LUND UNIVERSITY

Time Series Analysis
Fall 2018

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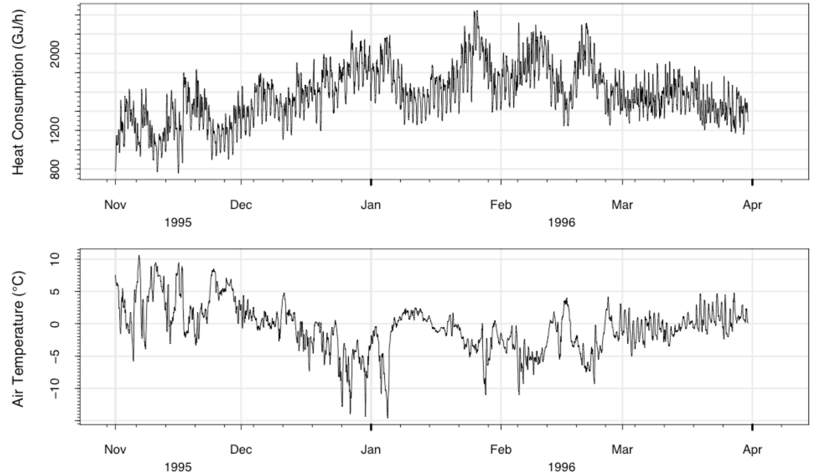
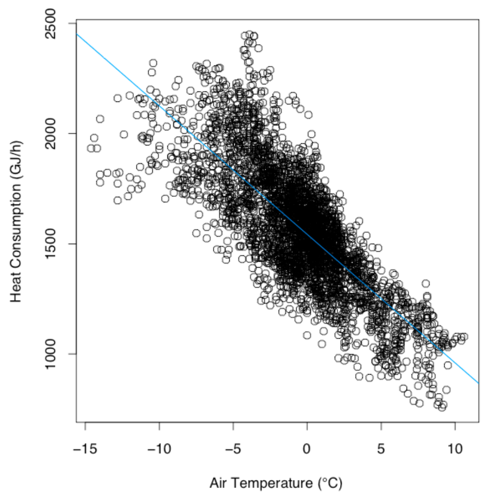
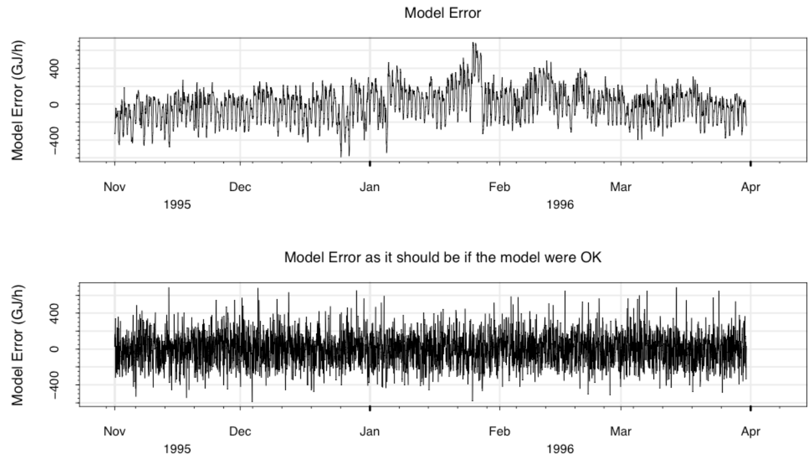
Consumption of district heating



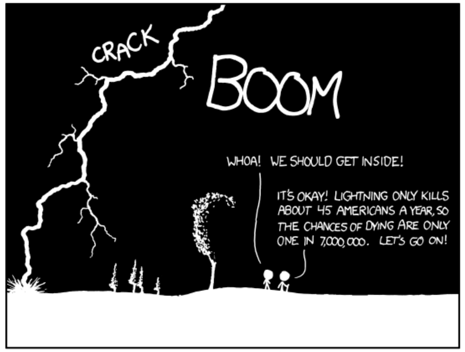




Conditional expectations

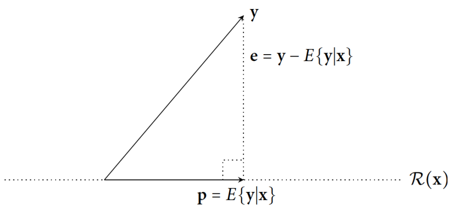
$$
\begin{aligned}
E\{Y|X=x\} &= \int y f_{Y|X=x}(y)dy \\
&= \int y \frac{f_{X,Y}(x,y)}{f_X(x)}dy \\
E\{g(X)Y\} &= E\Big\{g(X)E\{Y|X\}\Big\} \\
C\{Y,Z|X\} &= E\Big\{\big(Y-E\{Y|X\}\big)\big(Z-E\{Z|X\}\big)^T|X\Big\} \\
C\{Y,Z\} &= E\Big\{C\{Y,Z|X\}\Big\}+C\Big\{E\{Y|X\},E\{Z|X\}\Big\}
\end{aligned}
$$

Conditional expectations



THE ANNUAL DEATH RATE AMONG PEOPLE WHO KNOW THAT STATISTIC IS ONE IN SIX.

Linear projection



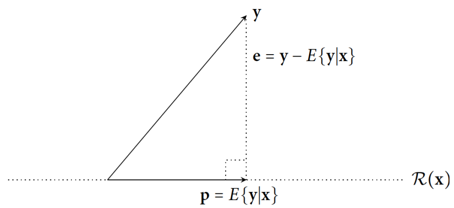
We defined the linear prediction of **y** on to **x** as

$$E\{\mathbf{y}|\mathbf{x}\} = \mathbf{a} + \mathbf{B}\mathbf{x}$$

Then, the prediction error is *orthogonal* with **x**

$$C\Big\{\mathbf{y} - E\{\mathbf{y}|\mathbf{x}\}, \mathbf{x}\Big\} = \mathbf{0}$$

Linear projection



The optimal linear prediction is formed as

$$E\{\mathbf{y}|\mathbf{x}\} = m_{\mathbf{y}} - \mathbf{R}_{\mathbf{y},\mathbf{x}}\mathbf{R}_{\mathbf{x},\mathbf{x}}^{-1}(\mathbf{x} - m_{\mathbf{x}})$$

with error variance

$$V\{\mathbf{e}|\mathbf{x}\} = \mathbf{R}_{\mathbf{y},\mathbf{y}} - \mathbf{R}_{\mathbf{y},\mathbf{x}}\mathbf{R}_{\mathbf{x},\mathbf{x}}^{-1}\mathbf{R}_{\mathbf{y},\mathbf{x}}^{*}$$