ECONOMICS 6002 CLASS 13
SIMULTANEOUS EQUATION MODELS

1.   In simultaneous systems, some endogenous variable appears in more than one equation in
      the system.
      a.   As a result, OLS estimation may be inconsistent, because an endogenous variable
            acts as an "independent" variable.
      b.   Examples
      c.   Demand-Supply Models
      d.   Most macro models
            i.   e.g., Klein's Model 1

2.   Structural Form vs Reduced Form
      a.   Structural Form is based on behavioural characteristics of units in model
      b.   Reduced form relates the endogenous variables in the model directly to the
            exogenous variables
      c.   Reduced form is adequate for prediction, but policy simulation often requires
            structural form

3.   Identification
      a.   Reduced form can always be estimated consistently
      b.   Structural form cannot always inferred from the reduced form – if so, the structure
            is **not identified** or unidentified.
      c.   If an equation is not identified, it is impossible to distinguish it from some linear
            combination of the equations in the entire system.
      d.   When the structural form can be inferred from the reduced form, it cannot always
            be inferred **uniquely** – if so, the equation is **overidentified**
      e.   If an equation is just identified, all consistent estimators give the same estimate,
            because there is only one value that can be inferred from the reduced form
      f.   If an equation is overidentified, more than one value can be inferred from the
            reduced form, and different estimators will combine this information in different
            ways, leading to different estimates (even if they are all consistent)
      g.   Identification is normally secured by *exclusion conditions* on variables in an
            equation.
            i.   The **order** condition is necessary but not sufficient for identification, and
                  requires that the number of exogenous variables **excluded** from the
                  equation be no less than the number of endogenous variables on the right
                  hand side of the equation.
            ii.   The **rank** condition is a condition on the rank of a submatrix of the
                  reduced form, and is necessary and sufficient for identification. It is
                  normally (but not always) satisfied when the order condition is satisfied.
      h.   Identification can also be secured by linear restrictions on the parameters,
            restrictions on the covariance matrix of the disturbances, and nonlinearities.

4.   Three-Stage Least Squares Estimator
      a.   A simultaneous equation **system** can be estimated efficiently through two-step
            FGLS, using the 2SLS residuals in the first step to estimate the covariance matrix
            of the equation disturbances.
      b.   Parameter estimates of just-identified equations are the same in 3SLS as in 2SLS.