

Online 6: Nonlinear Constraints – Conditions

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1 Computable General Equilibrium – CES Production/Cobb Douglas Consumption

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The problem I want to consider is where the decision maker maximizes utility based on production

$$\begin{aligned}
 & \max_{y_1, y_2, y_3, x_{11}, x_{12}, x_{13}, x_{21}, x_{22}, x_{23}, x_{31}, x_{32}, x_{33}} y_1^{0.25} y_2^{0.15} y_3^{0.40} \\
 & y_1 = \left[0.687 x_{11}^{-0.0526} + 0.184 x_{12}^{-0.0526} + 0.316 x_{13}^{-0.0526} \right]^{19} \\
 & y_2 = \left[0.517 x_{21}^{0.0476} + 0.318 x_{22}^{0.0476} + 0.447 x_{23}^{0.0476} \right]^{21} \\
 & y_3 = \left[0.351 x_{31}^{0.1304} + 0.547 x_{32}^{0.1304} + 0.447 x_{33}^{0.1304} \right]^{7.667} \\
 & x_{11} + x_{21} + x_{31} \leq 100 \\
 & x_{12} + x_{22} + x_{32} \leq 100 \\
 & x_{13} + x_{23} + x_{33} \leq 100
 \end{aligned} \tag{1}$$

Linearization of the Constraints

$$\tilde{A}(x)' = \nabla_x G(x)' = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ -\frac{\partial y_1}{\partial x_{11}} & 0 & 0 & 1 & 0 & 0 \\ -\frac{\partial y_1}{\partial x_{12}} & 0 & 0 & 0 & 1 & 0 \\ -\frac{\partial y_1}{\partial x_{13}} & 0 & 0 & 0 & 0 & 1 \\ 0 & -\frac{\partial y_2}{\partial x_{21}} & 0 & 1 & 0 & 0 \\ 0 & -\frac{\partial y_2}{\partial x_{22}} & 0 & 0 & 1 & 0 \\ 0 & -\frac{\partial y_2}{\partial x_{23}} & 0 & 0 & 0 & 1 \\ 0 & 0 & -\frac{\partial y_3}{\partial x_{31}} & 1 & 0 & 0 \\ 0 & 0 & -\frac{\partial y_3}{\partial x_{32}} & 0 & 1 & 0 \\ 0 & 0 & -\frac{\partial y_3}{\partial x_{33}} & 0 & 0 & 1 \end{bmatrix} \quad (2)$$