OLS Matrix procedure

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3-factors model:

$$\hat{Y}_i = \alpha + \beta_{1i} + \beta_{2i} + \beta_{3i} + \epsilon_i$$

$$\Downarrow$$

$$(Y_i - \hat{Y}_i) \Rightarrow \textbf{Min.}$$

$$\vdots$$

$$Partial Derivations$$

$$\Downarrow$$

$$\begin{pmatrix} n & \sum_{i=1}^{n} X_1 i & \sum_{i=1}^{n} X_2 i & \sum_{i=1}^{n} X_3 i \\ \sum_{i=1}^{n} X_{1i} & \sum_{i=1}^{n} X_1 i^2 & \sum_{i=1}^{n} X_1 i X_2 i & \sum_{i=1}^{n} X_1 i X_3 i \\ \sum_{i=1}^{n} X_1 i & \sum_{i=1}^{n} X_2 i X_1 i & \sum_{i=1}^{n} X_2 i^2 & \sum_{i=1}^{n} X_2 i X_3 i \\ \sum_{i=1}^{n} X_1 i & \sum_{i=1}^{n} X_3 i X_1 i & \sum_{i=1}^{n} X_3 i X_2 i & \sum_{i=1}^{n} X_3 i^2 \end{pmatrix} * \begin{pmatrix} \alpha \\ \beta_1 \\ \beta_2 \\ \beta_3 \end{pmatrix} = \begin{matrix} \sum_{i=1}^{n} Y_i \\ \sum_{i=1}^{n} Y_i X_{1i} \\ \sum_{i=1}^{n} Y_i X_{2i} \\ \sum_{i=1}^{n} Y_i X_{3i} \end{matrix}$$