

Basic Principles of Experimental Design

經濟學實驗設計原理

Joseph Tao-yi Wang (王道一)
Lecture 8, Topics in Exp Econ

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Define Economic Experiment 定義經濟學實驗

- ▶ **An Economic Experiment**
- ▶ Constructs a **controlled environment** to
- ▶ observe how **people make economic decisions** under **real incentives**, to answer
- ▶ questions raised by the researcher, testing a hypothesis or which theory matches reality
 - ▶ 建構一個控制的環境，在有真實誘因的情況下，觀察人們如何做決定（經濟決策），為要回答研究者所提出的問題，檢驗哪個假說或理論比較符合現實。

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4 Components of Controlled Environment

□ 經濟學實驗：建構一個控制的環境，在有真實誘因的情況下，觀察人們如何做決定（經濟決策），為要回答研究者所提出的問題，檢驗哪個假說或理論比較符合現實。

- ▶ **4 Components: (建構控制的環境有4個要素)**
- 1. **Real Incentives:**
 - ▶ Choices have real consequences (真實後果或誘因)
- 2. **A Good Control Group**
 - ▶ (對照組的設計)
- 3. **Random Assignment**
 - ▶ (隨機分組)
- 4. **No deception**
 - ▶ (完全不欺騙受試者)

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你們這一組的論文所描述的實驗符合經濟學實驗建構控制環境的四大要素嗎？請一一檢視。
Real Incentives (真實後果或誘因)
A Good Control Group (對照組的設計)
Random Assignment (隨機分組)
No deception (完全不欺騙受試者)

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Principles of Experimental Design 實驗設計原理

<ol style="list-style-type: none"> 1. Control, Measure, or Assume (控制, 測量或假設) 2. Controlling Risk Tastes (控制風險偏好) 3. Instructions (實驗說明) 4. Anonymity (匿名性) 5. Matching Protocols & Reputation Building (配對方式與受試者信譽) 	<ol style="list-style-type: none"> 6. Order Effects (不同實驗的先後次序) 7. Within-Subject and Between-Subject Design (同一 vs. 不同受試者) 8. Experimentics (實驗計量) 9. Incentives (金錢誘因) 10. No Deception (不欺騙受試者)
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▶ Reference: BGT, A1.2

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Control, Measure or Assume 控制/測量/假設

- ▶ **Control (控制)**
 - ▶ Taking an action to affect a variable's value (主動賦予該變因的參數值)
 - ▶ "Induced" value theory (賦予參數理論)
- ▶ **Measurement (測量)**
 - ▶ Measure the value of a variable (測量該變因的參數值)
 - ▶ Via various methods (see below) (用下頁所列不同方法)
- ▶ **Assumption (假設)**
 - ▶ Pseudo-control (直接假設該變因的參數值)
 - ▶ Accept a maintain hypothesis about the value of a variable

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Control, Measure or Assume 控制/測量/假設

- ▶ **Methods of Measurement (測量方法):**
- ▶ Psychometric measures (surveys) (心理測驗/問卷)
- ▶ Risk-aversion measures (certainty equiv) (風險偏好)
- ▶ Probability judgments (scoring rules) (主觀機率判斷)
- ▶ Information acquisition (mouse/eye-tracking)
 - ▶ 資訊取得: 滑鼠追蹤或眼球追蹤
- ▶ Psychophysiological measures (測量心理生理學上的反應)
 - ▶ fMRI (功能性磁振造影), GSR (皮膚電阻反應), PDR (瞳孔放大反應), EEG (頭皮腦電波), etc.

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Control Risk Preferences 控制風險偏好

- ▶ Binary Lottery Procedure: (發樂透彩券當報酬)
 - ▶ Widely used to **control** risk preferences, but not much evidence that it works (控制風險偏好的常用辦法, 但沒太多證據顯示有效, 且常假設人們能把複合樂透簡化為簡單樂透)
- ▶ Alternatives: (其他辦法)
- ▶ **Assume** risk neutrality (假設受試者是風險中立)
- ▶ **Measure** risk preferences (測量風險偏好)
 - ▶ Holt and Laury (2002) or Tanaka et al. (2010)
 - ▶ Choi et al. (2007); Andreoni and Sprenger (2012)
 - ▶ DOSE: Wang et al. (QJE-R&R)

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Individual Decision Making (個別決策實驗)

- ▶ Study Personal Preferences
 - ▶ Risk Aversion,
 - ▶ Time Discounting,
 - ▶ Ambiguity Aversion, etc.
 - 研究個人的偏好: 風險趨避、時間折現、未知趨避等
- ▶ Measured Characteristics
 - 可以用實驗來測量個人特質
- ▶ Does this correlate with other behavior?
 - 這些特質是否跟受試者其他行為相關?

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你們這一組的論文所描述的實驗, 當中哪些變數是由實驗者賦予(控制)的? 他們有控制風險偏好嗎? 你們有沒有想到哪些變數可以怎麼測量、而非直接假設呢?

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Instructions 實驗說明

- ▶ Tell subjects what they need to know (告知所需資訊)
- ▶ **Public Knowledge (公共知識):** (來自公開朗讀說明)
 - ▶ Established by reading instructions out loud
- ▶ How much to reveal? (要告訴受試者多少?)
 - ▶ Entire payoff structure (default) (完整告知報酬如何決定)
 - ▶ Since we're not sure what subjects would think about what they are not told (不知道他們會怎麼解讀未揭露的資訊)
- ▶ Withhold some information: Study how people/markets learn under limited information
 - ▶ (不告知某些資訊: 用以研究人們或市場如何在有限資訊下學習探索)

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你們這一組的論文所描述的實驗, 其線上附錄(Online Appendix)有沒有附上完整實驗說明? 有哪些資訊「沒有」揭露? 有沒有採用「非中立的語言」?

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Anonymity 匿名性

- ▶ Who's Who? Subject behavior can change knowing opponent's identity due to
 - 見面三分情? 受試者的行為會因為知道對方是誰而改變, 因為
- ▶ Appearance, gender, (長相外貌、性別)
- ▶ Fear of retaliation, etc. (害怕被報復等等)
- ▶ Use the anonymity case as a benchmark
 - (因此, 我們通常用匿名實驗來當作基準實驗)
- ▶ Measure opponent characteristics (appearance) and compare to benchmark
 - 要研究這些變因時, 可以測量對方特質(例如長相多好看), 同時把它們顯示給受試者看, 然後把實驗結果和基準實驗作比較

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Matching Protocol/Reputation 配對方式/信譽

- ▶ **Random matching** (random switch)
 - ▶ Empirically kills repeated game effects
 - ▶ 隨機配對: 每回合重新洗牌, 實際上可除去重複賽局效果
- ▶ **Mean-matching** (play with everyone)
 - ▶ 與所有人配對: 每個決定都跟其他每個人各配對一次
- ▶ More strict matching protocols: (更嚴格配對方式)
- ▶ **Non-repeat matching** (meet only once)
 - ▶ 不重複配對: 整個實驗中只跟每個對手配對一次, 所需實驗參與者人數的魔術數字是2的n次方, 因為能做 $2^n - 1$ 回合不重複配對
- ▶ **Non-contagion matching** (no chain-of-influence)
 - ▶ 不污染配對: 整場沒有「我跟你配、你再跟他配, 最後我遇到他」的情形

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你們這一組的論文所描述的實驗, 採用哪一種配對方式?
如果可以重來, 你們會建議他採用其他配對方式嗎?

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Order Effects 不同實驗的先後次序

- ▶ AB: A came first; B came second
 - ▶ Is this why we see different behavior?
 - ▶ AB即「先做實驗A, 再做實驗B」
 - ▶ 行為的改變是否只是因為先後次序不同?
- ▶ Try BA and include order dummies in analysis
 - ▶ 必須也做BA(次序反過來), 然後在資料分析的時候加上次序的虛擬變數(dummies)來檢驗是否有影響
- ▶ What if ABC?
- ▶ ACB/BAC/BCA/CBA/CAB or simplify design
 - ▶ 有ABC怎麼辦?
 - ▶ 做ACB/BAC/BCA/CBA/CAB或簡化實驗設計

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Within-subject vs. Between-subject 同一|不同

- ▶ **Within-Subject Design** (「比較同一受試者」的設計)
 - ▶ Same subject observed in various treatments
 - ▶ Pro: More statistically powerful (優點: 統計上解釋力強)
 - ▶ Con: Possible demand effect (缺點: 可能有「要求效果」)
 - ▶ 觀察同一受試者在不同實驗環境中的反應。(可做paired t-test)
- ▶ **Between-Subject Design** (「比較不同受試者」的設計)
 - ▶ Different subjects observed in each treatment
 - ▶ Norm in experimental economics (實驗經濟學標準做法)
 - ▶ Con: "Impossible" for fMRI or eyetracking
 - ▶ 觀察不同受試者在各自的實驗環境中的反應。(很難做fMRI/眼動實驗)

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你們這一組的論文所描述的實驗, 採用的是Within還是Between的實驗設計?
作者如何避免次序效果? 有控制風險偏好的影響嗎?

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Experimetrics 實驗計量

- ▶ Econometrics customized for experiments, just like
- ▶ Econometrics is statistics customized for economics
 - 特別為實驗開發的計量方法，正如計量是為經濟學開發的統計方法
- ▶ **Bottom line: Use all econometrics feasible to get the most out of your (experimental) data**
 - (良心建議：請充分利用所有可能的計量工具來分析實驗資料)
- ▶ Experimental Design and Experiments sometimes look like substitutes, but they actually
- ▶ **Complement** each other in a good paper!
 - 實驗設計和實驗計量有時可以互相替代，因為有好的設計，簡單的敘述統計可能就夠了。但兩者相輔相成能產生最好的論文

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List of Experiments 實驗計量方法列表

- ▶ Mann-Whitney-Wilcoxon Test(s) vs. T-test
 - Non-parametric test similar to (un-)paired t-test
- ▶ Regression (with random effects)
- ▶ Maximum Likelihood Estimations (最大概似估計)
 - Simulate (模擬) and Estimate (估計)
 - Level-k, Cognitive Hierarchy models
 - Learning (學習理論): EWA, Reinforcement
 - Quantal Response Equilibrium (手滑反應均衡)
- ▶ Out-of-sample Predictions (預測新的資料)
 - Machine Learning (Random Forest, LASSO, etc.)
- ▶ Markov-switching (Eyetracking), SPM (fMRI)

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下列哪一個實驗計量方法是你「沒有」看過論文使用過的？

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Incentives 真實誘因

- ▶ Hypothetical vs. Real Money Decisions
 - Difference b/w economic & psychological experiments
 - 假設性問題 vs. 「玩真的」：經濟學實驗和心理學實驗一大分野
- ▶ Assumption behind money payments:
 - "Everybody likes having more money and nobody gets tired of having more of it." 使用金錢報酬只需要一個行為假設：
「每個人都喜歡獲得更多金錢，而且多多益善(沒有人會覺得拿太多)」
- ▶ Cost of deviation without real money is 0
 - 只是假設性問題的話，亂講亂選沒有成本
- ▶ Paying money reduces variation & outliers
 - 故金錢報酬會降低亂選的變異，減少極端的特例

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Incentives 真實誘因

- ▶ Pay Less vs. Pay More (付得少/多是否影響結果?)
- ▶ Comparison studies not done often enough
- ▶ Expensive to double/triple the payments
 - 有一些人做這種比較的實驗，但還不夠多，因為把報酬乘倍很貴
- ▶ Some experiments done in poor countries
 - (不過仍有些實驗會特別到貧窮的國家去做)
 - ▶ Vietnam (越南：試字率高、人民卻很窮、鮮少遷徙)
 - ▶ Few results that disconfirm theory have been overturned by paying more money
 - 這些少數重複實驗結果顯示：如果原本的實驗結果不支持理論預測，多付錢也大概不會讓實驗結果變得合乎理論的預測

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Incentives 真實誘因

- ▶ Flat Maximum Critique (「作什麼都沒差」)
 - Is it worthwhile (high stakes) to think hard?
 - 值得想得更深入嗎？(重賞之下必有勇夫，沒勇夫表示賞金不夠?)
 - ▶ EX: Costless to deviate from (1/3, 1/3, 1/3) in rock-paper-scissors (例如：「剪刀石頭布」不按照均衡策略(1/3, 1/3, 1/3)來做沒有損失，因為不管出什麼報酬都相同)
- ▶ No ideal solution yet... (尚未有很好的解決辦法，不過...)
 - Design steep marginal incentives
 - 可以設計得讓「邊際誘因」很高
 - ▶ Modest effect on high stakes anyway
 - 高獎金對結果的影響雖不是0，但也沒那麼大

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你們這一組的論文所描述的實驗，所採用的真實誘因是甚麼？有「做甚麼都沒差」的問題嗎？

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No Deception 不欺騙受試者

- ▶ Economists do not deceive their subjects
 - ▶ (實驗經濟學家從不欺騙他們的受試者)
- ▶ Economists do not deceive their subjects
 - ▶ (實驗經濟學家從不欺騙他們的受試者)
- ▶ Economists do not deceive their subjects
 - ▶ (實驗經濟學家從不欺騙他們的受試者)
- ▶ This creates credibility (「徒木立信」)
 - ▶ Makes monetary payments “real”
 - ▶ (因而相信真的有金錢報酬)

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No Deception 不欺騙受試者

- ▶ And avoids anticipation/strategic responses
 - ▶ Differs from psychologists (who use debriefing)
 - ▶ 避免預期會被騙時的鬥智反應 (心理學家只要事後說明即可)
- ▶ Can achieve most goals with better design
 - ▶ Except to study the effect of deception (Really?)
 - ▶ 所謂「需要欺騙的實驗」大多能設計另一個「不需欺騙的實驗」來達到同樣目的 (除了研究人們被實驗者欺騙時的反應)
- ▶ Let subjects act as experimenters (to see...)
 - ▶ 真有人設計實驗讓受試者扮演實驗者的角色(來看被騙時...)

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有哪一個研究問題「一定要」使用欺騙受試者的實驗設計才能回答？

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Conclusion: The Gold Standards 設計十誠

<ol style="list-style-type: none"> 1. Control, Measure, or Assume (控制, 測量或假設) 2. Controlling Risk Tastes (控制風險偏好) 3. Instructions (實驗說明) 4. Anonymity (匿名性) 5. Matching Protocols & Reputation Building (配對方式與受試者信譽) 	<ol style="list-style-type: none"> 6. Order Effects (不同實驗的先後次序) 7. Within-Subject and Between-Subject Design (同一 vs. 不同受試者) 8. Experimentics (實驗計量) 9. Incentives (金錢誘因) 10. No Deception (不欺騙受試者)
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你們這一組的論文，研究問題是甚麼？(What is the Question?)
 這個問題干我們甚麼事？(Why Should we Care About it?)
 論文的答案是甚麼？(What is The Answer?)
 你怎麼得到這個答案？(How Did You Get There?)

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