

Estimating Outstanding Claims in General Insurance

Exercise 9

Making the assumptions of the Bühlmann-Straub model (slides 62-64), prove the following identities:

$$E(b_j^* | \Theta_j) = b(\Theta_j)$$

$$\text{Var}(b_j^* | \Theta_j) = v(\Theta_j) / p_j \pi_{\leq J-j}$$

$$E(b_j^*) = \beta$$

$$\text{Var}(b_j^*) = \lambda + \varphi / p_j \pi_{\leq J-j} = \lambda / \zeta_j$$

$$\text{Cov}(b_j^*, b_{j'}^*) = 0 \quad \text{for } j \neq j'$$

And then, on slides 68-69

$$E(v_j^* | \Theta_j) = v(\Theta_j)$$

$$E(\varphi^*) = \varphi$$

$$E(\beta^*) = E\left(\sum_{j=1}^J \zeta_j \hat{b}_j / \sum_{j=1}^J \zeta_j\right) = \beta$$

$$E\left(\frac{1}{J-1} \sum_{j=1}^J \zeta_j (b_j^* - \beta^*)^2\right) = \lambda$$

This motivates the estimation procedure (slides 68-69).

Exercise 10

Attached is an Excel workbook with the Accident portfolio, that shows the Bühlmann-Straub model. Familiarise yourself with the iterative estimation and with the calculation of MSEF.