

# 實驗經濟學一：行為賽局論

Experimental Economics I: Behavioral Game Theory

## 第一講：實驗經濟學概述

## Lecture 1: Experimental Economics and Behavioral Game Theory

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本課程指定教材：Colin E. Camerer, *Behavioral Game Theory: Experiments in Strategic Interaction*. New York: Russell Sage Foundation; New Jersey: Princeton UP, 2003.



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[「姓名標示—非商業性—相同方式分享」臺灣 3.0](#)  
[版授權釋出](#)】<sub>1</sub>

# 3 Cores of Economics 經濟學三大核心方法論

- Micro, Macro, Metrics (個體，總體，計量)?
  - Because of 1st year course (因為是博一必修)?
- Economic Theory (經濟理論 / 模型建構)
  - Mathematical/graphical/verbal models
    - (數學模型、圖形模型、嘴砲模型)
- Data Analysis (資料分析 / 計量方法)
  - Statistical methods, graphs (統計方法、製作圖表)
- Data Collection (資料取得)
  - Surveys, experimental methods, requesting data
    - (問卷調查、實驗方法、索取資料的管道)

# Experimental Economics Behavioral Game Theory

## 實驗經濟學與行為賽局論

# What is Experimental Econ? 何謂實驗經濟學？

- Science ( 科學的定義 ): (Merriam-Webster)
  - “knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through scientific method.” 
  - 用來描述普遍真理或普遍法則如何運行的系統性知識，特別是用科學方法獲得與檢驗的知識
- What is the “Scientific Method”?
  - 何謂「科學方法」？

# Scientific Methods (Wikipedia) 科學方法

- The scientific method seeks to explain the events of nature in a reproducible way, and to use these reproductions to make useful predictions. It is done through observation of natural phenomena, and/or through
- experimentation that tries to simulate natural events under controlled conditions.
  - 科學方法希望用可重複驗證的方式來解釋自然現象，並用此來做有用的預測。達成方式包含觀察自然發生的現象，<sup>5</sup>以及用實驗在控制條件下產生自然發生的現象。



# What is Experimental Econ? 何謂實驗經濟學？

- Observation (觀察) vs. experimentation (實驗)
- Experimental Economics is a method of economics that seeks “experimentation that tries to simulate natural (economic) events under controlled conditions”
  - 實驗經濟學是經濟學的一種研究方法，目的是要「用實驗在控制條件下產生自然發生的現象」
- Other empirical work are “observation of natural (economic) phenomena”
  - 其他實證方法則是「觀察自然發生的經濟現象」

# Two Traditions of EE ( 實驗經濟學兩大傳統 )

Two Nobel Laureates of 2002 ( 兩位諾獎得主 )

- **Vernon Smith ( 臥龍 • 史密斯 )**
  - Market Experiments ( 市場實驗 )
  - Experimental Economics = Economic Science
    - ( 實驗經濟學 = ( 唯一的 ) 經濟科學 )
- **Daniel Kahneman ( 丹尼 • 卡尼曼 )**
  - “Psychology and Economics”
  - aka “Behavioral Economics” (see next slide)
    - 結合心理學與經濟學 ( 又稱 「行為經濟學」 )
- The two traditions interacted and grew...
  - 兩大傳統互相影響、一起成長...

# What is Behavioral Econ? 何謂「行為經濟學」

- Isn't **Economics** by definition **Behavioral**?  
經濟學的目的不就是要解釋人類的行為嗎？
- What is “Non-behavioral Economics”?  
( 到底甚麼算是「非行為經濟學」嗎？ )
  - “Bad” economics? 那應該叫「不好的經濟學」！
- **Non-behavioral Economics doesn't exist!**  
( 「非行為經濟學」有定義上的矛盾！ )
  - Though **Experimental Economics** and **Behavioral Game Theory** are fine...  
「實驗經濟學」與「行為賽局論」沒問題 ?!

# Two Traditions of EE ( 實驗經濟學兩大傳統 )

## 1. Market Experiments/Design ( 市場實驗 / 設計 )

- How Adam Smith's **invisible hand** really works
  - ( 在實際市場中「看不見的手」如何運作 )

## 2. Behavioral Game Theory ( 行為賽局論 )

- What players actually do in games
  - ( 在賽局中真實的人如何做決定 )

## Like the Two Traditions in Economic Theory

( 正如經濟理論兩大傳統 : )

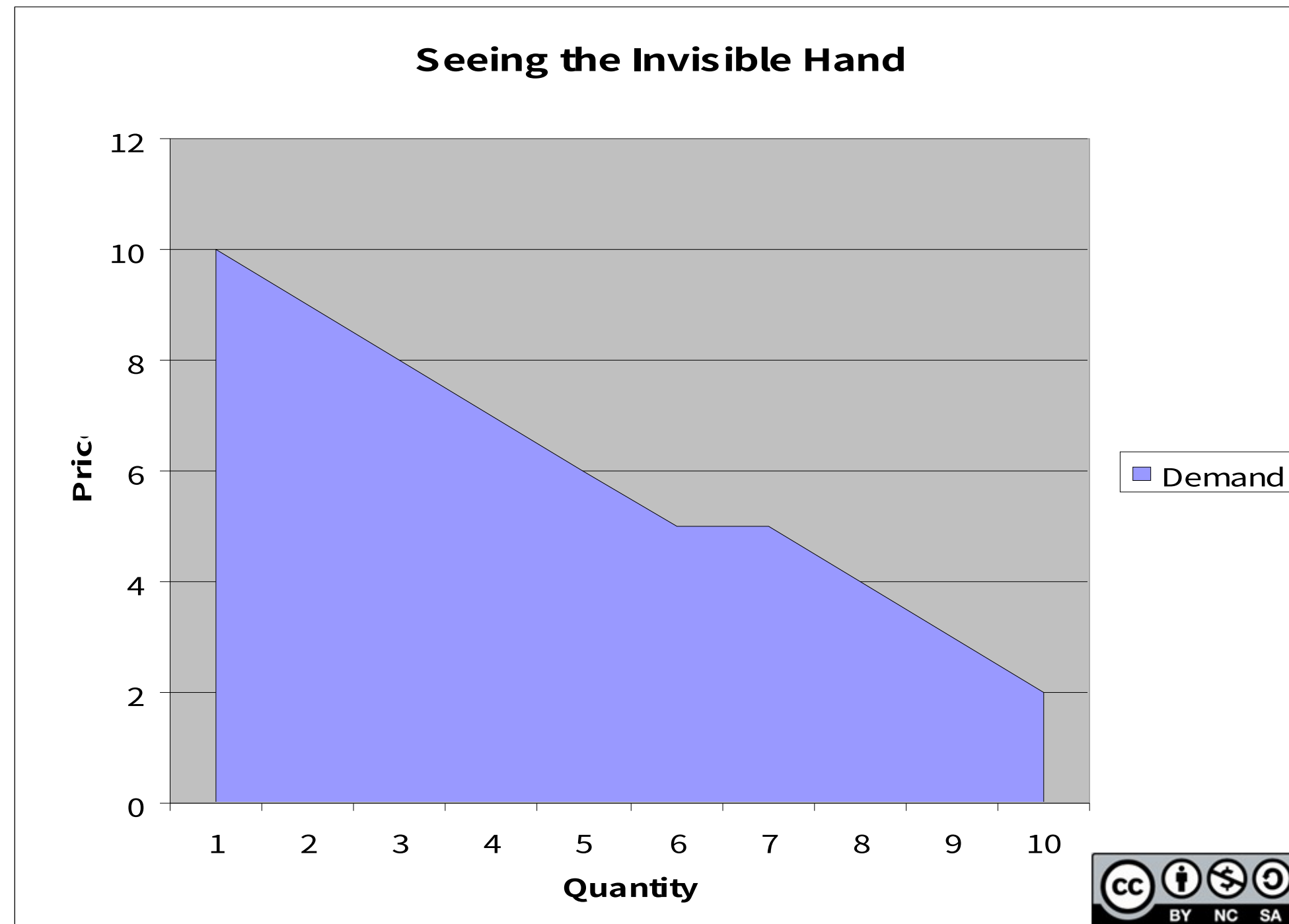
- General Equilibrium Theory ( 全面均衡理論 )
- Game Theory ( 賽局論 )

# Market Experiments and Market Design

## – 市場實驗與市場設計

- The Pit Market ( 交易坑市場 )
  - Chamberlin (JPE, 1948) 張伯倫
  - Smith (JPE, 1962) 臥龍・史密斯
- Experiment: Seeing the Invisible Hand
  - ( 課堂實驗：發現看不見的手 )
  - Ran in Principles of Microeconomics Class
    - ( 在大一經濟學原理有做過 )
  - See instructions ( 請見實驗說明 )

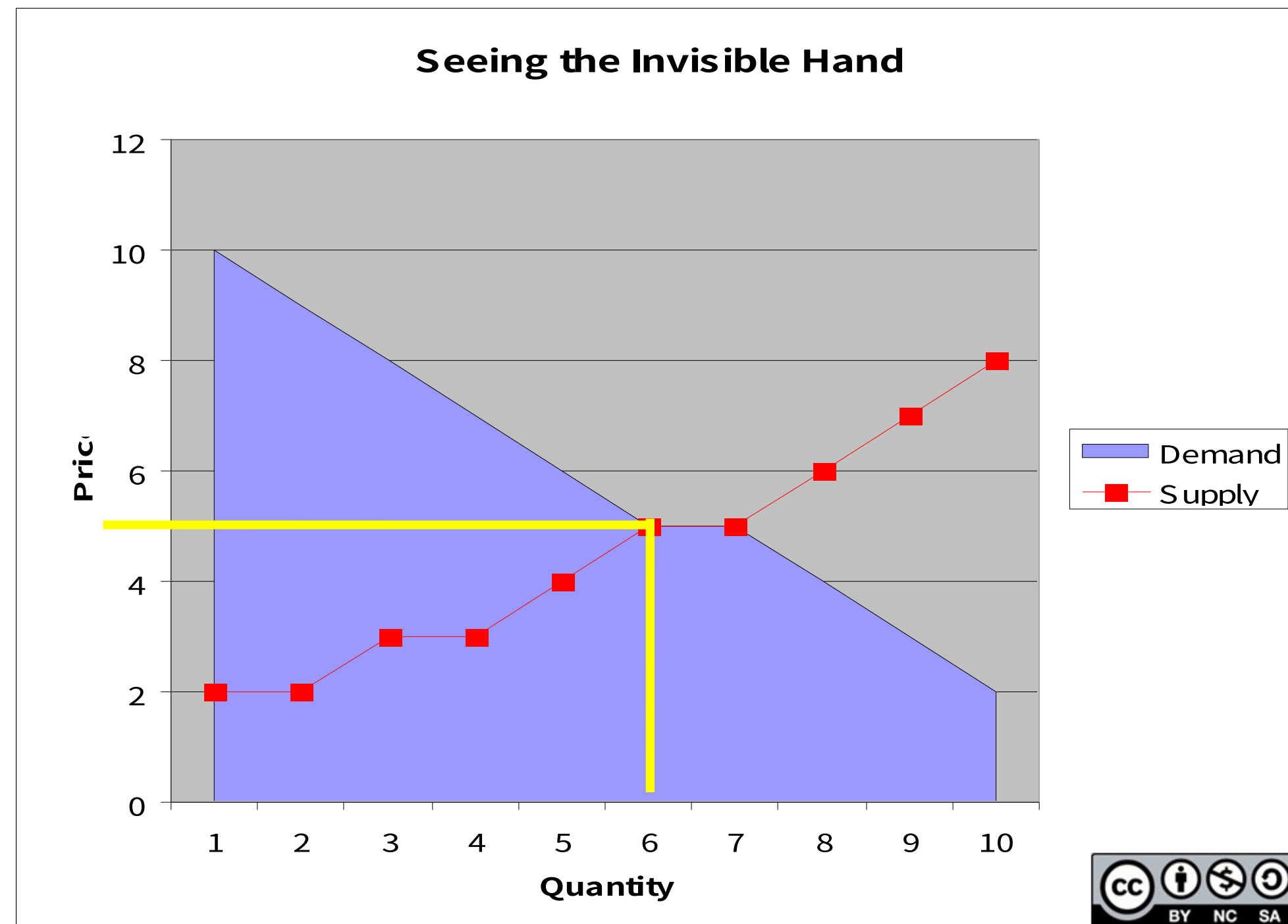
# Seeing the Invisible Hand ( 發現看不見的手 )



# Seeing the Invisible Hand ( 發現看不見的手 )



# Seeing the Invisible Hand ( 發現看不見的手 )



# Seeing the Invisible Hand ( 發現看不見的手 )

- Prices ( 成交價格 )
  - 07F Economics I 經濟學一
- Pit Market ( 交易坑市場 )
  - A: 6, 6, 6, 8, 5, 6, 6
  - B: 5, 5, 4, 6, 6, 6, 7
- Double Auction ( 雙邊喊價市場 )
  - A: 5, 5, 5, 5, 5
  - B: 5, 5, 6, 6, 6
  - C: 4, 5, 5, 6, 5, 5



# Seeing the Invisible Hand ( 發現看不見的手 )

| 回合        |     | 價 格 | 買方利潤 | 賣方利潤 |
|-----------|-----|-----|------|------|
| 交易坑1      | 平均值 | 6.1 | 1    | 2    |
|           | 變異數 | 0.8 | 5.3  | 2.7  |
| 交易坑2      | 平均值 | 5.6 | 1.6  | 2.1  |
|           | 變異數 | 1.0 | 1.3  | 1.5  |
| 雙邊<br>喊價1 | 平均值 | 5   | 3    | 2.2  |
|           | 變異數 | 0   | 2.5  | 0.7  |
| 雙邊<br>喊價2 | 平均值 | 5.6 | 2.4  | 2.2  |
|           | 變異數 | 0.3 | 2.8  | 1.2  |
| 雙邊<br>喊價3 | 平均值 | 5   | 2.5  | 1.8  |
|           | 變異數 | 0.4 | 2.3  | 0.6  |

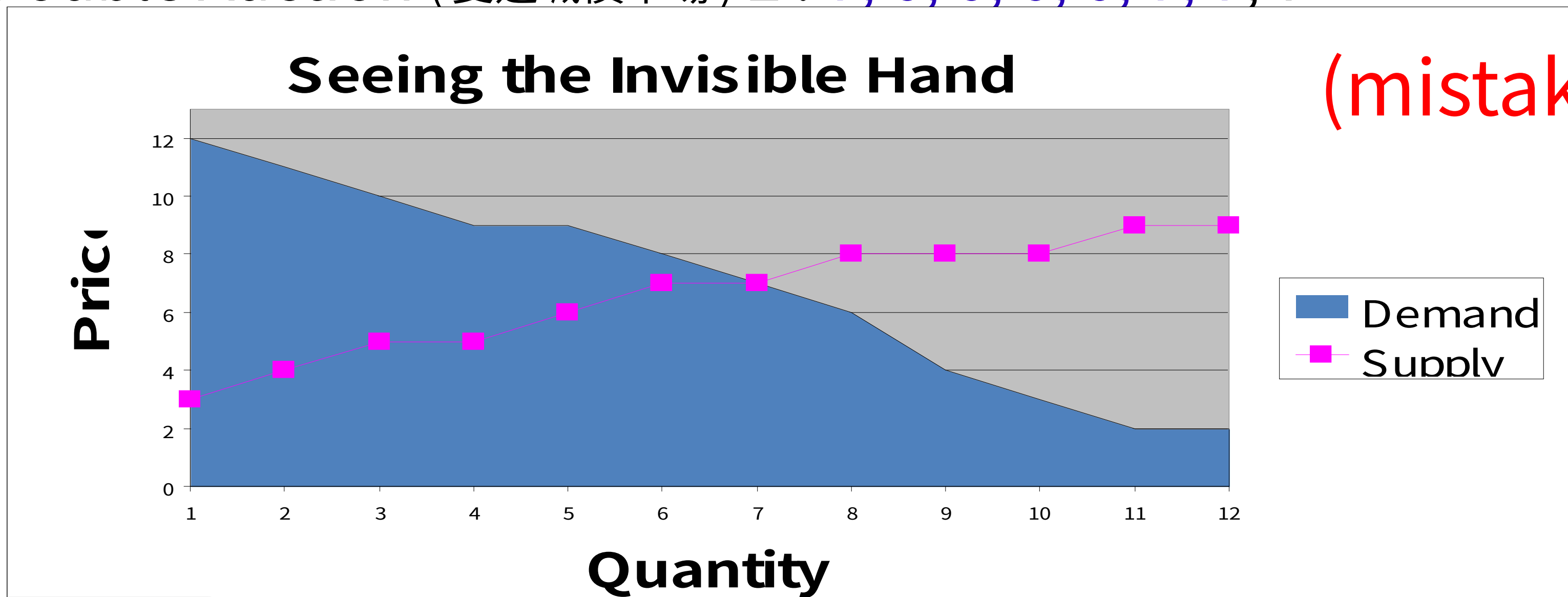
# Seeing the Invisible Hand ( 發現看不見的手 )

- Pit Market ( 交易坑市場 ) 1: 5, 6, 5, 3, 8, 8, 8
- Pit Market ( 交易坑市場 ) 2: 6, 4, 8, 4, 6, 7, 7, 7, 5



# Seeing the Invisible Hand ( 發現看不見的手 )

- Double Auction ( 雙邊喊價市場 ) 1: 6, 10, 7, 7, 7, 8, 8, 7
- Double Auction ( 雙邊喊價市場 ) 2: 7, 6, 6, 6, 6, 7, 7, 7



(mistake?)

# Market Design: Nobel Prize of 2012

– 市場設計：2012 年瑞典央行紀念諾貝爾經濟科學獎得主

- **Lloyd S. Shapley** (夏普利)

- Gale-Shapley algorithm finds stable matching in matching markets (提出演算法求配對分發市場的穩定解)



- **Alvin E. Roth (AER!)** (艾文·羅斯)

- Test this in the lab (在「實驗室」中驗證夏普利的理論)
  - Take this to the field (在「現場」設計穩定配對分發制度)

- Medical Residents, School Choice, Kidney Exchange. (實習醫生、學校分發、器官交換市場等等)



實習醫

# Behavioral Game Theory 行為賽局論 (大綱)

## 1. What is Game Theory Good for?

– (賽局論有甚麼用?)

## 2. Three Examples (三個例子):

1. Ultimatum Bargaining (最後通牒談判實驗)
2. Continental Divide (產業發展分水嶺實驗)
3. Beauty Contests (選美結果猜測實驗)

## 3. Experimental Regularity and Behavioral Game Theory (一致的實驗結果與行為賽局論)

## 4. Conclusion (結論)

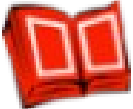
# What is Game Theory? 何謂賽局論？

- Game Theory: What happens if people or nations interact. (賽局論研究「人們」互動的結果)
- Game (賽局): Taxonomy of strategic situations
  - 需要籌思對策的各種情境
  - Strategies (策略), Players (參與者), Payoffs (報酬)
- Important Milestones (重要里程碑)
  - **GEB**: Von Neumann & Morgenstern (1944)
  - **Nash Equilibrium** (奈許均衡): Nash (PNAS, 1950)
  - **Asymmetric information as Types** (把資訊不透明看作每個人有不同類型): Harsanyi (MS, 1967-68)

# What is Game Theory? 何謂賽局論？

- Power of game theory: Generality/precision
  - 賽局論能廣泛應用在不同的領域，也能做精確的預測
- **Analytical Game Theory** (數學賽局「論」)
  - Mathematical derivations of what players with different cognitive capabilities are likely to do
    - 用數學分析不同聰明程度的玩家在不同的賽局採取何種對策
- Possible Barrier: Highly mathematical
- Bigger Problem (可能的問題是需要很多數學，但更大的問題是)
  - Based on introspection and guesses, not observations about how people actually play
    - 根據數學家的自我想像與猜測<sup>21</sup>，而非人們實際上怎麼做

# What is Behavioral Game Theory?

- Von Neumann and Morgenstern (1944):
- “Our knowledge of the relevant facts of economics is incomparably smaller than that commanded in physics at the time when mathematization of that subject was achieved...” 
- 「跟物理學（在三百年前）數理化的時候相比，目前我們對於跟經濟學相關的事實和實證結果真的知道太少了！……

# What is Behavioral Game Theory?

- Von Neumann and Morgenstern (1944):
- “It would have been absurd in physics to expect Kepler and Newton without Tycho Brahe---and...
  - 「在物理學上，要是沒有泰谷的天文觀測紀錄，刻卜勒和牛頓不可能寫出行星運動定律。……」
- “...there is no reason to hope for an easier development in economics.”
  - 「……同樣地，如果沒有足夠資料，經濟學如何有同樣的發展？當然不可能！」



# What is Game Theory Good For? 賽局有啥用？

- Is Game Theory meant to 賽局論可以
  - **Predict** what people do, ( **預測** 人們的行為 )
  - **Explain** why people act this ways, ( **解釋** 人們的行為 )
  - **Advise** people what to do? ( **建議** 人們該怎麼做 )
- Case ( 實例 ): auction theory & real world auctions
  - Auction Theory ( 拍賣理論 )  
vs. Experimental Evidence ( 實驗結果 )
  - Auction Theory ( 拍賣理論 )  
vs. Real World Auction Design ( 拍賣制度設計 )

# Three Examples 三個例子

- **BGT: what players actually do**
  - (行為賽局論：人們實際怎麼做)
  - By utilizing results from hundreds of experiments 根據上百個「爾虞我詐」的實驗結果
- 1. Ultimatum Bargaining (最後通牒談判實驗)
- 2. Beauty Contests (選美結果預測實驗)
- 3. Continental Divide (產業發展分水嶺實驗)

# Three Examples 三個例子

- Goal: Show how BGT can
- explain what people do more accurately
- by **extending** game theory to include:
  - **social preferences (fairness),**
  - **limited strategic thinking, and**
  - **learning.**
- 目的：說明行為賽局論如何更準確預測人們的行為，把**社會（公平）偏好、有限理性思考**和**學習過程**引入數學賽局論。

# 例一：最後通牒談判 (Ultimatum Bargaining)

- 2 players ( 參與者 ): Proposer ( 下通牒的提議者 ) and Respondent ( 回應者 )
- Action of Proposer ( 提議如何瓜分新台幣 100 元 ): First makes a proposal on how to split \$100: 10-90, 20-80, 30-70, 40-60, 50-50,...
- Act of Respondent ( 回應接受或拒絕 ): Accepts or Rejects the proposal.
- Outcome ( 結果 ): Split accordingly if accept, both get nothing if reject.
  - ( 接受則按該提議瓜分 100 元；拒絕則兩人什麼都沒有 )
  - Photographer vs. Tourist ( 觀光景點攝影師兜售照片 )



# 例一：最後通牒談判 (Ultimatum Bargaining)

- **AGT Predictions** (數學賽局論的預測)
  - Responders accept any low offer (回應者通通接受)
  - Proposers offer **unfairly** (提議者提出極不公平方案)
- **Experimental Results** (實驗結果)
  - Responders reject **unfair** offers (回應者拒絕不公平方案)
  - Proposers often offer **fairly** (50-50) (提議**合理**方案)
- **BGT Explanation:** (行為賽局論的解釋)
  - **Negative Reciprocity** (你對我不仁，我就對你不義)

# 例一：最後通牒談判 (Ultimatum Bargaining)

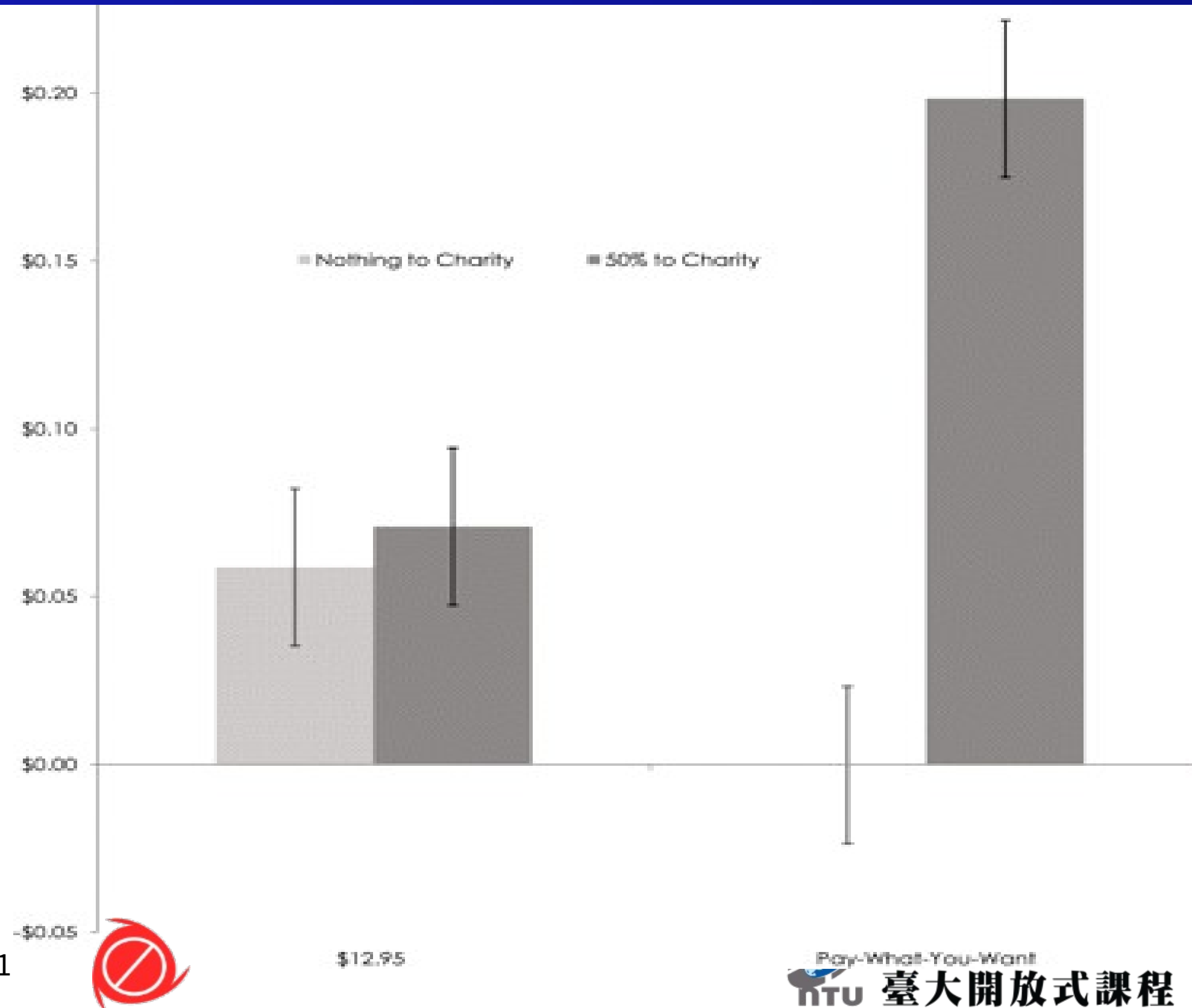
- Responders do not maximize own earnings
  - (回應者並非追求自己「物質上」的報酬最大)
  - Still think strategically (w/ social preferences)
    - 但仍是理性思考，只是有社會偏好、厭惡不公平
- Further Investigation (延伸研究): BGT, Ch.2
- Primitive societies under different culture of fairness (不同原始部落有不同的公平文化) 
- Knoch, ..., Fehr, Science 2006 
  - TMS your DLPFC to accept unfair offers
    - 用穿顱刺激 DLPFC 腦區能讓人接受不公平方案

# Disneyland Photo Field Experiment 還真的有！

- Gneezy et al. (2010), “Shared Social Responsibility: A Field Experiment in **Pay-What-You-Want** Pricing and **Charitable Giving**,” *Science* **329** (5989): 325–327.
  - Change pricing scheme of photo taken at a Disneyland ride (on different days)
- Fixed US\$12.95 vs. Pay-What-You-Want
- Nothing to Charity vs. 50% to Charity\*

# Fig.1 Profit per rider (amount paid minus production costs)

- Problem: This is profit only because Disney did not really donate more money to charity!
- Instead reduced regular donations by the same amount!
- Likely to change results if disclosed...



## 例二：選美結果預測賽局 (p-Beauty Contest)

- Newspaper shows 6 pictures
- Choose one picture and win a prize if
  - you chose the **most chosen** picture
    - 凱因斯認為股票市場就像報紙預測選美結果：
- “It is not a case of choosing those which, to the best of one’s judgment, are really **the prettiest**,
- nor even those which **average opinion genuinely thinks the prettiest**.
  - 「這不是要挑每個人**各自認為最漂亮**的 [臉蛋]，
  - 更不是要挑**大家公認最漂亮**的。

## 例二：選美結果預測賽局 (p-Beauty Contest)

- We have reached the third degree, where we devote our intelligences to
- anticipating what average opinion expects the average opinion to be.
  - 我們已經想到第三層去，
  - 努力預測一般人心目中認為大家公認最漂亮的會是誰。
- And there are some, I believe, who practice the fourth, fifth, and higher degrees.”
  - 而且我相信有些人還可以想到第四層、第五層或更高。」

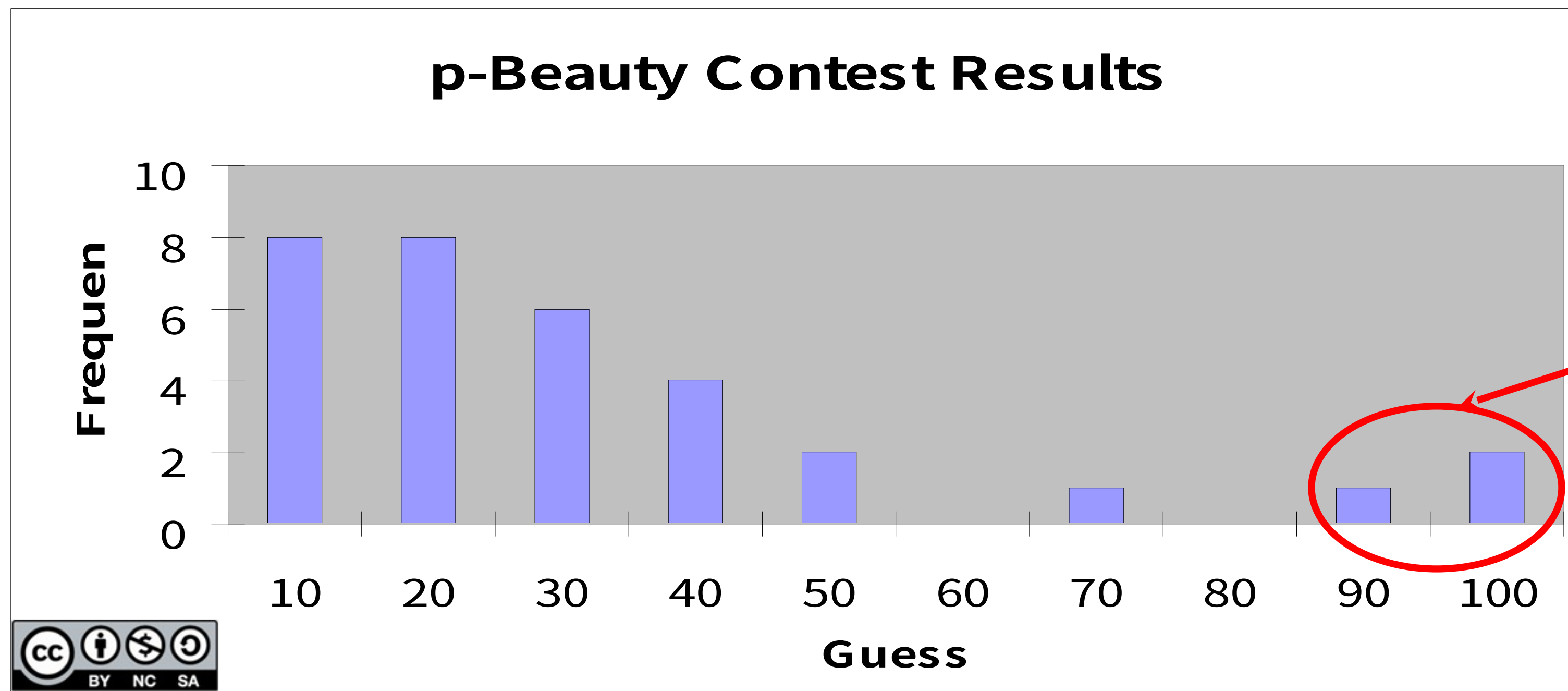
## 例二：選美結果預測賽局 (p-Beauty Contest)

- p-Beauty Contest (Guessing Game)
  - 選美結果預測賽局，又稱「猜測 ( 平均的三分之二 ) 賽局」
- Environment ( 遊戲規則 ): N players ( 參與者 )
- Action of Player ( 參與者的策略 ): Each player guess a number from 0-100
  - 每一位參與者都猜一個 0-100 數字
- Outcome ( 結果 ): Number closest to  $p=2/3$  of the average wins
  - 所猜數字最接近所有猜測數字的平均乘  $p=2/3$  的人就是贏家

## 例二：選美結果預測賽局 (p-Beauty Contest)

- Each pick 0-100 to predict  $\frac{2}{3}$  of the average
- **AGT Predictions** (數學賽局論的預測)
  - Unique Nash: Choose 0 (dominant solvable)
    - 不斷地刪除劣勢策略可解出唯一的 Nash 均衡 (大家都選 0)
- **Experimental Results** (實驗結果)
  - First-round choices (首次平均) around 21-40
  - Converge to 0 within 10 rounds (十回合內到均衡)
- **BGT Explanation:** (行為賽局論的解釋)
  - Limited iterated reasoning (level-k; 多層次思考)
  - Learning: Towards equilibrium (學習「到」均衡)

# Results from 2008 課堂實驗結果



Average =  
27.75

Target =  
18.5

Exclude 3  
obs.

Average =  
20.93

Target =  
13.95

# 例三：產業發展分水嶺 (Continental Divide)

- Location Problem: Silicon Valley or Hollywood?
- 7 a group, each choose 1-14 (一組七人，各選1-14)
- Payoff based on **your choice & group median**
  - 你的報酬取決於**你的數字**和**所有人的中位數**(報酬矩陣見下表)
- Key Feature: (別人選小你也該選小、別人選大你也該選大)
  - Should pick low if others pick low
  - Should pick high if others pick high 
- When everyone is going to China, Hsinchu Science Park, etc. will you follow the trend?
  - 當大家都在竹科(或東莞?)設廠，你會獨排眾議，還是隨波逐流？

# 例三：產業發展分水嶺 (Continental Divide)

|    | 3    | 4   | 5   | 6   | 7  | 8  | 9   | 10  | 11  | 12  |
|----|------|-----|-----|-----|----|----|-----|-----|-----|-----|
| 3  | 60   | 66  | 70  | 74  | 72 | 1  | -20 | -32 | -41 | -48 |
| 4  | 58   | 65  | 71  | 77  | 80 | 26 | 8   | -2  | -9  | -14 |
| 5  | 52   | 60  | 69  | 77  | 83 | 46 | 32  | 25  | 19  | 15  |
| 6  | 42   | 52  | 62  | 72  | 82 | 62 | 53  | 47  | 43  | 41  |
| 7  | 28   | 40  | 51  | 64  | 78 | 75 | 69  | 66  | 64  | 63  |
| 8  | 11   | 23  | 37  | 51  | 69 | 83 | 81  | 80  | 80  | 80  |
| 9  | -11  | 3   | 18  | 35  | 57 | 88 | 89  | 91  | 92  | 94  |
| 10 | -37  | -21 | -4  | 15  | 40 | 89 | 94  | 98  | 101 | 104 |
| 11 | -66  | -49 | -31 | -9  | 20 | 85 | 94  | 100 | 105 | 110 |
| 12 | -100 | -82 | -61 | -37 | -5 | 78 | 91  | 99  | 106 | 112 |



# 例三：產業發展分水嶺 (Continental Divide)

|    | 3    | 4   | 5   | 6   | 7  | 8  | 9   | 10  | 11  | 12  |
|----|------|-----|-----|-----|----|----|-----|-----|-----|-----|
| 3  | 60   | 66  | 70  | 74  | 72 | 1  | -20 | -32 | -41 | -48 |
| 4  | 58   | 65  | 71  | 77  | 80 | 26 | 8   | -2  | -9  | -14 |
| 5  | 52   | 60  | 69  | 77  | 83 | 46 | 32  | 25  | 19  | 15  |
| 6  | 42   | 52  | 62  | 72  | 82 | 62 | 53  | 47  | 43  | 41  |
| 7  | 28   | 40  | 51  | 64  | 78 | 75 | 69  | 66  | 64  | 63  |
| 8  | 11   | 23  | 37  | 51  | 69 | 83 | 81  | 80  | 80  | 80  |
| 9  | -11  | 3   | 18  | 35  | 57 | 88 | 89  | 91  | 92  | 94  |
| 10 | -37  | -21 | -4  | 15  | 40 | 89 | 94  | 98  | 101 | 104 |
| 11 | -66  | -49 | -31 | -9  | 20 | 85 | 94  | 100 | 105 | 110 |
| 12 | -100 | -82 | -61 | -37 | -5 | 78 | 91  | 99  | 106 | 112 |



# 例三：產業發展分水嶺 (Continental Divide)

- AGT Predictions (數學賽局論的預測)
  - Multiple Equilibrium (兩個均衡): 3 or 12
- Experimental Results (實驗結果)
  - Don't always gravitate toward Good Eq.
  - Small history accidents have big LR impact
  - 重複多次不見得會到較好的均衡、歷史的偶然對長期發展有重大影響
- BGT Explanation (行為賽局論的解釋)
  - Learning in the basin of attraction
  - Initial Conditions: Lucky 7 vs. 8 (一路發)?
  - 在「引力範圍」內被牽引，初始條件<sub>40</sub> Lucky 7 vs. 8 (一路發)

# Experimental Regularity 有一致的結果，然後？

- **Goal: Improve** game theory by establishing regularity and inspiring new theory
  - **目的：**改進賽局論（而非推翻），用一致的結果激發新理論
- **Why has empirical observation played a small role in game theory until recently?**
  - 為何實證觀察直到最近才對賽局論有影響？
- **John Nash did experiments at RAND**
  - 奈許本人其實有嘗試跟蘭德智庫一起做賽局實驗，但是…
- **“Unbelievable” PD results?!**
  - 沒有進一步發展是因為囚犯兩難的實驗結果「難以置信」？

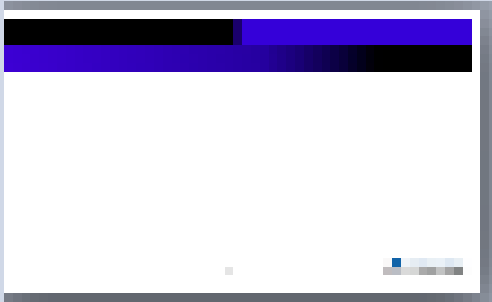
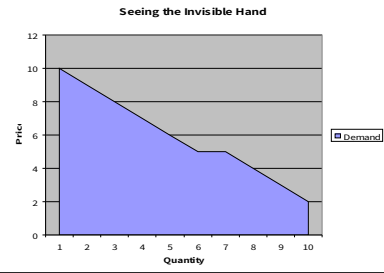
# Experimental Regularity 有一致的結果，然後？

- How others react to (experimental) data?
  - 關於實驗方法的反對意見：
    1. People are confused, not motivated
      - 人們搞錯了、沒誘因？好的實驗設計可克服、讓決策有真實後果
    2. Experimental designs are all bad
      - 實驗設計都很糟？民主政治是最糟的政治制度，但其他更不可行
    3. People were playing a different game
      - 人們其實在做別的？也許是「美麗人生」，但 as-if 模型都如此
    4. Non-rational behavior cannot be modeled
      - 非理性就是亂選？但非理性行為仍可預測 (Predictably Irrational)

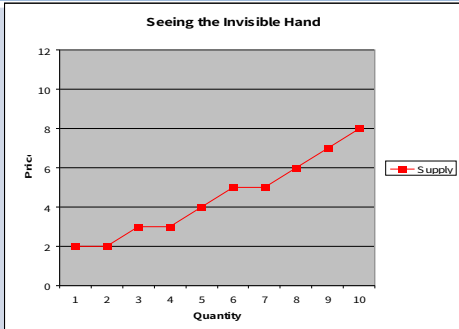
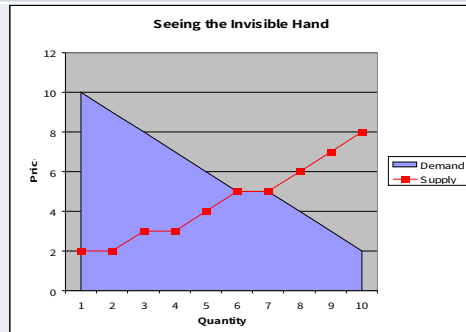
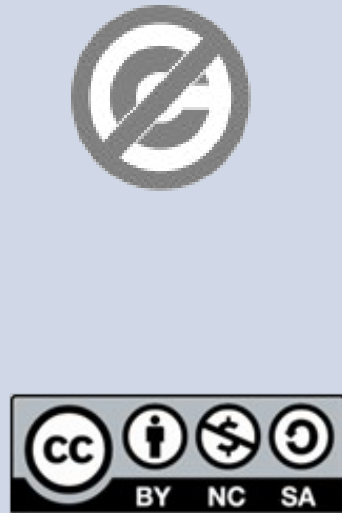
# Conclusion 結論

- AGT  $\boxtimes$  Experimental Regularities  $\boxtimes$  BGT
  - 數學賽局論  $\boxtimes$  看到一致的實驗結果  $\boxtimes$  行為賽局論
- Three Examples (三個例子)
- Want to see more? (更多請見)
  - Camerer (2003), Behavioral Game Theory
- Homework:
  - Read BGT, Ch.1 and Lecture notes (both online)
  - Solve the equilibrium of the 3 examples above
  - 你能解出上述三個例子的均衡嗎？翻翻大二個經課本吧！

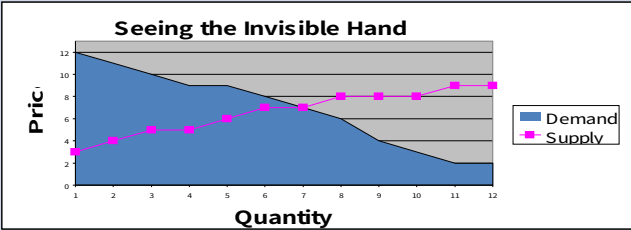
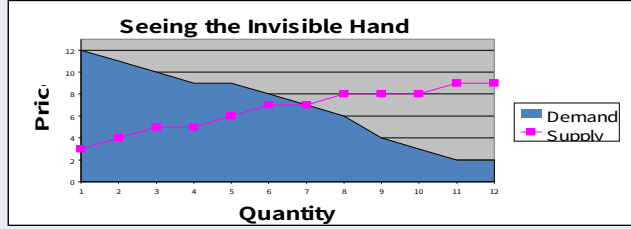
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| 1-43 |                                                                                    |                                                                                             | 國立臺灣大學 經濟學系 王道一 教授                                                                                                                                                                                                 |
| 4    | Science : knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through scientific method    | <br>   | Science / Merriam-Webster Online Dictionary<br><a href="http://www.merriam-webster.com/dictionary/science">http://www.merriam-webster.com/dictionary/science</a><br>瀏覽日期 : 2015/9/20<br>依據著作權法第 46 、 52 、 65 條合理使用 |
| 5    | The scientific method seeks to explain the events of nature in a reproducible way ... or through experimentation that tries to simulate natural events under control | <br> | Scientific method / wikipedia<br><a href="https://en.wikipedia.org/wiki/Scientific_method">https://en.wikipedia.org/wiki/Scientific_method</a><br>瀏覽日期 : 2015/9/20<br>本作品採創用 CC 「姓名標示 - 相同方式分享」 3.0 未本地化版授權釋出      |
| 11   |                                                                                   |                                                                                                                                                                                | 國立臺灣大學 經濟學系 王道一 教授                                                                                                                                                                                                 |

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|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------|------|------|------|------|-----|-----|---|---|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|---|---|-----|-----|---|-----|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|---|-----|-----|-----|-----|-----|-----|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  | 國立臺灣大學 經濟學系 王道一 教授 |      |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
| 13    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  | 國立臺灣大學 經濟學系 王道一 教授 |      |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
| 14    |  <table><tr><th>回合</th><th></th><th>價 格</th><th>買方利潤</th><th>賣方利潤</th></tr><tr><td rowspan="2">交易坑1</td><td>平均值</td><td>6.1</td><td>1</td><td>2</td></tr><tr><td>變異數</td><td>0.8</td><td>5.3</td><td>2.7</td></tr><tr><td rowspan="2">交易坑2</td><td>平均值</td><td>5.6</td><td>1.6</td><td>2.1</td></tr><tr><td>變異數</td><td>1.0</td><td>1.3</td><td>1.5</td></tr><tr><td rowspan="2">雙邊喊價1</td><td>平均值</td><td>5</td><td>3</td><td>2.2</td></tr><tr><td>變異數</td><td>0</td><td>2.5</td><td>0.7</td></tr><tr><td rowspan="2">雙邊喊價2</td><td>平均值</td><td>5.6</td><td>2.4</td><td>2.2</td></tr><tr><td>變異數</td><td>0.3</td><td>2.8</td><td>1.2</td></tr><tr><td rowspan="2">雙邊喊價3</td><td>平均值</td><td>5</td><td>2.5</td><td>1.8</td></tr><tr><td>變異數</td><td>0.4</td><td>2.3</td><td>0.6</td></tr></table> | 回合                                                                                  |                    | 價 格  | 買方利潤 | 賣方利潤 | 交易坑1 | 平均值 | 6.1 | 1 | 2 | 變異數 | 0.8 | 5.3 | 2.7 | 交易坑2 | 平均值 | 5.6 | 1.6 | 2.1 | 變異數 | 1.0 | 1.3 | 1.5 | 雙邊喊價1 | 平均值 | 5 | 3 | 2.2 | 變異數 | 0 | 2.5 | 0.7 | 雙邊喊價2 | 平均值 | 5.6 | 2.4 | 2.2 | 變異數 | 0.3 | 2.8 | 1.2 | 雙邊喊價3 | 平均值 | 5 | 2.5 | 1.8 | 變異數 | 0.4 | 2.3 | 0.6 |  | Chicago Bot.Wiki Commons/user: Leslie/ creator: Jeremy Kemp<br>(<br><a href="https://commons.wikimedia.org/wiki/File:Chicago_bot.jpg">https://commons.wikimedia.org/wiki/File:Chicago_bot.jpg</a><br>)<br>瀏覽日期 : 2015/9/20<br>上 作 品 屬 公 共 領 域 之 藝 術 作 品 |
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| 交易坑1  | 平均值                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 6.1                                                                                 | 1                  | 2    |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
|       | 變異數                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.8                                                                                 | 5.3                | 2.7  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
| 交易坑2  | 平均值                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5.6                                                                                 | 1.6                | 2.1  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
|       | 變異數                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.0                                                                                 | 1.3                | 1.5  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
| 雙邊喊價1 | 平均值                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5                                                                                   | 3                  | 2.2  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
|       | 變異數                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                                                                                   | 2.5                | 0.7  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
| 雙邊喊價2 | 平均值                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5.6                                                                                 | 2.4                | 2.2  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
|       | 變異數                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.3                                                                                 | 2.8                | 1.2  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
| 雙邊喊價3 | 平均值                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5                                                                                   | 2.5                | 1.8  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
|       | 變異數                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.4                                                                                 | 2.3                | 0.6  |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |
| 15    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     | 國立臺灣大學 經濟學系 王道一 教授 |      |      |      |      |     |     |   |   |     |     |     |     |      |     |     |     |     |     |     |     |     |       |     |   |   |     |     |   |     |     |       |     |     |     |     |     |     |     |     |       |     |   |     |     |     |     |     |     |                                                                                       |                                                                                                                                                                                                                                                         |

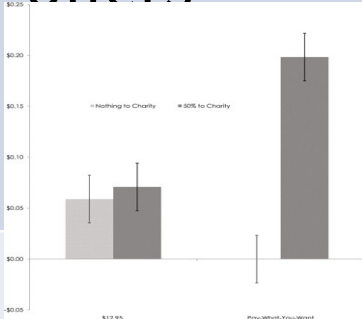
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| 17 |  |    | 國立臺灣大學 經濟學系 王道一 教授                                                                                                                                                                    |
| 18 | Gale-Shapley algorithm finds stable matching in matching markets                   |  | D. Gale and L. S. Shapley, “College Admissions and the Stability of Marriage.” The American Mathematical Monthly, Vol. 69, NO. 1(Jan., 1962), pp. 9-15.<br>依據著作權法第 46 、 52 、 65 條合理使用 |
| 18 | Test... Kidney Exchange                                                            |  | A.E Roth and MAO Sotomayor, Two Sided Matching: A Study in Game-Theoretic Model and Analysis. New York: Cambridge UP, 1992.<br>依據著作權法第 46 、 52 、 65 條合理使用                             |

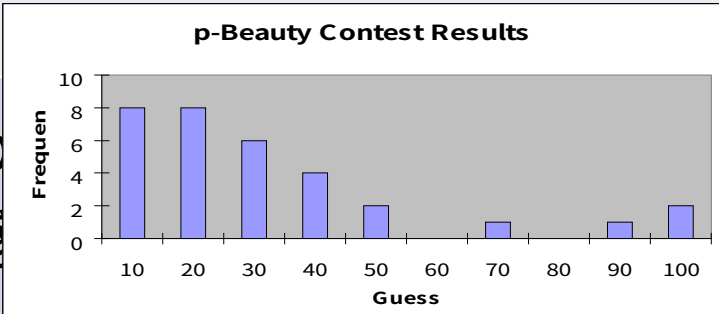
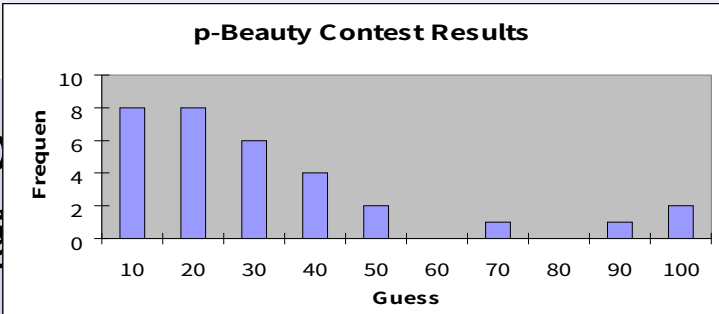
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| 21 | Based on introspection and guesses, not observations about how people actually play                                          |    | Colin E. Camerer, Behavioral Game Theory: Experiments in Strategic Interaction. New York: Russell Sage Foundation; New Jersey: Princeton UP, 2003. Pp. 5<br>依據著作權法第 46 、 52 、 65 條合理使用                                              |
| 22 | Our knowledge of the relevant facts of economics is incomparably smaller than that commanded in physics at the time ...      |    | J. von Neumann and Oskar Morgenstern, Theory of Games and Economic Behavior. Princeton: Princeton UP, 1944. Pp. 4.<br>依據著作權法第 46 、 52 、 65 條合理使用                                                                                    |
| 23 | It would have been absurd in physics to expect Kepler and Newton without Tycho Brahe---and... there is no reason to hope ... |  | J. von Neumann and Oskar Morgenstern, Theory of Games and Economic Behavior. Princeton: Princeton UP, 1944. Pp. 4.<br>依據著作權法第 46 、 52 、 65 條合理使用                                                                                    |
| 24 | Auction Theory ... Auction Design                                                                                            |  | 由王道一教授整理自<br>1. Colin E. Camerer, Behavioral Game Theory: Experiments in Strategic Interaction. New York: Russell Sage Foundation; New Jersey: Princeton UP, 2003. Pp. 6<br>2. Paul R. Milgrom, Putting Auction Theory to Work, New |

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| 27 | Two player ...<br>Both getting rejected                                             |                                                                                             | Colin E. Camerer, Behavioral Game Theory: Experiments in Strategic Interaction. New York: Russell Sage Foundation; New Jersey: Princeton UP, 2003. Pp. 8-9<br>依據著作權法第 46 、 52 、 65 條合理使用            |
| 29 | Primitive societies under<br>different culture of fairness                          |                                                                                             | J. Henrich et al., “In Search of Homo Economicus: Behavioral Experiments in 15 Small- Scale Society.” The American Economic Review Vol.91, No.2(May, 2001), Pp. 73-78<br>依據著作權法第 46 、 52 、 65 條合理使用 |
| 29 | TMS your DLPFC to accept<br>unfair offers                                           | <br> | Daria Knoch et al., “Diminishing Reciprocal Fairness by Disrupting the Right Prefrontal Cortex.” Science, Vol. 314, No. 580 (October 2006), Pp. 829-832.<br>依據著作權法第 46 、 52 、 65 條合理使用              |
| 31 |  |                                                                                                                                                                                | Gneezy et al., “Shared Social Responsibility: A Field Experiment in Pay-What-You-Want Pricing and Charitable Giving,” Science Vol.329, No. 5989 (July 2010), Pp. 326 由所有人授權，您如須利用本作品，請另行向權利         |

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| 32 | <p>It is not a case of choosing those which, to the best of one’s judgment, are really the prettiest, nor even those which average opinion genuinely thinks the prettiest</p>                                                                                                                                               | <br> | <p>J.M. Keynes, “The General Theory of Employment, Interest, and Money, A Project Gutenberg of Australian ebook.<br/>(<a href="http://gutenberg.net.au/ebooks03/0300071h/printall.html">http://gutenberg.net.au/ebooks03/0300071h/printall.html</a>)</p> <p>複製日期：2015/8/20</p> |
| 33 | <p>We have reached the third degree, where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practice the fourth, fifth, and higher degrees.”</p>  |                                                                                       | <p>J.M. Keynes, “The General Theory of Employment, Interest, and Money, A Project Gutenberg of Australian ebook.<br/>(<a href="http://gutenberg.net.au/ebooks03/0300071h/printall.html">http://gutenberg.net.au/ebooks03/0300071h/printall.html</a>)</p> <p>複製日期：2015/8/20</p> |
| 34 |                                                                                                                                                                                                                                         |                                                                                       | <p>Colin E. Camerer, Behavioral Game Theory: Experiments in Strategic Interaction. New York: Russell Sage Foundation; New Jersey: Princeton UP, 2003. Pp. 16<br/>依據著作權法第 46 、 52 、 65 條合理使用</p>                                                                                |
|    |                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                            | 國立臺灣大學 經濟學系 王道一 教授                                                                                                                                                                                                                                                             |

版權聲明

| 頁碼 | 作品                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 版權標示                                                                                  | 來源 / 作者                                                                                                                                                                                                                          |     |    |    |     |     |     |     |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|----|-----|-----|-----|-----|----|----|---|----|----|----|----|----|---|-----|-----|-----|-----|---|----|----|----|----|----|----|---|----|----|-----|---|----|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|---|-----|---|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|----|----|-----|-----|----|-----|-----|-----|----|----|----|----|-----|-----|-----|----|------|-----|-----|-----|----|----|----|----|-----|-----|---------------------------------------------------------------------------------------|--------------------|
| 37 | <p>Location Problem ... pick high.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    | Colin E. Camerer, Behavioral Game Theory: Experiments in Strategic Interaction. New York: Russell Sage Foundation; New Jersey: Princeton UP, 2003. Pp. 12-13<br>依據著作權法第 46 、 52 、 65 條合理使用                                       |     |    |    |     |     |     |     |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 38 | <table><tr><td></td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr><tr><td>3</td><td>60</td><td>66</td><td>70</td><td>74</td><td>72</td><td>1</td><td>-20</td><td>-32</td><td>-41</td><td>-48</td></tr><tr><td>4</td><td>58</td><td>65</td><td>71</td><td>77</td><td>80</td><td>26</td><td>8</td><td>-2</td><td>-9</td><td>-14</td></tr><tr><td>5</td><td>52</td><td>60</td><td>69</td><td>77</td><td>83</td><td>46</td><td>32</td><td>25</td><td>19</td><td>15</td></tr><tr><td>6</td><td>42</td><td>52</td><td>62</td><td>72</td><td>82</td><td>62</td><td>53</td><td>47</td><td>43</td><td>41</td></tr><tr><td>7</td><td>28</td><td>40</td><td>51</td><td>64</td><td>78</td><td>75</td><td>69</td><td>66</td><td>64</td><td>63</td></tr><tr><td>8</td><td>11</td><td>23</td><td>37</td><td>51</td><td>69</td><td>83</td><td>81</td><td>80</td><td>80</td><td>80</td></tr><tr><td>9</td><td>-11</td><td>3</td><td>18</td><td>35</td><td>57</td><td>88</td><td>89</td><td>91</td><td>92</td><td>94</td></tr><tr><td>10</td><td>-37</td><td>-21</td><td>-4</td><td>15</td><td>40</td><td>89</td><td>94</td><td>98</td><td>101</td><td>104</td></tr><tr><td>11</td><td>-66</td><td>-49</td><td>-31</td><td>-9</td><td>20</td><td>85</td><td>94</td><td>100</td><td>105</td><td>110</td></tr><tr><td>12</td><td>-100</td><td>-82</td><td>-61</td><td>-37</td><td>-5</td><td>78</td><td>91</td><td>99</td><td>106</td><td>112</td></tr></table> |                                                                                       | 3                                                                                                                                                                                                                                | 4   | 5  | 6  | 7   | 8   | 9   | 10  | 11 | 12 | 3 | 60 | 66 | 70 | 74 | 72 | 1 | -20 | -32 | -41 | -48 | 4 | 58 | 65 | 71 | 77 | 80 | 26 | 8 | -2 | -9 | -14 | 5 | 52 | 60 | 69 | 77 | 83 | 46 | 32 | 25 | 19 | 15 | 6 | 42 | 52 | 62 | 72 | 82 | 62 | 53 | 47 | 43 | 41 | 7 | 28 | 40 | 51 | 64 | 78 | 75 | 69 | 66 | 64 | 63 | 8 | 11 | 23 | 37 | 51 | 69 | 83 | 81 | 80 | 80 | 80 | 9 | -11 | 3 | 18 | 35 | 57 | 88 | 89 | 91 | 92 | 94 | 10 | -37 | -21 | -4 | 15 | 40 | 89 | 94 | 98 | 101 | 104 | 11 | -66 | -49 | -31 | -9 | 20 | 85 | 94 | 100 | 105 | 110 | 12 | -100 | -82 | -61 | -37 | -5 | 78 | 91 | 99 | 106 | 112 |    | 國立臺灣大學 經濟學系 王道一 教授 |
|    | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4                                                                                     | 5                                                                                                                                                                                                                                | 6   | 7  | 8  | 9   | 10  | 11  | 12  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 3  | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 66                                                                                    | 70                                                                                                                                                                                                                               | 74  | 72 | 1  | -20 | -32 | -41 | -48 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 4  | 58                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 65                                                                                    | 71                                                                                                                                                                                                                               | 77  | 80 | 26 | 8   | -2  | -9  | -14 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 5  | 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 60                                                                                    | 69                                                                                                                                                                                                                               | 77  | 83 | 46 | 32  | 25  | 19  | 15  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 6  | 42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 52                                                                                    | 62                                                                                                                                                                                                                               | 72  | 82 | 62 | 53  | 47  | 43  | 41  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 7  | 28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 40                                                                                    | 51                                                                                                                                                                                                                               | 64  | 78 | 75 | 69  | 66  | 64  | 63  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 8  | 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 23                                                                                    | 37                                                                                                                                                                                                                               | 51  | 69 | 83 | 81  | 80  | 80  | 80  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 9  | -11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3                                                                                     | 18                                                                                                                                                                                                                               | 35  | 57 | 88 | 89  | 91  | 92  | 94  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 10 | -37                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -21                                                                                   | -4                                                                                                                                                                                                                               | 15  | 40 | 89 | 94  | 98  | 101 | 104 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 11 | -66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -49                                                                                   | -31                                                                                                                                                                                                                              | -9  | 20 | 85 | 94  | 100 | 105 | 110 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 12 | -100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -82                                                                                   | -61                                                                                                                                                                                                                              | -37 | -5 | 78 | 91  | 99  | 106 | 112 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 39 | <table><tr><td></td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr><tr><td>3</td><td>60</td><td>66</td><td>70</td><td>74</td><td>72</td><td>1</td><td>-20</td><td>-32</td><td>-41</td><td>-48</td></tr><tr><td>4</td><td>58</td><td>65</td><td>71</td><td>77</td><td>80</td><td>26</td><td>8</td><td>-2</td><td>-9</td><td>-14</td></tr><tr><td>5</td><td>52</td><td>60</td><td>69</td><td>77</td><td>83</td><td>46</td><td>32</td><td>25</td><td>19</td><td>15</td></tr><tr><td>6</td><td>42</td><td>52</td><td>62</td><td>72</td><td>82</td><td>62</td><td>53</td><td>47</td><td>43</td><td>41</td></tr><tr><td>7</td><td>28</td><td>40</td><td>51</td><td>64</td><td>78</td><td>75</td><td>69</td><td>66</td><td>64</td><td>63</td></tr><tr><td>8</td><td>11</td><td>23</td><td>37</td><td>51</td><td>69</td><td>83</td><td>81</td><td>80</td><td>80</td><td>80</td></tr><tr><td>9</td><td>-11</td><td>3</td><td>18</td><td>35</td><td>57</td><td>88</td><td>89</td><td>91</td><td>92</td><td>94</td></tr><tr><td>10</td><td>-37</td><td>-21</td><td>-4</td><td>15</td><td>40</td><td>89</td><td>94</td><td>98</td><td>101</td><td>104</td></tr><tr><td>11</td><td>-66</td><td>-49</td><td>-31</td><td>-9</td><td>20</td><td>85</td><td>94</td><td>100</td><td>105</td><td>110</td></tr><tr><td>12</td><td>-100</td><td>-82</td><td>-61</td><td>-37</td><td>-5</td><td>78</td><td>91</td><td>99</td><td>106</td><td>112</td></tr></table> |                                                                                       | 3                                                                                                                                                                                                                                | 4   | 5  | 6  | 7   | 8   | 9   | 10  | 11 | 12 | 3 | 60 | 66 | 70 | 74 | 72 | 1 | -20 | -32 | -41 | -48 | 4 | 58 | 65 | 71 | 77 | 80 | 26 | 8 | -2 | -9 | -14 | 5 | 52 | 60 | 69 | 77 | 83 | 46 | 32 | 25 | 19 | 15 | 6 | 42 | 52 | 62 | 72 | 82 | 62 | 53 | 47 | 43 | 41 | 7 | 28 | 40 | 51 | 64 | 78 | 75 | 69 | 66 | 64 | 63 | 8 | 11 | 23 | 37 | 51 | 69 | 83 | 81 | 80 | 80 | 80 | 9 | -11 | 3 | 18 | 35 | 57 | 88 | 89 | 91 | 92 | 94 | 10 | -37 | -21 | -4 | 15 | 40 | 89 | 94 | 98 | 101 | 104 | 11 | -66 | -49 | -31 | -9 | 20 | 85 | 94 | 100 | 105 | 110 | 12 | -100 | -82 | -61 | -37 | -5 | 78 | 91 | 99 | 106 | 112 |  | 國立臺灣大學 經濟學系 王道一 教授 |
|    | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4                                                                                     | 5                                                                                                                                                                                                                                | 6   | 7  | 8  | 9   | 10  | 11  | 12  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 3  | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 66                                                                                    | 70                                                                                                                                                                                                                               | 74  | 72 | 1  | -20 | -32 | -41 | -48 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 4  | 58                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 65                                                                                    | 71                                                                                                                                                                                                                               | 77  | 80 | 26 | 8   | -2  | -9  | -14 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 5  | 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 60                                                                                    | 69                                                                                                                                                                                                                               | 77  | 83 | 46 | 32  | 25  | 19  | 15  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 6  | 42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 52                                                                                    | 62                                                                                                                                                                                                                               | 72  | 82 | 62 | 53  | 47  | 43  | 41  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 7  | 28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 40                                                                                    | 51                                                                                                                                                                                                                               | 64  | 78 | 75 | 69  | 66  | 64  | 63  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 8  | 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 23                                                                                    | 37                                                                                                                                                                                                                               | 51  | 69 | 83 | 81  | 80  | 80  | 80  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 9  | -11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3                                                                                     | 18                                                                                                                                                                                                                               | 35  | 57 | 88 | 89  | 91  | 92  | 94  |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 10 | -37                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -21                                                                                   | -4                                                                                                                                                                                                                               | 15  | 40 | 89 | 94  | 98  | 101 | 104 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 11 | -66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -49                                                                                   | -31                                                                                                                                                                                                                              | -9  | 20 | 85 | 94  | 100 | 105 | 110 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 12 | -100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -82                                                                                   | -61                                                                                                                                                                                                                              | -37 | -5 | 78 | 91  | 99  | 106 | 112 |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |
| 41 | <p>Why has... PD results?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | 由王道一教授整理自<br>1.Colin E. Camerer, Behavioral Game Theory: Experiments in Strategic Interaction. New York: Russell Sage Foundation; New Jersey: Princeton UP, 2003. Pp. 21<br>2 Sylvia Nasar A Beautiful Mind: A Biography of John |     |    |    |     |     |     |     |    |    |   |    |    |    |    |    |   |     |     |     |     |   |    |    |    |    |    |    |   |    |    |     |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |   |     |   |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |    |    |     |     |    |     |     |     |    |    |    |    |     |     |     |    |      |     |     |     |    |    |    |    |     |     |                                                                                       |                    |