HW2
Labor Economics

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1 Identification

1.1 Heuristic Identification

1. *"We don't have enough sample size to identify the causal effects of the problem."*

   The sample size doesn't effect the identification. Only the standard error of the estimation is effected.

2. *"We don't have a good identification strategy so I need to use a structural model."*

   Having a structural model does not guarantee the identification of its parameters.

3. *"Because I have a structural model, I don't need to think about identification."*

   Same as above, consider a structural model with two indistinguishable clusters. If the two clusters are the same, the identification of the parameters is impossible.

4. *"Because I can use the maximum likelihood estimator, I can identify that."*

   Let's take a counterexample. Assume the maximum likelihood estimator that we constructed is flat around its global maximum (for some reason). The estimation is unidentified in this case.

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1.2 Identification of OLS

Recall that

$$\hat{\beta} = (X'X)^{-1}X'Y$$

As long as $X'X$ is nonsingular, the estimator of OLS will be certain. It turns out that this is true if there exists no perfect multicollinearity.

1.3 Identification of Factor Model

Labeling the equations,

$$y_{i,t} = \nu_{i,t} + \epsilon_{i,t} \tag{1a}$$
$$\nu_{i,t} = \rho\nu_{i,t-1} + \xi_{i,t} \tag{1b}$$

1.3.1 ρ

Substituting Eq. (1b) into Eq. (1a), we get

$$y_{i,t} = \rho\nu_{i,t-1} + \xi_{i,t} + \epsilon_{i,t} \tag{2}$$

By Eq. (1a), we know $y_{i,t-1} = \nu_{i,t-1} + \epsilon_{i,t-1}$, hence by Eq. (2) we get

$$y_{i,t} = \rho y_{i,t-1} - \rho\epsilon_{i,t-1} + \epsilon_{i,t} + \xi_{i,t} \tag{3}$$

ρ can then be obtained by

$$\rho = \frac{\mathbb{E}(y_{i,t})}{\mathbb{E}(y_{i,t-1})}$$

1.3.2 σ_ϵ^2