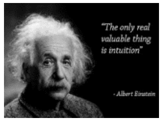
Structural Equation Models



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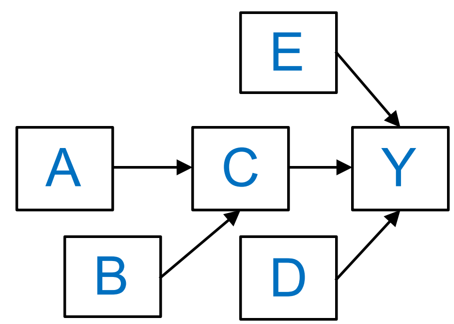
Structural Equations: Intuition

- In depth coverage of structural equation modeling is beyond the scope of this class, but we discuss a few issues here
- When some variable are highly correlated but business rationale suggests that they belong in a model, the relationship among variables in the model is probably "structural"
- This simply means rather than having a single predictor model, we have a group of inter-related models in which the outcome variable in some models are predictors of other models, e.g.:

(1) $\boldsymbol{C = \beta_{0C} + \beta_A A + \beta_B B + \varepsilon}$

(2) $\boldsymbol{Y = \beta_{0Y} + \beta_C C + \beta_D D + \beta_E E + \varepsilon}$



- A, B → **"direct"** effect on **C** ($\boldsymbol{\beta_A, \beta_B}$)
- C, D, E → **"direct"** effect on **Y** ($\boldsymbol{\beta_C, \beta_D, \beta_E}$)
- A, B → **"indirect"** effect on **Y** ($\boldsymbol{\beta_A * \beta_C,\ \beta_B * \beta_C}$)

Structural Equations Models (SEM)

- **SEM** is a **complex** topic; It is discussed here as an **FYI**
- In some cases, you can use **OLS** to model **SEM**, only **if**:
  - The model is **"non-recursive"** – i.e., all arrows in the model go in **1 direction** → **posterior** variables are **not predictors** of anterior **variables**
  - The model is estimated **"hierarchically"** – i.e., all **predictors** in the prior models are **included** in **posterior** models, to test all possible paths. The example above would be modeled:

    (1) $\boldsymbol{C = \beta_{0C} + \beta_A A + \beta_B B + \varepsilon}$ (same)

    (2) $\boldsymbol{Y = \beta_{0Y}} + \beta_A A + \beta_B B + \boldsymbol{\beta_C C + \beta_D D + \beta_E E + \varepsilon}$

    If $\boldsymbol{\beta_A, \beta_B}$ are **significant** in **(2)**, the structural model is **wrong**

    If $\boldsymbol{\beta_A, \beta_B}$ are **significant** in **(1)** but **not** in **(2)** the model is **right**

- There are various **SEM methods** (e.g., Lisrel, PLS) which **estimate** the multiple model equations **jointly**

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