

請用計量分析說服我

— 從經濟計量到政策研究

管中閔

中央研究院經濟研究所

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◆ 劉大中院士

◆ 劉大中院士與經濟計量

◆ 讓我們來看計量分析

◆ 我們要什麼樣的政策分析

◆ 結論

劉大中院士 (1914 - 1975)

- Ph. D., Cornell University, 1940
- Professor of Economics, Cornell U., 1958-1964
Goldwin Smith Professor of Economics, Cornell U.,
1964 - 1975
- 中央研究院院士, 1960
- Fellow, Econometric Society, 1965
- 臺灣大學經濟學博士班計畫執行委員會主任委員,
1967-1975
- 行政院賦稅改革委員會主任委員, 1968-1970

劉大中



中研院暑期講學班，1966



1966年中央研究院主辦經濟學講學班。（攝於台北南港）

台灣經濟發展會議，1967



梨山會談，1967



梨山會談，1967



A Remarkable Record

- 二十七歲發表論文於頂尖經濟期刊：
American Economic Review
- 五篇頂級期刊 *Econometrica* 論文
- 三篇 *American Economic Review* 論文，
三篇 *AER Papers and Proceedings*
- 一篇 *IER*，兩篇 *REStat*，...
- 教出日後獲得諾貝爾獎的學生 (Robert F. Engle, Nobel prize, 2003)

Liu, T. C. (1941), "China's Foreign Exchange Problems: A Proposed Solution," *The American Economic Review*, 31, 266-279.

CHINA'S FOREIGN EXCHANGE PROBLEMS: A
PROPOSED SOLUTION¹

The foreign exchange situation in China is probably the most complicated existing anywhere in the world. Efforts at stabilization have been unsuccessful, and unless a solution is found the loan made by the United States to China to aid in stabilizing the exchanges will be ineffective and is likely to benefit the Japanese. The problem is integrally related to more fundamental problems of economizing China's war efforts and supporting morale. With the cooperation of the United States the problem could be solved by "freezing" Chinese funds in the United States and putting into effect bilateral clearing arrangements. Such a plan would also strengthen the position of the Chinese currency in the occupied areas and Shanghai, halt the inflation of prices, and serve as an economic weapon against Japan.

I. Introduction

The recent loan to China by the United States for the purpose of stabilizing the Chinese currency² was immediately beset with difficulties which diminish the value of the loan. The nature of the difficulties can be briefly stated.

Having abandoned the silver standard in the year 1935, China adopted the foreign exchange policy of pegging the value of the national currency to pound sterling and the United States dollar through the process of unlimited selling and buying at the official rates by the Chinese governmental banks. Eight months after the so-called "China Incident" which started on July 7, 1937, the Chinese national government had to suspend this policy and to institute other measures of exchange control. Since March, 1938, foreign exchange has been obtainable from the governmental banks at the official rates only on application. As many applications were denied, the unofficial (or "black" market) of foreign exchange emerged, the bulk of the transactions being carried out in Shanghai where the national government has no effective control.

The unofficial rates have been progressively lower than the official rates.³ This decline in the unofficial market is the result of a combination of factors. In addition to the flight of capital and the large excess of imports over exports in the occupied areas and in Shanghai,⁴ operations by the speculative interests and the Japanese-controlled agencies having possession of the Chinese national currency have contributed greatly to the demoralization of the Chinese currency.

In order to maintain the external value of the currency, an official Stabili-

¹ This article is a briefer version of a memorandum prepared for private circulation in January, 1941. The author has benefited from discussion with many persons too numerous to thank by name. Mr. Albert R. Beisel, Jr., has been especially helpful in the preparation of the initial draft; and Professor Paul T. Homan, the present draft.

² A loan of \$50,000,000 was granted to China for the purpose of supporting China's currency. See *The New York Times*, section 1, p. 1, Dec. 1, 1940.

³ See Statistical Appendix I, p. 279.

⁴ See Statistical Appendix II, p. 279.

Polak, J. J. and T. C. Liu (1954), "Stability of the Exchange Rate Mechanism in a Multi-Country System," *Econometrica*, 22, 360-389.

STABILITY OF THE EXCHANGE RATE MECHANISM IN A MULTI-COUNTRY SYSTEM

BY J. J. POLAK AND TA-CHUNG LIU¹

The conditions under which a devaluation will improve a country's balance of payments—stability conditions of exchange rate adjustments—have been extensively dealt with in literature for a two-country system under static conditions. This paper represents an attempt to analyze the complications arising from the introduction of more countries into the system under dynamic conditions.

The dynamic stability conditions for an n -country model have been derived in mathematical terms through a system of difference equations under quite general conditions in the Appendix. Special pain has been taken in the text to interpret these mathematical conditions in economic terms for a more restricted three-country model. Three cases of exchange rate adjustments have been analyzed. It has been found that, provided that each country taken by itself is stable (i.e., that a depreciation of its currency will improve its balance of payments, all other countries' par values remaining unchanged), a sufficient condition for the stability of a three-country system is that, for any pair of countries, the absolute value of the product of the effects on each others' balances, each acting alone, is smaller than the product of the effects on their own balances.

I. INTRODUCTION AND SUMMARY

THE AVAILABLE literature on the stability of the exchange rate mechanism deals almost exclusively with this problem on the assumption of a world consisting of two countries, sometimes in the form of one country and a "rest-of-the-world." The purpose of the present paper is to widen the enquiry to cover a multi-country system.²

¹The authors are indebted to Drs. Stephen Enke and Nicholas Georgescu-Roegen for criticisms and suggestions. It was at Dr. Georgescu-Roegen's suggestion that $\log r_i(t)$, instead of $r_i(t)$, are used as the explanatory variables in equation (49) and that the restriction (53) is introduced. These suggestions made it possible to simplify greatly the interpretation of the stability conditions obtained.

²A first treatment of this problem was contained in J. J. Polak, "Exchange Depreciation and International Monetary Stability," *Review of Economic Statistics*, XXIX, No. 3, August, 1947, pp. 173-182. In that paper it was argued that the two-country approach remained applicable for a multi-country system when the balance of payments disequilibrium that gave rise to the depreciation of a currency was a price disequilibrium or "overvaluation" in the narrow sense of the word. In that case and assuming that all domestic prices have risen proportionately and that the extent of depreciation has been determined by the degree of overvaluation, depreciation will not only eliminate the deficit in the balance of payments of the depreciating country, but will also restore the *status quo ante* in the balance of payments of all other countries. But, it was argued, when a country depreciates to meet a structural disequilibrium resulting from shifts in the country's schedules of demand for and supply of foreign exchange, new disequilibria are created in the balance of payments of other countries which may necessitate further exchange rate adjustments.

A number of commentators have pointed out that it cannot as a general rule be assumed that a price disequilibrium means that all domestic prices have risen proportionately (see, e.g. T. G. Balogh, "Exchange Depreciation and Economic Readjustment," *Review of Economics and Statistics*, November, 1948, p. 280ff., and C. Bresciani-Turroni, "Fundamental

Engle, R. F. and T. C. Liu (1972), “Effects of Aggregation Over Time on Dynamic Characteristics of an Econometric Model,” *NBER*, 36.

EFFECTS OF AGGREGATION OVER TIME ON DYNAMIC CHARACTERISTICS OF AN ECONOMETRIC MODEL

ROBERT F. ENGLE · Massachusetts Institute
of Technology
TA-CHUNG LIU · Cornell University

The paper examines the biases in estimates of the average lag and long-run marginal propensity which result when a model of the general Koyck-Nerlove variety is estimated with data which is aggregated over time. The problem is analyzed in simple terms, and then the approach is generalized by using spectral analysis. These theoretical calculations are then compared with the experience of aggregating Liu's (1969) monthly model of the U.S. economy to quarterly and annual forms, and estimating these with two-stage least squares and a nonlinear regression program designed to compensate for serial correlation in the disturbance. The single-equation results are compared with the theoretical analysis to substantiate the validity of the analytical approach. The systems of equations are then compared by examining dynamic interim multipliers and eigenvalues of the different sets of regression coefficients.

MODERN economic theory, in its effort to forecast the future and to describe the operation of complex economic systems, has become much concerned with the temporal interrelationships between economic variables. The empirical analysis of this problem has been pursued most successfully by using distributed-lag models as tools for econometric research. These models are often rich in dynamic structure, since difference-equation analysis on the estimated coefficients can yield insight into short- and long-run cyclical and noncyclical characteristics

NOTE: The authors are grateful to F. M. Fisher and E. Kuh for helpful comments on an early draft. The theoretical analysis in Section 2 is a summary of the results obtained by Engle in his Ph.D. thesis, *Biases from Time Aggregation of Distributed Lag Models*, Cornell University, 1969, under the supervision of Liu. The empirical research in Section 3 has been formulated jointly by the authors.

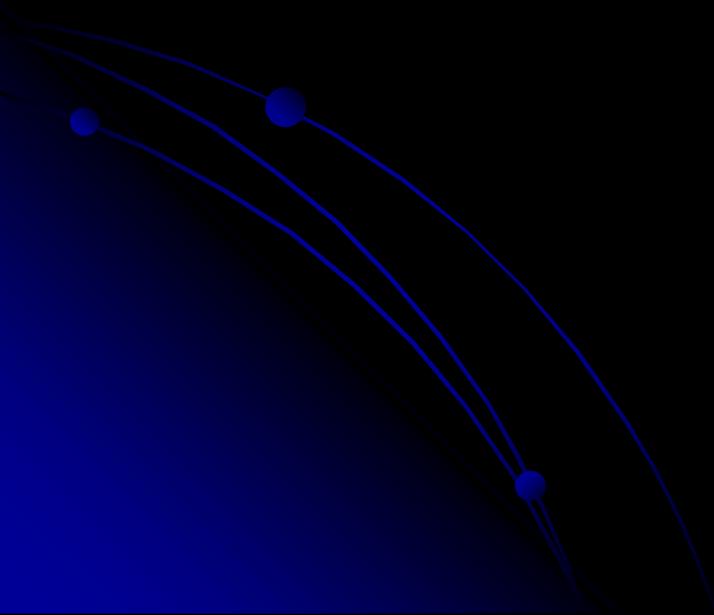
第一次賦稅改革委員會 (1968-1970)

- 成立目的：通盤檢討當時賦稅結構及稅務行政，建立公平合理之賦稅制度，以促進經濟穩定與成長。
- 成員：劉大中、李國鼎 (經濟部長)、俞國華 (財政部長)、徐柏園 (央行總裁)、陶聲洋 (國際經合會秘書長)、張導民 (主計長)、李榦 (國建會經濟組召集人)、周宏濤、蔣碩傑、張茲闓、邢慕寰。
- 主要工作：調整所得稅與間接稅之比重，開徵遺贈稅 (1973)，調整關稅稅率結構，成立財稅資料處理中心，設置稅務稽核組。

經濟成長率

Year	實質 GDP 單位：新台幣百萬元	Growth Rate	Per capita GDP 單位：新台幣元
1968	801,958	9.29	57,509
1969	875,288	9.14	61,363
1970	975,173	11.41	66,953
1971	1,100,399	12.84	74,026
1972	1,246,712	13.30	82,335
1973	1,407,296	12.88	91,223
1974	1,426,659	1.38	90,818
1975	1,497,151	4.94	93566
1976	1,706,218	13.96	104490
1977	1,882,015	10.30	112959
1978	2,139,296	13.67	126034

劉大中院士與經濟計量



劉大中先生的學術貢獻之一

- 計量方法：Simultaneous equation system 的認定 (identification)，估計與檢定
- 常見的問題：經濟計量與統計的差異？
 - 針對經濟問題的特殊性
 - Example: Structural simultaneous equation system
 - Cowles Commission: R. Frisch, T. Koopmans, L. Klein, T. Haavelmo, T. W. Anderson, C. Christ

為什麼需要經濟計量？

“An ultimate aim of economics is to give accurate **quantitative expression** to economic behavior both for understanding the past and for predicting the future.”

— 劉大中, Structural Estimation and Forecasting ,
清華學報, 1963

什麼是經濟計量分析？

- 計量分析是根據經濟知識（理論）與訊息集合，透過科學方法掌握特定經濟變數過去行為的規則性，並對其未來行為加以判斷。
 - 特定經濟變數：股票價格，經濟成長率，通貨膨脹率，失業率
 - 經濟知識：市場均衡，效率市場，景氣循環
 - 訊息集合：各種經濟變數的過去數據
 - 科學方法：經濟計量模型與計量方法
- 沒有適當的計量分析與實證證據，經濟理論或假設就只是空中樓閣

計量分析 as A Structure Analysis

- 計量分析以模型來分析經濟變數的條件行為
 - 利用訊息集中的變數 X 來解釋 Y (Y conditional on X)
 - 建立變數 X 與 Y 之間的結構關係，也控制不同變數 X 對 Y 的影響
- 一般敘述統計 (descriptive statistics) 沒有利用其他變數的訊息，而忽略其他變數的影響可能造成錯誤推論。
- 計量分析不僅要以數字來呈現經濟現象，更重要的是用正確的數字來呈現。

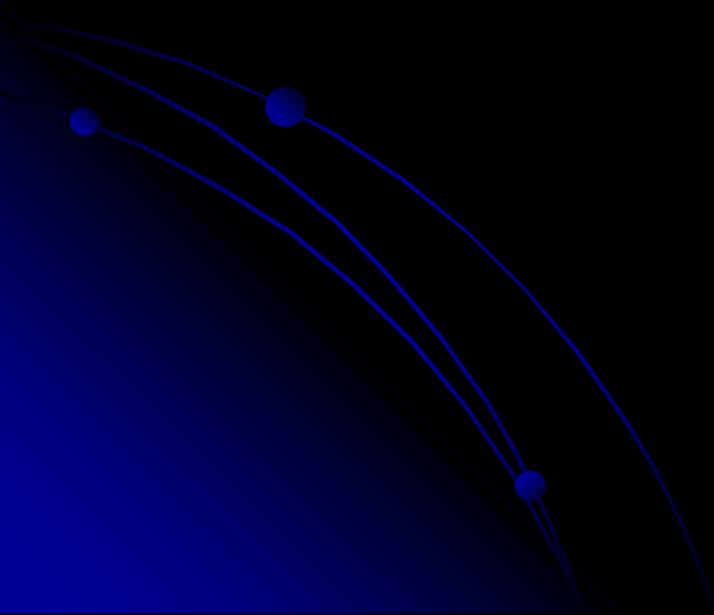
Liu, T. C. (1963). "An Exploratory Quarterly Econometric Model of... U.S. Economy," *Econometrica*, 31, 301 - 348

- **Simultaneous equation system**: 1947:III – 1959:IV
- Example: I_t depends on GNP_t , r_{Lt} , m_{bt} , $(F/GNP)_t$, t , K_{t-1} , I_{t-1} , I_{t-2} , $(GNP/K)_t$
 - Dynamic behavior: distributed lag
 - Long-term trend
 - Nonlinearity and asymmetry effects
- Extrapolations and Simulations for 1960 – 1962
- Drawback: Giving up some 2SLS estimates (due to their insignificance)

Liu, T. C. (1959). "Structural Changes in the Economy of the Chinese Mainland, 1963 to 1952 – 1957," *AER*, 49, 84 - 93

- "During the past two decades, China has undergone changes so violent, extensive, and intensive as perhaps no other nation has experienced in such a short time."
- Estimate domestic product and expenditure (and their components) in 1933, 1952 and 1957
 - In constant 1933 prices
 - In constant 1952 prices
- Comparison in constant prices: **Compare the comparables**

讓我們來看計量分析

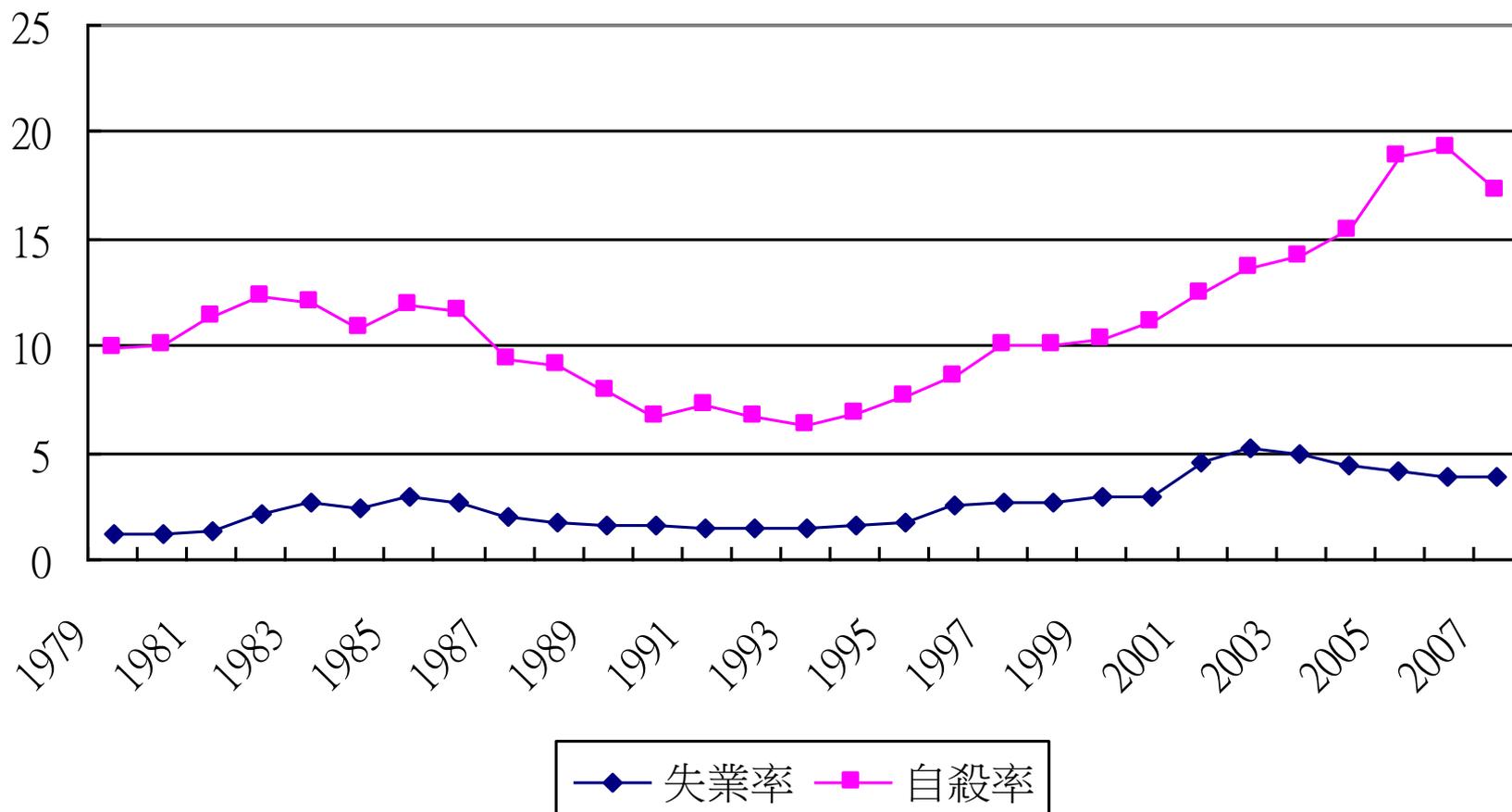


例：失業率與自殺率

- 自殺人數：2281 人 (1999)，3933 人 (2006)。
- 自殺率 (十萬分之一) 與什麼經濟變數有相關性？
- 自殺率 (Y) 與失業率 (X)：

	失業率	自殺率
2003	4.99	14.16
2004	4.44	15.31
2005	4.13	18.84
2006	3.91	19.3

失業率與自殺率：1979-2007 (訊息集合)



自殺率的計量分析 I

- 模型： $Y_t = a + b t + c X_t + e_t$, 1979-2007

Y ：自殺率； X ：失業率 (GDP 成長率，離婚率)

- 控制時間趨勢 t 下，(前一期或當期) **失業率顯著影響自殺率**，而 GDP 成長率則否。
- $c \approx 2.7$ ：前一年失業率每增加 1%，今年自殺率增加 2.7，約 616 人。
- $R^2 = 0.64$ ：自殺率中約 2/3 的變動可由前一期的失業率與時間趨勢 t 來解釋。

自殺率的計量分析 II

- 模型： $Y_t = a + b t + c X_t + e_t$, 1979-2007
- 當 X_t 為同年的失業率：傳統計量方法必須調整，以避免「同期性偏誤」(simultaneity bias)
- 2SLS 方法
 - 以前一期失業率為工具變數
 - $c \approx 2.9$ ：同年失業率每增加 1%，當年自殺率增加 2.9，約 662 人。
- 傳統方法低估失業率的影響： $c \approx 2.59$ ，約 591 人

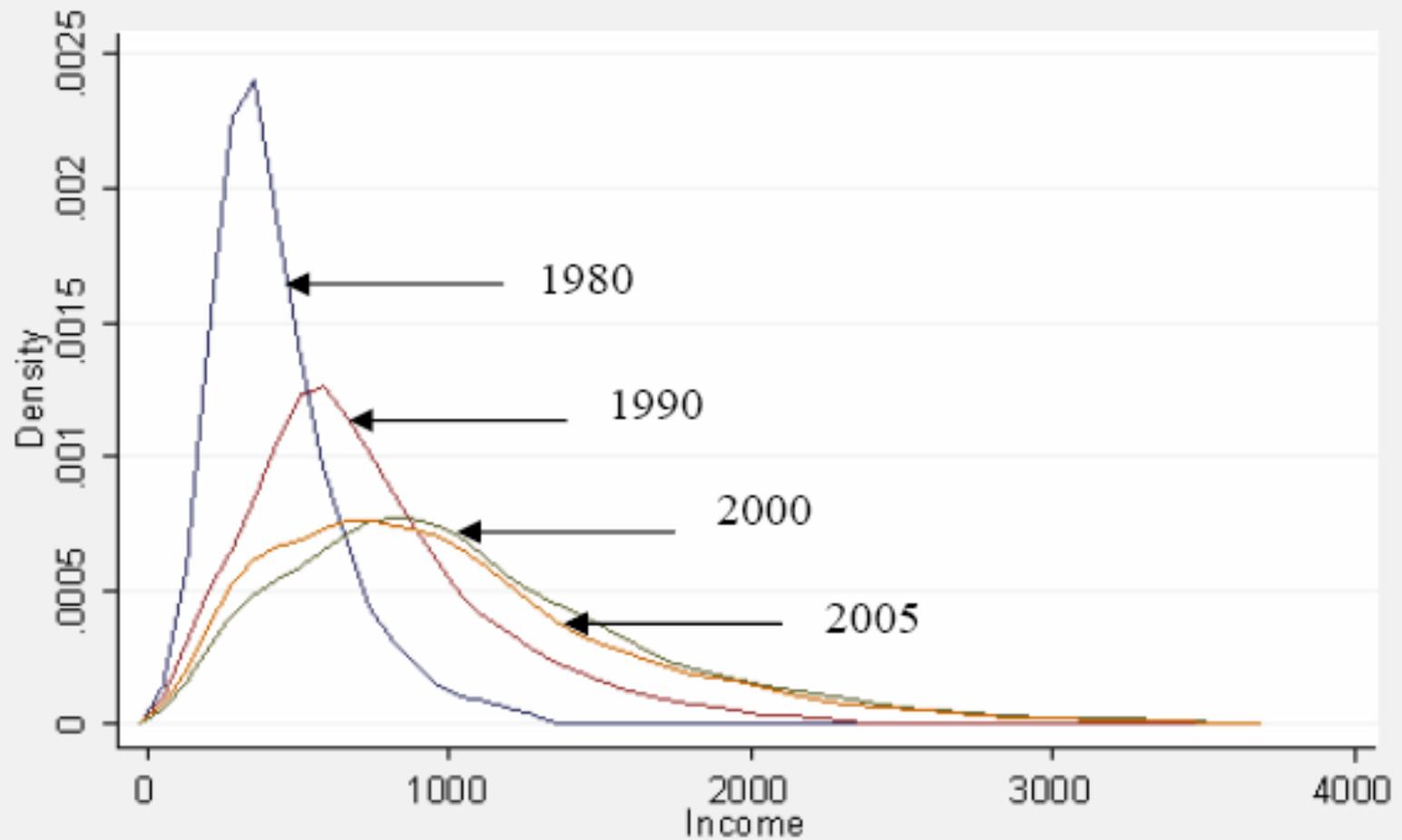
例：所得分配與「M 型社會」

- 所得最高與最低 20% (10%) 家戶的平均所得比值

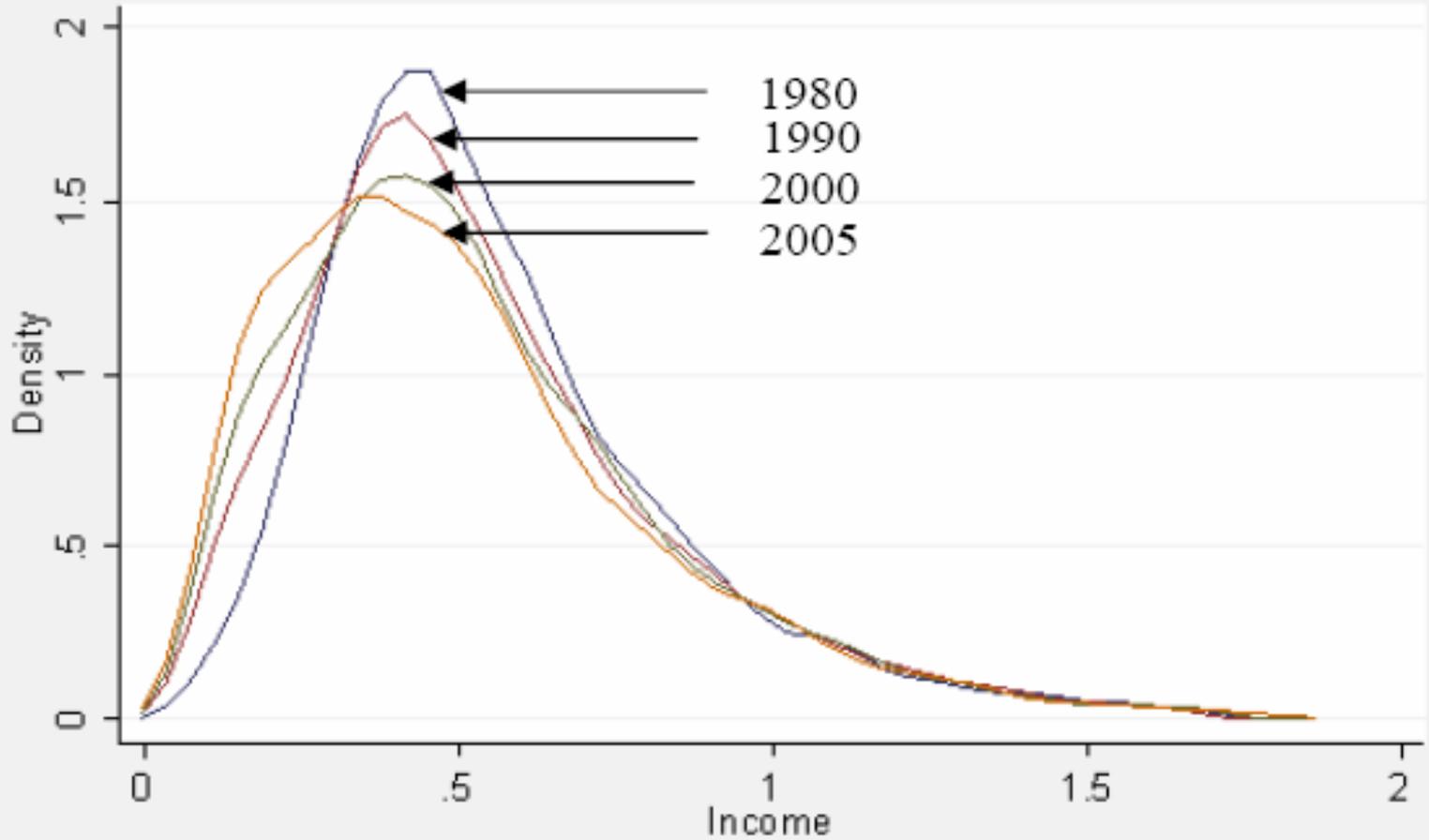
1980	4.28	(6.59)
1990	5.30	(8.92)
2000	5.86	(8.17)
2005	6.49	(10.73)

- 大前研一的說法：所得不均度增加，趨向 M 型社會
- 是否出現 M 型社會是一個實證問題

不同年度的實質所得分配



不同年度的相對所得分配



所得最低與最高 20% 家戶

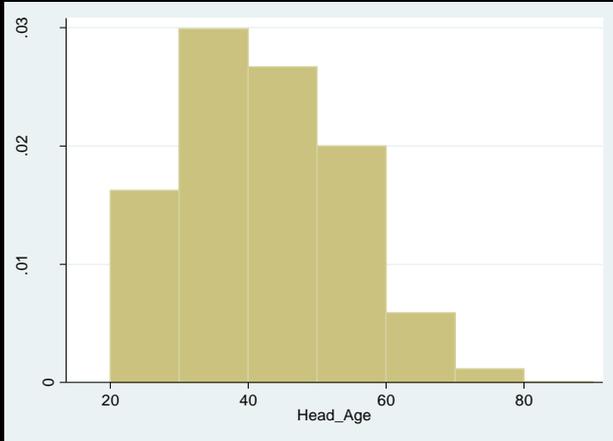
單位：新台幣元；%

資料年度	變數	所得最低20%家戶		所得最高20%家戶	
		平均數	標準差	平均數	標準差
1980	家戶總所得	193,046	51,605	826,806	318,421
	儲蓄率	0.15	0.25	0.38	0.17
1990	家戶總所得	281358	93152	1490752	609403
	儲蓄率	0.10	0.53	0.36	0.21
2000	家戶總所得	374,531	121,339	2,195,486	776,717
	儲蓄率	0.08	0.34	0.28	0.20
2005	家戶總所得	330,320	102,708	2,145,175	824,832
	儲蓄率	0.00	0.37	0.27	0.19

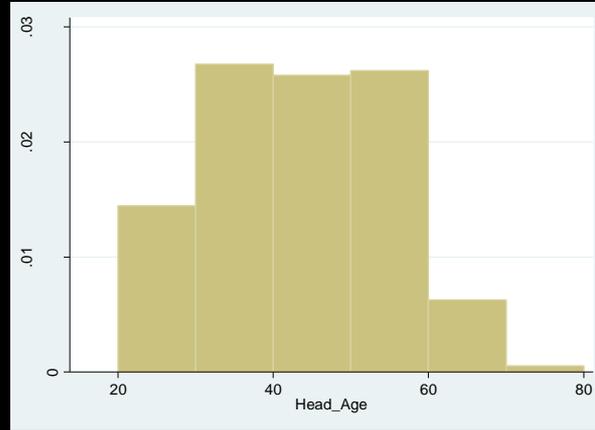
所得最低與最高 20% 家戶特性跨年度比較

資料年度	變數	所得最低20%家戶		所得最高20%家戶	
		平均數	標準差	平均數	標準差
1980	戶長年齡	43.92	14.26	43.00	11.27
	戶長為女性	0.14	0.35	0.05	0.21
	家戶規模	3.66	1.89	5.67	2.37
	家戶所得人數	1.32	0.55	2.37	1.23
1990	戶長年齡	51.29	16.23	43.29	10.95
	戶長為女性	0.23	0.42	0.07	0.26
	家戶規模	2.66	1.55	4.96	1.93
	家戶所得人數	1.16	0.38	2.46	1.14
2000	戶長年齡	58.44	16.48	45.08	10.01
	戶長為女性	0.36	0.48	0.11	0.32
	家戶規模	1.93	1.02	4.50	1.68
	家戶所得人數	1.05	0.23	2.37	1.03
2005	戶長年齡	61.65	15.50	45.82	9.99
	戶長為女性	0.36	0.48	0.15	0.36
	家戶規模	1.87	0.88	4.24	1.54
	家戶所得人數	1.04	0.19	2.30	0.97

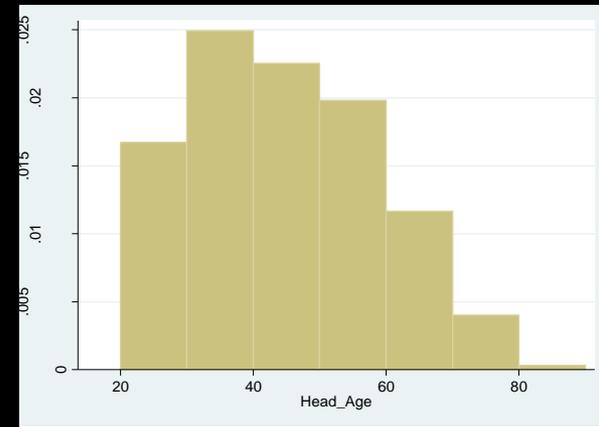
1980 與 2005 年的戶長年齡分佈



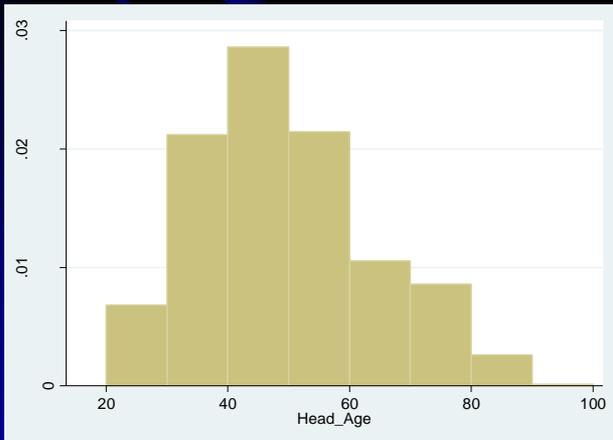
1980



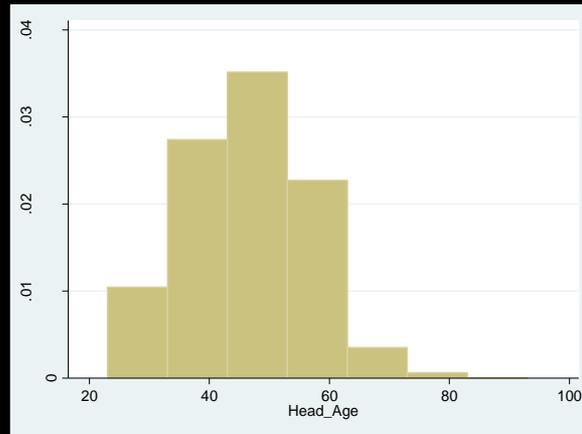
1980 高所得20%



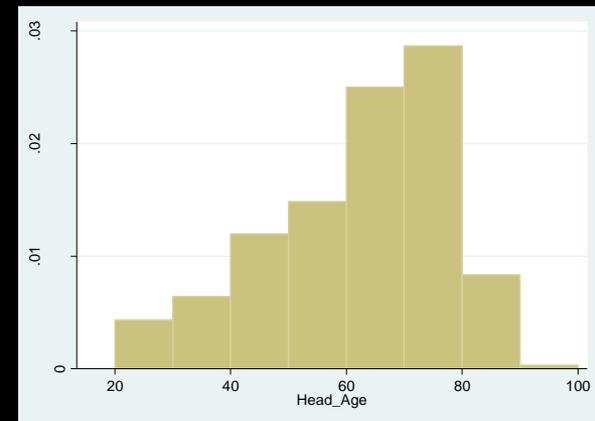
1980 低所得 20%



2005

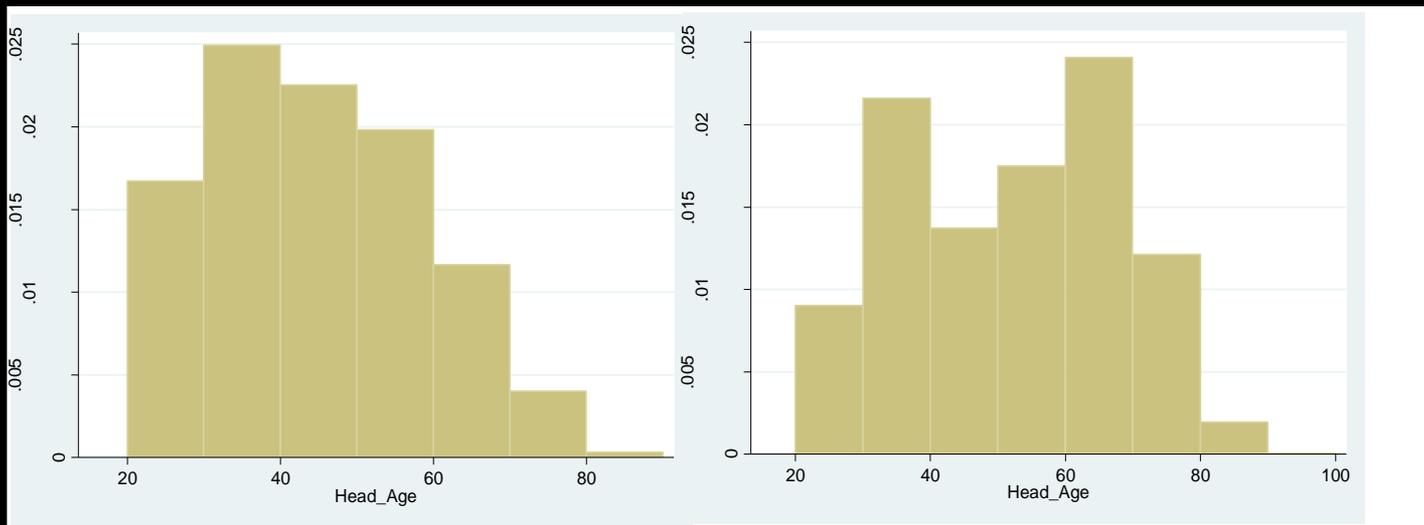


2005 高所得20%



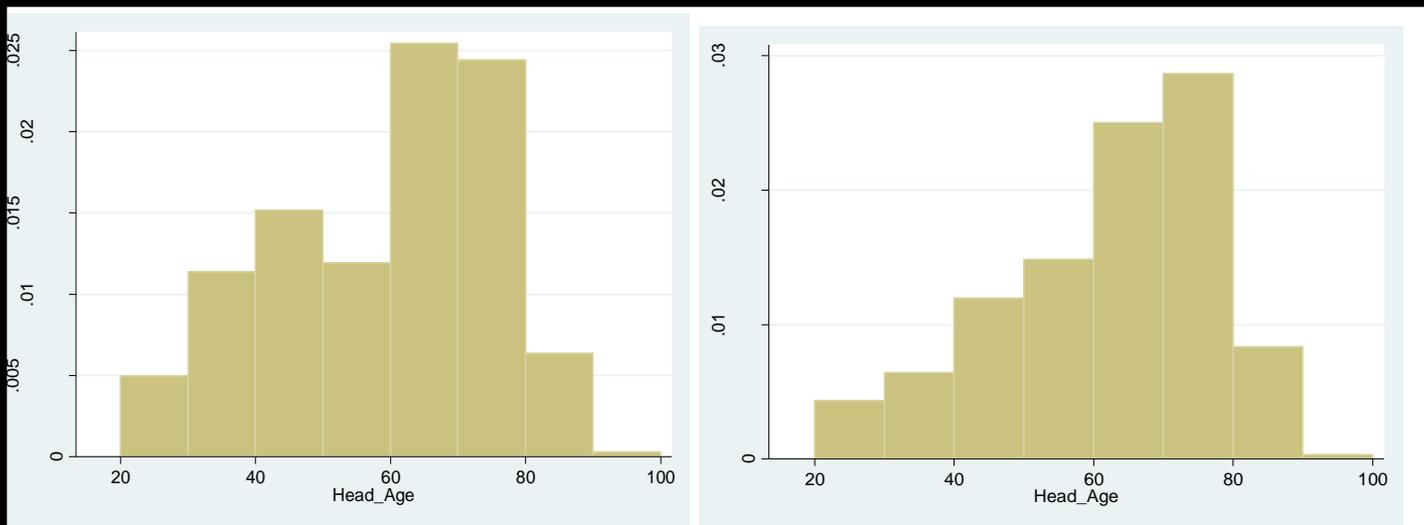
2005 低所得 20%

不同年度所得最低 20% 家戶的戶長年齡分佈



1980

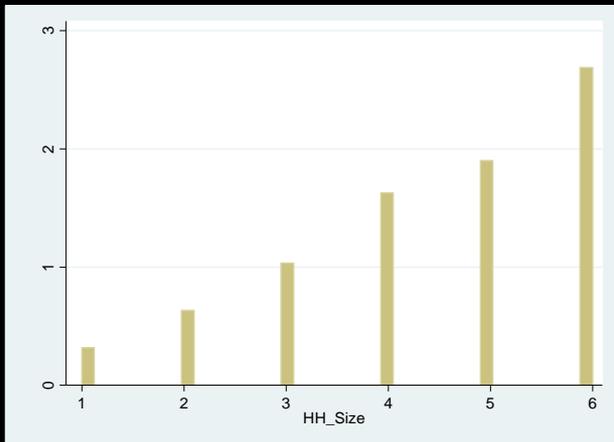
1990



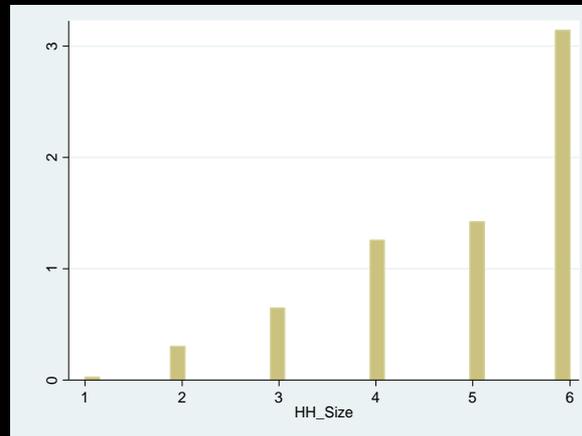
2000

2005

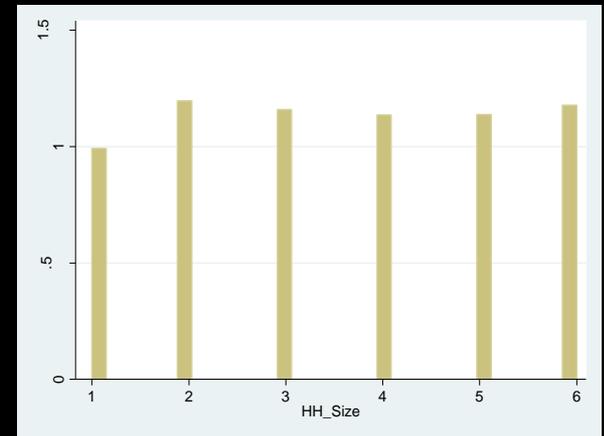
1980 與 2005 年的家戶規模分佈



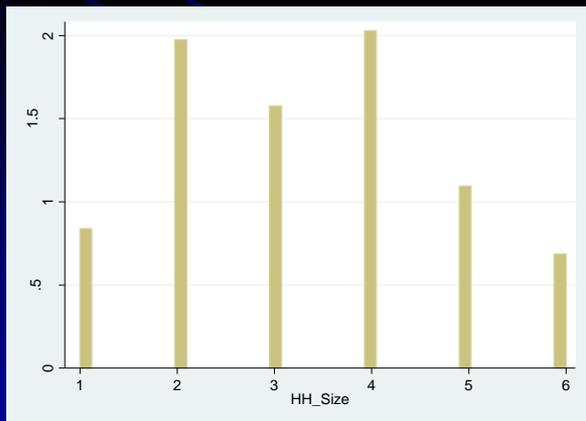
1980



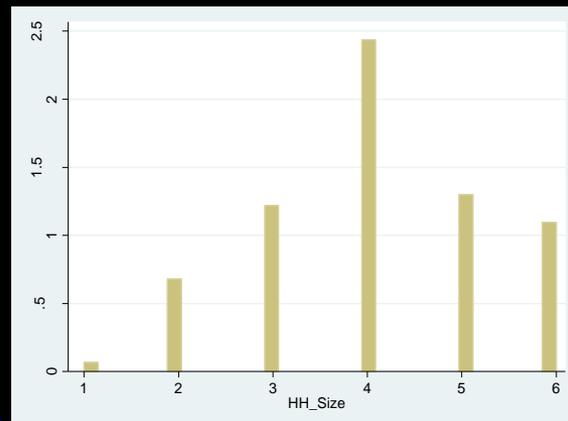
1980 高所得20%



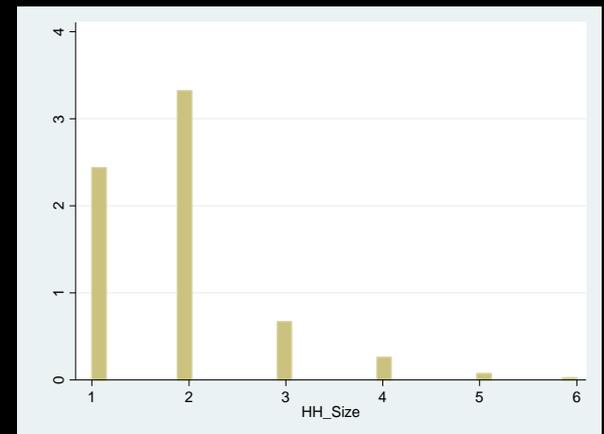
1980 低所得 20%



2005



2005 高所得20%



2005 低所得 20%

2005 年所得最低 20% 家戶構成

- 戶長年齡超過 60 歲者佔 61%
- 戶長年齡小於 60 歲者女性戶長佔 45%
 - 40 歲以下：無配偶者 86%
 - 40--60 歲：無配偶者 66%
- 家戶規模 1.87；所得人數 1.04

所得不均度的擬真計算

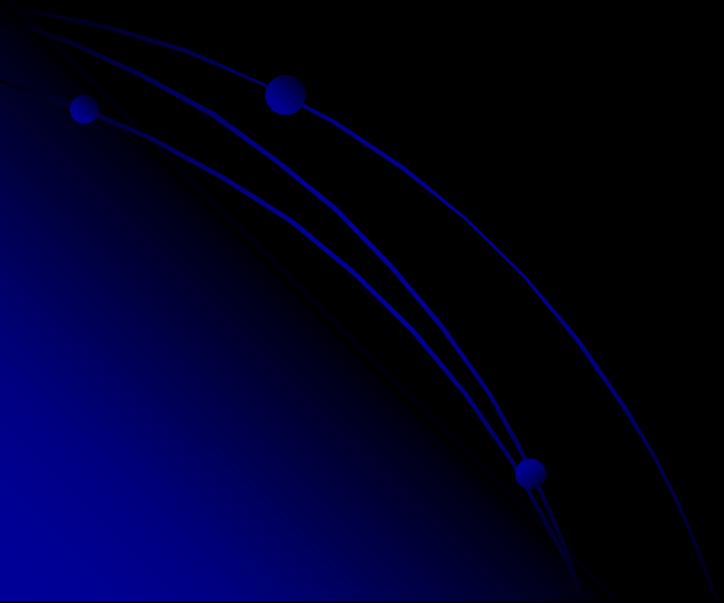
- **擬真 (Counterfactual)**：設法使 2005 年的樣本符合以前年代的樣本特性，然後加以比較 (try to compare the comparables)。
- 選擇「戶長年齡」與「家戶規模」調整樣本。

	Counterfactual	
	1980	1990
只控制戶長年齡	5.19	5.56
只控制家戶規模	4.67	5.45
同時控制兩者	4.54	4.99
當年的比值	4.28	5.30

請用「計量分析」說服我

- 計量分析是分析性的 (analytical)，而不是敘述性的 (descriptive)
- 計量分析藉由經濟變數的結構關係，可以驗證經濟理論，也可以預測未來的變動。
- 計量分析可以為政策提供實證依據與數字基礎，使我們得以做到「以數字管理」。
- 不需臆測，請用「計量分析」的數字來說服我。

我們要什麼樣的政策分析？



政策分析的三種階段

- 基礎分析
 - 相關背景與研究
 - 收集與整理數據
- 計量分析
 - 建立分析架構與模型
 - 估計模型並檢定估計結果
 - 討論政策意涵
- 改進現有的計量分析
 - 設計新計量方法
 - 改善舊計量方法

政策研究單位

民間智庫

學術研究單位

全民健保「論質計酬制」的效果

- 基礎分析

- 論質計酬制 (quality payment) 的背景與各種作法
- 以結核病治療的論質計酬制為例：健保制度現有的作法與相關病患的數據

- 計量分析

- 傳統分析：完治率為 78% (加入論質計酬制的醫院) vs. 42% (未加入制度的醫院)，所以完治率提高 36 % (average treatment effect, ATE)
- 新的非參數方法：在控制各種疾病與社經變數的影響後，ATE 僅約 13% (vs. 36%) .

- 方法改進：控制選擇性偏誤 (selection bias)

對政策研究的理解

- 誤解：政策研究只是敘述性的或圖表式的，甚至可能只有籠統臆測。
- 正解：
 - 除了敘述部分，政策研究也可以是分析性的。
 - 除了圖表部分，政策研究也可以包括計量估計與檢定。
 - 政策研究應有科學依據，精確的推論與預測。
- 計量分析與政策研究二者不是（也不該是）互斥，而應互補。

結論

- 經濟活動更加複雜，經濟型態日新月異。
- 經濟數據愈來愈多，計量分析工具的功能愈來愈強大，也愈來愈有效。
- 政策研究若要能掌握經濟活動的核心變化，就必須充分利用數據，有效分析。經濟計量的重要性在此。
- 如何讓計量工作能融入政策研究，也讓政策制定者能理解並接受計量分析的結果，對此，經濟計量的研究者責無旁貸。