

$$y = m_x x + b_x$$

$$\hat{x} = m_z z + b_z$$

Extended Logical Proof
of Corrected Treatment Effect.

~~MD~~

$$y = m_x (m_z z + b_z) + b_x$$

$$y - b_x = m_x (m_z z + b_z) \\ = (m_x + c_z) (b_z)$$

$$\therefore (m_x + c_z) (b_z) = m_x (m_z z + b_z)$$

$$c_z = \frac{m_x m_z z + m_x b_z}{b_z} - m_x$$

$$= \frac{m_x ((m_z z + b_z) - b_z)}{b_z} \quad \therefore m_z z + b_z = \hat{x}$$

$$= \frac{m_x (\hat{x} - b_z)}{b_z}$$

$$y \perp_x y = (m_x + c_z) x + b_x$$

$$= \left(m_x + \frac{m_x (\hat{x} - b_z)}{b_z} \right) x + b_x$$

$$= m_x \left(\frac{b_z + \hat{x} - b_z}{b_z} \right) x + b_x$$

$$y \perp_x y = m_x \left(\frac{\hat{x}}{b_z} \right) x + b_x$$

$$= a_z m_x x + b_x$$

$$\text{where } a_z = \frac{\hat{x}}{b_z}$$

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