$$\begin{aligned} Y &= \beta_0 + \beta_1 X_i + \epsilon_i \\ &= 0 + X_i + 0 \\ &= X_i \end{aligned} \tag{1}$$



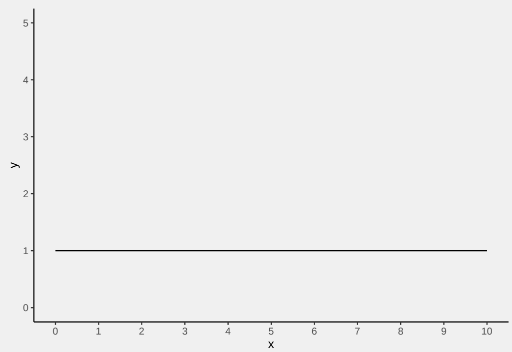
2.2 Situation 2

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

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.