**Rank and Order Conditions**

**1** Q = α0 + α1P + α2P**’** + α3Y (11)

**1** Q = β0 + β1P + + β4W (12)

**2** Q**’** = γ0 + γ1P + γ2P**’** + γ3Y (13)

**2** Q**’** = δ0 + + δ2P**’** (14)

Now set (11) – (14) and put into a form to determine identification.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Q | Q**’** | 1 | P | P**’** | Y | W | Equation # |
| -1 | 0 | α0 | α1 | α2 | α3 | 0 | **1**1 |
| -1 | 0 | β0 | β1 | 0 | 0 | β4 | **1**2 |
| 0 | -1 | γ0 | γ1 | γ2 | γ3 | 0 | **1**3 |
| 0 | -1 | δ0 | 0 | δ2 | 0 | 0 | **1**4 |

# of endogenous variables: Q, Q**’**,P, P**’**

# of exogenous variables: Y, W

**Order Condition:**

With a model of G linear equations, an equation is identified if it excludes G – 1 variables appearing in the model.

|  |  |  |  |
| --- | --- | --- | --- |
| Equation | G – 1 | # of exclusions | Identified |
| **1**1 | 3 | 2 | Under |
| **1**2 | 3 | 3 | Just |
| **1**3 | 3 | 2 | Under |
| **1**4 | 3 | 4 | Over |

* # of exclusions $\geq $ G – 1

**Rank Condition:**

 In a model of G equations, an equation is identified iff at least one non-zero (G – 1) $× $(G – 1) determinant is contained in the array of coefficients with which those variables excluded from the equation in question appear in the other equations.

**Verify:**

Equation (**1**2): $\left[\begin{matrix}0&α\_{2}&α\_{3}\\-1&γ\_{2}&γ\_{3}\\-1&δ\_{2}&0\end{matrix}\right]$

$$\left|det\right|=α\_{3}\left(γ\_{2}-δ\_{2}\right)-α\_{2}γ\_{3}\ne 0$$

Equation (**1**4): $\left[\begin{matrix}-1&α\_{1}&α\_{3}\\-1&β\_{1}&0\\0&γ\_{1}&γ\_{3}\end{matrix} \begin{matrix}0\\β\_{4}\\0\end{matrix}\right]$

$$\left|det\right|=four 3 ×3 determinants possible$$