

# GRADUATE EDUCATION IN ECONOMICS: MICROECONOMICS AT CHICAGO AND YALE IN THE 1960s

BY  
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## I. INTRODUCTION

The purpose of this paper is to compare some of the basic graduate training received by students in the 1960s at two of the leading economics departments – the University of Chicago and Yale University. This comparison is useful and meaningful because it is widely acknowledged that a distinct Chicago School of Economics had been established by the early 1960s; the first explicit description of this school of thought was provided by H. Laurence Miller (1962). Yale is chosen for the purpose of comparison because the program in economics was also highly regarded as a graduate program, but was quite different from Chicago in the nature of the training in microeconomics. In addition, the Cowles Commission had moved from Chicago to Yale in 1955 after several years of disagreement between economics faculty at Chicago (led by Milton Friedman) and Cowles Commission staff members on matters of methodology and research strategy in economics. As shown by Arthur Diamond and Donald Haurin (1994) in a summary of surveys, during the time in question (the mid 1960s) Chicago at number three and Yale at number four had comparable rankings for quality among departments of economics in the United States. Harvard was ranked first and MIT was ranked second. A brief discussion of the Harvard PhD program is included below.

The paper concentrates on a comparison of price theory at Chicago and microeconomic theory at Yale as taken by graduate students in their first year. Often it is observed that, while distinctly different schools of thought coexist in macroeconomics, economists generally agree on microeconomics. This paper shows that such was not the case in the 1960s, and that the basic training received by PhD students reflected deep differences regarding how research in economics ought to be

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ISSN 1053-8372 print; ISSN 1469-9656 online/09/02000161-180 © 2009 The History of Economics Society  
doi:10.1017/S1053837209090178

conducted. Differences in basic training are important because they have influenced the field for decades afterwards as those who were educated in the 1960s went on to successful and influential careers.

At the outset my hypothesis is that the differences in graduate training were derived ultimately from a fundamental disagreement about the purpose of economic analysis – what ought to be (i.e., the ultimate objective in normative economic analysis). The “new” welfare economics of the 1930s and 1940s asserted that the ultimate objective of economic analysis is the maximization of the utility of the members of the society, subject to resource constraints. This theory involved extending the idea of Pareto optimality and movements thereto to the more general class of situations of potential Pareto improvements – benefits exceed costs (all properly measured). The theory also introduced the concept of the social welfare function as a function of the utility levels of the individual members of the society. As we shall see, graduate training at Yale (and Harvard as well) was based partly on this approach. In addition, while the Pareto optimality of perfectly competitive equilibrium under standard assumptions was emphasized, the sources of market inefficiency (externalities, public goods, market power) and corrective public policies were also emphasized.

As we shall see, the approach at Chicago was different in that its origins are clearly in the older Marshallian tradition that was continued by Jacob Viner, Frank Knight, and others. Milton Friedman was hired to teach price theory at Chicago in 1946, and continued to teach a two-quarter sequence until 1964 (and then again from 1972 to 1976). J. Daniel Hammond (1999, p. xiv) has determined that the origin of Friedman’s price theory courses is found in the two-semester course he taught at Columbia University in 1939–40 titled “The Structure of Neo-classical Economics.” As Hammond (1999, p. xiv) states, the archives of the Hoover Institution “. . . show that Friedman’s Chicago price theory courses originated with ‘The Structure of Neo-classical Economics’.” The Chicago reading lists contain almost all of the items on the Columbia reading list, and these items remained the core readings in the early 1960s. As Hammond (1999, p. xv) observes, “Friedman did not consider the profession’s evolution away from Marshallian price theory to be progress.” An undated memo by Friedman in the Hoover Institution archives cited by Hammond (1999, p. xv) states that “Marshall’s superiority is explained primarily by his approach to economics as contrasted with the modern approach. Marshall was interested in economics as a real problem rather than as a form of geometry. Economics to him was an engine of analysis, a tool to study the economic system as it was.”<sup>1</sup>

However, some believe that Marshallian price theory was not the only influence on Friedman. David Fand (1999), who collaborated in producing summaries of Friedman’s lecture notes on price theory, writes that Frank Knight’s philosophical approach to economics was also influential. Fand (1999, p. 13) cites George Stigler, Friedman’s partner in creating Chicago price theory: “Knight, Stigler suggests, believed that the primary role of economic theory is to contribute to a consensus on how to fashion a liberal society in which individual freedom is preserved and

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<sup>1</sup>One can add that John Maynard Keynes, another economist with Marshallian roots, approached economic theory in the same way. This is abundantly clear in Keynes’s (1936) most famous work, *The General Theory of Employment, Interest, and Money*. But that is a topic for another day.

satisfactory economic performance achieved.” Fand (1999, p. 15) goes on to state that “Accordingly, in his overarching approach to economic theory and philosophy, Friedman was following Knight’s famous course in economic theory.”<sup>2</sup> Note that the productivity of the free-market economy is a supporting argument, not the main point. Fand’s view is that (1999, p. 18)

For many students, Friedman’s course offered their first sympathetic appreciation of free markets, as well as the first introduction to classical liberal philosophy. Friedman viewed economic theory as a tool that could help design a liberal society to preserve individual freedom and achieve a satisfactory economic performance.

Others who took the course (such as one of the reviewers of this paper) disagree with Fand, and emphasize that the course was taught as series of problems and puzzles that was not closely connected to any deeper philosophical motivation.

## II. THE FIRST YEAR OF GRADUATE WORK AT CHICAGO AND YALE

The courses in microeconomics that are examined in detail below are only a fraction of the class work that students completed in the first year of graduate study.

The first year at Chicago consisted of nine courses taken on the quarter system (three courses per quarter). Students took two or three quarters of price theory and two or three quarters of the courses in money, income, employment, and price level depending upon the strength of their prior training in economics. The students typically took courses in statistics and econometrics and/or mathematics to fill out the first year program. The general examinations for doctoral students in price theory and money were administered after the first year.

Economics 300 was the basic course in price theory, and often used Stigler’s *Theory of Price* (1952) as the text. Economics 301 and 302 are the “famous” courses in price theory that were developed by Milton Friedman. Some students began in the Fall quarter with Economics 300 (and took Economics 301 in the Winter quarter), while others took Economics 301 in the Fall. Friedman’s *Price Theory: A Provisional*

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<sup>2</sup>There perhaps is no simple way to characterize Frank Knight’s philosophy. An early essay (1923, p. 588) titled “the ethics of competition” was reprinted in a volume of essays by the same title (1935) that was compiled by Milton Friedman (at age 23), Homer Jones, George Stigler, and Allen Wallis, and includes the following:

Economic activity is at the same time a means of want-satisfaction, an agency for want- and character-formation, a field of creative self-expression, and a competitive sport. While men are ‘playing the game’ of business, they are also moulding their own and other personalities, creating a civilization whose worthiness to endure cannot be a matter of indifference.

The point of the essay is to outline the possible ethical shortcomings of competitive capitalism. At the same time, Knight (1923, p. 604) stated that “We are impelled to look for ends in the economic process itself, other than the mere consumption of produce, and to give thoughtful consideration to the possibilities of participation in economic activity as a sphere of self-expression and creative achievement.” Another essay in that volume of essays titled “economic theory and nationalism” concludes that the conservative position is the best method for approaching social problems, and that (1935, p. 344) “If freedom is to be maintained, the rate of change must be limited – with perhaps some provision for temporary recourse to authoritarian rule in times of crisis.”

*Text* (1962) was used in both sections of Economics 301 and 302. Friedman taught Economics 301 and 302 until 1964, and then switched to the money courses.

The program in the first year at Yale consisted of eight semester courses, including two-semester courses in economic theory, statistics and econometrics, and economic history. The other two courses typically were electives in economics such as labor economics, international economics, economic development, and so on. Economics 100, the course in economic theory, was divided into microeconomics in the Fall semester and macroeconomics in the Spring semester. William Fellner and William Brainard normally taught microeconomics, and James Tobin and Brainard usually taught macroeconomics. All sections of Economics 100 used the same reading list, and there was no assigned textbook. The general examinations for doctoral students were taken at the end of the second year, and consisted of written exams in economic theory, statistics and econometrics, and economic history and an oral examination in two specialized fields. The examination in economic theory consisted of two parts, microeconomics and macroeconomics.

As a point of comparison, the required economic theory at Harvard consisted of three semester courses – two courses in microeconomics and one in macroeconomics. The first course in microeconomics was based on the textbook by James Henderson and Richard Quandt (1958), a text that uses intermediate mathematics (one year of calculus, or the first fifteen chapters of R. G. D. Allen (1938)). The Henderson and Quandt text is based in part on the lectures at Harvard by Professor W. Leontief. The course also used material from J. R. Hicks (1946), Paul Samuelson (1947), and Tjalling Koopmans (1957), and covered a good deal of material on welfare economics, including readings from Francis Bator (1957, 1958), J. Graaf (1957), and I. M. D. Little (1957). The second course covered general equilibrium theory, including material on proofs of the existence of equilibrium using fixed-point theorems. Robert Dorfman taught the course, and used Robert Dorfman, Paul Samuelson, and Robert Solow (1958) and Robert Kuenne (1963) as texts. Students also read selections from *Models of Man* by Herbert Simon (1957). In short, training in microeconomics at Harvard was more mathematically advanced than at either Chicago or Yale in that there was no *requirement* comparable to the Harvard general equilibrium course. As Joseph Persky (2008) puts it, the courses were “. . . largely based on 1950s thinking.” One might hypothesize that Harvard was attempting to train theorists in the modern (at least, 1950s) version, while Chicago was training economists to apply Marshallian price theory to the real world. As is explained below, the training at Yale was directed at economic measurement in more general terms – both testing hypotheses and measuring changes in economic welfare.

### III. INTRODUCTION TO CHICAGO PRICE THEORY

As Claire Hammond and J. Daniel Hammond (2006) have discussed in detail, the courses in price theory were based on Friedman's earlier courses at Columbia and developed by Friedman in collaboration with of George Stigler during the years 1946 to 1951. Stigler was teaching at Columbia during these years, and joined the Chicago economics department in 1958. Friedman (1998, p. 204) explained his approach as follows:

Like Viner, I stressed original sources in my reading list, using the course as a way to introduce students to the great economists of the past as well as to more recent developments. Like him also, I taught economic theory as, in Alfred Marshall's words, an 'engine for the discovery of concrete truth,' not as a branch of mathematics. This was, and I believe remains, the distinctive feature of Chicago 'economics,' in sharp contrast to economic theory as taught at some other leading centers of graduate education.

The purpose of this section is to explore what Friedman meant by this statement.

The original version of *Price Theory: A Provisional Text* was first published in paperback form in 1962, but it was circulated as mimeographed notes for some years prior to 1962. This volume provides notes taken from Friedman's lectures by David Fand and Warren Gustus, reprints of four of Friedman's previous writings, the reading list, and problems. It therefore provides a comprehensive description of Economics 301 and 302.

The course began with a section of introductory and methodological readings, the most important of which is Friedman's famous essay "The Methodology of Positive Economics." This essay was first published as the first chapter in Friedman (1953), but it had been in development throughout the 1946-51 period. This section of readings also included selections from Frank Knight (1933) on social economic organization and its primary functions, J. N. Keynes (1891) on positive and normative economics, and F. A. Hayek (1945) on the efficiency of the price system in informational terms. It is likely that Friedman's essay was the first item that some students at Chicago studied. This essay was intended to be read by his fellow professional economists, but I believe that it is best understood as also being partly aimed at first-year graduate students.

Friedman's essay (1953, p. 41) argues that the development of useful positive economics must be based on the ability of economic models to make "... predictions that are good enough for the purpose at hand or better than predictions from alternative theories," and not on the realism of the assumptions of the model. Predictions can refer to any outcomes not previously observed by the economist – past, present, or future. Empirical evidence enters at two stages; first in checking that the model is not contradicted by facts that have already been observed, and second in making the predictions that are not shown to be wrong (i.e., not rejected). If assumptions are not to be judged on the grounds of realism, how are they to be selected? Friedman's (1953, p. 15) answer is that "... the relevant question to ask about the 'assumptions' of a theory is not whether they are descriptively 'realistic,' for they never are, but whether they are sufficiently good approximations for the purpose at hand." Indeed, Friedman (1953, p. 14) states that

A hypothesis is important if it 'explains' much by little, that is, if it abstracts the common and crucial elements from the mass of complex and detailed circumstances surrounding the phenomena to be explained and permits valid predictions on the basis of them alone. To be important, therefore, a hypothesis must be descriptively false in its assumptions; it takes account of, and accounts for, none of the many other attendant circumstances, since its very success shows them to be irrelevant for the phenomena to be explained.

What assumptions satisfy this criterion? Friedman's essay provides examples that he derived from his years of experience as an empirical economist:

- Firms act to maximize expected returns (1953, p. 21).
- Firms are sufficiently similar that they can be grouped into industries (1953, p. 35).
- Markets are atomistically competitive in the Marshallian sense or are monopolized (1953, p. 35).
- Partial equilibrium models of supply and demand are sufficient for many purposes (1953, p. 8).

Friedman did not discuss in the essay the assumption that consumers maximize utility (attain the highest indifference curve) subject to their resource constraints, but he referred to his own articles on the Marshallian demand curve and utility analysis of choices involving risk. However, there is strong early evidence that Friedman thought that indifference curve analysis had little or no empirical application.<sup>3</sup> W. Allen Wallis and Friedman (1942, p. 176) stated that

The indifference function has proved fruitful in theoretical economics because it states premises about consumer choices in a form that materially facilitates the correct deduction of rather intricate conclusions. Thus, it has improved our understanding of competitive and complementary relations among goods and of the interrelated effects of prices and income on quantities purchased, and it has led to important substantive results in the economics of welfare and in the theory of index numbers . . . . A second use to which the indifference function might be put is the organization and analysis of empirical data on consumer expenditures. Its fecundity in the first use is no guaranty against sterility in the second.

They conclude (142, p. 189) that

In point of fact, empirical workers have adopted the direct approach of isolating factors correlative with consumer demand and measuring the relationships. Such factors as income, wealth, prices, family type, occupation, age, nationality, regional location, type of community, ownership of home or automobile, etc., have been studied with a view to determining which are most intimately associated with spending patterns, and in what matter. Whether these are taste factors or opportunity factors is irrelevant.

Also, as discussed below, Chicago price theory assumed the existence of a production function for a firm in a general form, but because of what were perceived to be extreme difficulties in the measurement of inputs, the specific form of the production function could not be determined.

Friedman also provided examples of theories that fail the test of adding to positive economic knowledge. One of these is the theory of monopolistic competition developed by E. H. Chamberlin (1933) that is based on the assumption of product differentiation among firms. Friedman's conclusion (1953, p. 39) is that

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<sup>3</sup>It is worth noting that Marshall's *Principles of Economics* (1920) includes little use of indifference curves. An indifference curve is drawn in the mathematical appendix (1920, p. 695) in a discussion of barter (of apples for nuts) and attributed to Professor Edgeworth. No budget constraint is included.

The theory of monopolistic competition offers no tools for the analysis of an industry and so no stopping place between the firm at one extreme and general equilibrium at the other. It is therefore incompetent to contribute to the analysis of a host of important problems: the one extreme is too narrow to be of great interest; the other too broad to permit meaningful generalizations.

Friedman's other example, Walrasian general equilibrium theory, was not included explicitly in the essay, but had been discussed in some detail in the earlier article on the Marshallian demand curve (Friedman, 1949). He thought that Walrasian general equilibrium theory was not capable of being contradicted. Regarding Walrasian theory, Friedman (1949, p. 489) stated that

Abstractness, generality, and mathematical elegance have in some measure become ends in themselves, criteria by which to judge economic theory. Facts are to be described, not explained. Theory is to be tested by the accuracy of its 'assumptions' as photographic descriptions of reality, not by the correctness of the predictions that can be derived from it.

Whom did Friedman have in mind here, given that this was first published in 1949? Friedman (1953, p. 39) mentioned Robert Triffin (1940) in the essay on methodology. The purpose of Triffin's book, which won the David A. Wells Prize at Harvard for 1938-39, was to restate the theory of monopolistic competition in general equilibrium terms that eliminates the industry as a unit of analysis. As Triffin (1940, p. 9) put it,

With monopolistic competition, not only the firm's behavior is systematically integrated into the analysis, but, more important, the emphasis is shifted definitely from the *industry* toward the *firm*. For Anglo-Saxon economics, the step is one of importance and leads immediately toward an analysis much closer to general equilibrium methodology than ever before."

Triffin (1940, p. 189) ended with the following:

"Instead of drawing its substance from arbitrary assumptions, chosen for their simplicity and unduly extended to a whole field of economic activity, our theory may turn to more pedestrian, but more fruitful methods. It will recognize the richness and variety of all concrete cases, and tackle each problem with due respect for its individual aspects. More advantage will be taken of all relevant factual information, and less reliance will be placed on a mere resort to the passkey of general theoretical assumptions . . . . We are rightly dissatisfied with the distorted picture of economic life which classical theory has bequeathed us. Subconsciously, however, we keep hoping for some other grand formula that would unravel as simply and elegantly the infinite complexity of our modern world. For economics to progress, it must give up its youthful quest for a philosopher's stone."

So it seems that Triffin produced a challenge for Milton Friedman and George Stigler. Hammond and Hammond (2006, p. 8) reach the following conclusion: "So the theory of monopolistic competition was provocation for Stigler's and Friedman's elaborations of Chicago price theory." Friedman (1941, p. 390) began to voice his opinion in a review of Triffin (1940), in which he stated, "The reviewer deduces that monopolistic competition adds little to our box of tools other than a refinement of

Marshall's monopoly analysis." Stigler also may have been motivated by the harshly critical review of his *Theory of Price* that was written by E. H. Chamberlin (1947, pp. 416–7), in which it was stated that "In addition to this 'faithful unto death' attitude towards perfect competition, and (I should like to believe) as a possible explanation of it, there is confusion and misconception in rare degree as to what 'imperfect' and monopolistic competition theories are all about."

I think that a fair reading of Friedman's lecture notes and the reading list leads to the conclusion that Economics 301 and 302 consisted of a series of very detailed examples that are consistent with his essay on methodology. As Johan Van Overtveldt (2007, p. 94) puts it, "It was largely because of Friedman's work and influence that, in the decades after the World War II, the combination of Marshallian partial equilibrium economics with empirical verification became 'scientific economics' at the University of Chicago." The next section provides some of the particulars.

#### IV. CHICAGO PRICE THEORY

Economics 301 and 302 covered six topics: theories of demand, consumer choice, supply and the economics of the individual firm, distribution, capital and profit, and general equilibrium. We begin with demand and consumer choice.

The required readings on demand and consumer choice were few; the most important readings clearly were chapters from Marshall (1920), Friedman's (1949) article on the Marshallian demand curve, Part I of *Value and Capital* by Hicks (1946), and two articles on the measurability of utility and choice under uncertainty by Friedman and Savage (1952) and Alchain (1953). Suggested readings included the essay by Wallis and Friedman (1942) discussed above and *Foundations of Economic Analysis* by Samuelson (1947) – the entire book. After a brief introduction to the concept of demand, the lecture notes presented a detailed discussion of "the problem of ceteris paribus" for demand functions that followed Friedman (1949). Friedman argued that the standard statement of the Marshallian demand curve holds constant money incomes, tastes, and the prices of all other goods. However, his reading of Marshall suggested to him (and few others) that real income was held constant along the Marshallian demand curve. He believed that his interpretation of Marshall was more useful for the development of positive economics. The standard demand function (in simple form) for good  $x$  can be written

$$q_x = f(p_x, I, P_o), \quad (1)$$

where  $q_x$  is the quantity of  $x$ ,  $p_x$  is its price,  $I$  is money income, and  $P_o$  is the average price of other goods. In this version the effect of a change in the price of  $x$  includes both the substitution and income effects. Friedman suggests instead that the demand function should be written

$$q_x = g(p_x/P, I/P), \quad (2)$$

where  $P$  is the weighted average price of all goods, including  $x$ . In this case the effect of a change in the price of  $x$  relative to all prices (including the price of  $x$ ),



holding  $I/P$  constant, yields an estimate of the pure substitution effect. The income effect has been eliminated from this price effect because, when the price of  $x$  changes,  $I/P$  (with  $I$  constant) is held constant by changing the prices of other goods so as to keep  $I/P$  constant. The presentation of utility theory, indifference curves, the derivation of individual demand curves, and the computation of substitution and income effects in the lecture notes follows Hicks (1946), and also includes a presentation of the Slutsky version of the substitution and income effects. Friedman's doubts about the usefulness of indifference curve analysis expressed earlier in Wallis and Friedman (1942, p. 176) were not stated in the *Provisional Text*. Rather, emphasis is on the fact that indifference curve analysis “. . . has proved fruitful in theoretical economics because it states premises in a form that facilitates the correct deduction of rather intricate conclusions.”

The lecture notes on utility analysis of uncertainty follow the classic article Friedman and Leonard Savage (1948). In order to explain the fact that people buy both insurance and lottery tickets, they proposed a utility function in which the marginal utility of income declines, rises, and then declines again as income increases. This is an excellent example of Friedman following his essay on methodology. A particular form of the utility function is assumed that is consistent with some facts that were known, and from which other testable hypotheses could be derived. Friedman and Savage (1948, p. 294) presaged the essay on methodology when they stated:

Whatever the psychological mechanism whereby individuals make choices, these choices appear to display some consistency, which can apparently be described by our utility hypothesis. This hypothesis enables predictions to be made about phenomena on which there is not yet reliable evidence. The hypothesis cannot be declared invalid for a particular class of behavior until a prediction about that class proves false. No other test of its validity is decisive.

The course turns next to supply and the economics of the firm. The lecture notes contain a lengthy chapter on supply curves and cost curves for the competitive industry and the firms in that industry. The output of a firm is assumed to be governed by a production function that likely is unique to each firm because of variations in entrepreneurial capacity. Friedman (1962, p. 96) stated that

The individual's entrepreneurial capacity can then be specified by a production function, showing the maximum quantity of product  $he$  is capable of producing under given conditions, with the given quantities of 'hired' resources (including any he 'hires' from himself). Thus if  $x_i$  represents the quantity of product produced by individual  $i$ , and  $a, b, c, \dots$  the quantities of various factors he uses, we can conceive of  $x_i = f_i(a, b, c, \dots)$  as the production function attached to the individual.

Thus the production function is assumed to be unique to each individual, just as each individual has a unique set of indifference curves. Friedman (1962, p. 97) adds the possibility that there are external technical economies or diseconomies in which the total output of the industry affects the output of an individual firm either in the positive or negative direction.

The discussion next examines the economics of the firm in the short run and in the long run. It is shown that the marginal cost of output to a firm is equal to the marginal

cost of each variable input divided by its marginal physical product, the partial derivative of the production function with respect to the variable input. However, given that the specific form of the underlying production function is not known, the specific functional form of the marginal physical product is not known. The next chapter of Friedman's notes contains a numerical and graphical depiction of the law of variable proportions (and the law of diminishing returns). This depiction is then connected to the firm's cost curves. The chapter concludes with a discussion of statistical cost curves that had been published previously. Friedman argued that cross-section data on costs from firms in an industry cannot be used to estimate the hypothetical cost functions of economic theory. He concluded (1962, pp. 143–44) that

It follows from this analysis that cross-section accounting data on costs tell nothing about 'economies of scale' in any meaningful sense. If firms differ in size because they use different specialized resources, their average costs will all tend to be equal provided they are properly computed so as to include rents. Whether actually computed costs are or are not equal can only tell us something about the state of the capital market or of the accounting profession. If firms differ in size partly because of mistakes . . . historical cost data might be relevant, but it is dubious that current accounting costs data are. And how do we know whether differences in size are mistakes or not?

Given this state of affairs, Friedman (1962, p. 146) suggested that

It may well be that a more promising source of information than cross-section accounting data would be the temporal behavior of the distribution of firms by size. If, over time, the distribution tends to be relatively stable, one might conclude that this is the 'equilibrium' distribution that defines not the optimum scale of the firm but the optimum distribution.

Here again Friedman is searching for an empirical test of a theory of the competitive firm that can be implemented.

The readings for this section of the course include classic selections from Marshall (1920), Jacob Viner (1931), and a few others, but the most important reading beyond the lecture notes is the article by Stigler (1958) in which he implemented, in the inaugural issue of the *Journal of Law and Economics*, Friedman's suggested method for investigating economies of scale. The method was dubbed the "survivor technique," and it was applied to several industries with the result that firm size was found to vary within a rather wide range.

The required readings included the core chapters from Chamberlin's (1933) book on monopolistic competition and Stigler's (1949) strong critique, the essence of which has been stated above from the essay on methodology. Stigler's memoirs (1988, p. 58) include this recollection:

Years later when I was a professor at Columbia University, I attended a meeting of the American Economic Association in Washington, D.C., and on the flight back to New York to my surprise I found myself sitting next to Edward Chamberlin. He opened the conversation, 'You and Professor Knight are the two most mistaken economists I know on the subject of monopolistic competition.' Thank heaven it was a short trip.

Additional required readings included A. C. Harberger's classic article (1954) on estimating the cost of monopoly in the American economy (and finding it to be quite low), and two more articles by Stigler – on monopoly and merger and on the “kinky” oligopoly demand curve and rigid prices.

The section of the course on the theory of distribution begins with a chapter in the lecture notes on the theory of derived demand, which includes a presentation of Marshall's laws of derived demand. Indeed, the lecture notes follow Marshall's (1920) Book V, Chapter 6 very closely. This is followed by chapters on the marginal productivity theory of the demand for factors of production and a chapter on the supply of factors of production (which concentrates on the supply of labor). The chapter on labor supply includes an introduction to the theory of human capital. Friedman (1962, p. 198) emphasized that the theory of distribution is to be used for the advancement of positive economic knowledge, and has no ethical implications. For example, the lecture notes provide several examples of forces that can bring about differences in wage rates that otherwise might be equal (and forces of competition that tend to mitigate the effects of those forces that cause wage differences). An example is the study of income from independent professional practice (including medical doctors) by Friedman and Simon Kuznets (1945) that was Friedman's doctoral dissertation and appears as a required reading in the course. The other required readings included a chapter on the elasticity of substitution in production and relative shares from Hicks's (1933) *Theory of Wages* and classic selections from Adam Smith, J. S. Mill, Marshall, and J. B. Clark.

The lecture notes conclude with a chapter on the theory of capital and the rate of interest. In this chapter careful distinction is made between the market for capital (which produces streams of permanent income) and saving and investment in the current period. The market for saving and investment in the current period was seen as the mechanism through which the market for capital reaches long-run equilibrium – the point at which current saving and investment would be zero. The required readings included chapters 11-14 from Keynes's (1936) *General Theory of Employment, Interest, and Money* as well as more recent articles on capital, investment, and profit. No empirical studies were assigned. In his introduction to the published lecture notes, Friedman stated that he supplemented this section through class presentation because the notes were too condensed. Thus it is not clear how closely this section of the course was derived from Friedman's methodology of positive economics.

The final section of the course was general equilibrium. There are no lecture notes for this topic. The required readings include a brief selection from Leon Walras's (1874) *Elements of Pure Economics*, presumably to show the kind of economic theory that is not empirically useful. But it may come as a surprise to some readers of this essay that the required readings also included the classic articles by Hicks (1937), Franco Modigliani (1944), and Donald Patinkin (1948) on the IS-LM model of macroeconomics. Friedman assigned Hicks on the IS-LM model – in the price theory course, no less! The explanation for this seemingly uncharacteristic behavior is to be found in article on the Marshallian demand curve. Friedman (1949, p. 490) stated that

Of course, it would be an overstatement to characterize all modern economic theory as ‘Walrasian’ in this sense (of yielding no predictions). For example, Keynes's theory of employment, whatever its merits or demerits on other grounds,

is Marshallian in method. It is a general equilibrium theory containing important empirical content and constructed to facilitate meaningful prediction.

Thus ends the course with the message that some (perhaps only a few) general equilibrium theories are useful economics after all.<sup>4</sup> This would appear to be an acknowledgement of the ongoing work by the Cowles Commission researchers to estimate various versions of the Keynesian model. Later Friedman would voice harsh criticism of the ability of their models to make predictions that were better than the alternative that all variables remained unchanged from one year to the next.

This section has described briefly each part of the Chicago price theory course. It is also useful to note what the course did not contain. First of all, the lecture notes and the required readings decidedly are non-mathematical. The lecture notes contain no mathematical derivations – all derivations are graphical. Even the Hicks and Slutsky versions of substitution and income effects are simply stated as equations after a graphical derivation. Second, with the exception of IS-LM models, general equilibrium theory was derided. The course did not contain a presentation of the Edgeworth box diagram, a tool that had become a very popular method for doing simple general equilibrium theory, particularly in international trade theory. However, Harry Johnson began offering a course at Chicago in 1965 on the theory of distribution that was based largely on the two-sector general equilibrium model. His lectures were published as Johnson (1971). Thirdly, the course included no mention of game theory other than a reference to John von Neumann and Oskar Morgenstern (1944) in the articles on utility analysis of choices involving risk. At the time many economists thought that game theory had yet to demonstrate its utility for positive economics. Fourth, the price theory course included no mention of welfare economics, other than inclusion in the lecture notes of Friedman's (1952) short article on the 'welfare' effects of an income tax and an excise tax. That article (1952, p. 25) includes the statement that

This paper is written in the spirit of the 'new' welfare economics, because the technical problem it deals with has been considered primarily in those terms and despite serious doubts about the acceptability and validity of this approach to normative economics.

Friedman did not explain those "serious doubts," other than to state that (1952, p. 29) "... the identification of 'being on a higher indifference curve' with 'is preferable to' is a far less innocent step than may appear on the surface."

In summary, the Chicago price theory course that was developed by Friedman was course in positive economics based on Marshallian partial equilibrium economics (and its lineal descendants). Major sections of Books III, IV, V, and VI in Marshall (1920) were assigned readings. The course avoided several recent topics, such as general equilibrium theory, welfare economics, public goods, externalities, game theory, monopolistic competition, and other models of imperfect competition on the grounds that these theories had not demonstrated the ability of produce positive economic knowledge as defined by Friedman in the essay on methodology.

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<sup>4</sup>Professor Becker, a student of Friedman's in the 1950s, believes (1999, p. 34) that "... more attention should have been given to general equilibrium analysis and to the potential of mathematical economics."

## V. MICROECONOMICS AT YALE

The basic course in microeconomics at Yale was only one semester in length (15 weeks), so it included fewer topics than the two-quarter course at Chicago.<sup>5</sup> Students were expected to have strong prior training in intermediate microeconomics and some sophistication in mathematics. A short course in multivariate calculus and linear algebra was offered (taught by an advanced graduate student) for entering students in the summer prior to the beginning of the fall semester. The four broad topics in the course were production, demand, efficient allocation and economic welfare, and the firm and market structures. The course was taught by William Fellner, and he was joined by William Brainard in the mid 1960s. As this section will show, the course at Yale differed from Chicago price theory in that

- Mathematics was used extensively (but far less than at Harvard).
- Production functions and technical change were studied in depth.
- Linear programming and activity analysis were included.
- Welfare economics was given extensive treatment.
- Externalities and public goods were included.
- A wide variety of models of market structures, including game theory, were included.

In short, the course was designed as an introductory survey of microeconomic theory rather than as a particular approach to the pursuit of positive economic knowledge.

The course began with production. After an introduction to basic production theory, with readings from J. M. Cassels (1927), Paul Douglas (1934), Hicks (1946), and R. G. D. Allen (1938), the emphasis was placed on the constant elasticity of substitution (CES) production function because, as Hicks (1933) discussed, changes in relative shares of inputs depend upon the elasticity of substitution of inputs in production. Later versions of the course included the article on the estimation of the CES production function by Kenneth Arrow et al. (1961). Technical change was included in the section on production, with emphasis on Hicks neutral, Hicks labor-saving, and Hicks capital-saving technical changes. The effects of these types of technical changes on factor shares were also discussed. Underlying this section of the course was the presumption that parameters of production functions and technical change could be measured. Time was also devoted to linear programming, and the required readings were the classic article by Dorfman (1953) and an unpublished paper by James Tobin (1963) on activity analysis as developed by Tjalling Koopmans and others. In short, production functions at Yale were very real and measurable.

Production was followed by the section on cost functions. It was pointed out that Marshall did not develop a theory of the firm, but that this omission was filled in by Viner, Roy Harrod, and Stigler. Viner's (1931) classic article on cost curves and supply curves (as corrected) was emphasized. Various versions of cost functions were presented, depending upon whether capital is variable and/or divisible. Theories of rent and pecuniary and non-pecuniary externalities in production were also included.

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<sup>5</sup>The information on the microeconomics course at Yale is taken from personal lecture notes (McDonald, 1967) and recollection.

Demand theory came next. The course covered standard material from Marshall (1920), Hicks (1946), and Allen (1938) that includes ordinal utility and substitution and income effects. Emphasis was then placed on the problem of measuring changes in consumer welfare. Individual consumer surplus was discussed extensively, and the article by A. Henderson (1941) was assigned. The course also included extensive discussion of the index number problem – and its relationship to substitution and income effects. The course covered the conditions under which the standard Laspeyres and Paasche quantity indexes are (or are not) accurate measures of changes in consumer welfare.

This section also included cardinal utility, utility measurable up to a linear transformation. The von Neumann–Morgenstern (1944) axioms for choice under conditions of uncertainty were emphasized, but also included were suggestions for the measurement of utility under conditions of certainty proposed by Marshall and Irving Fisher. That utility could be measured in a cardinal sense was held out as a possibility. This material was contained in Fellner's (1965) textbook *Probability and Profit*. The demand section concluded with readings by James Duesenberry (1949) and Harvey Leibenstein (1950) that extended consumer theory to cases in which the preferences of a consumer are influenced by the behavior of other consumers.

The course then turned to the theory of efficient allocation and economic welfare. The two expository articles by Francis Bator (1957, 1958) were emphasized. The first article presents the first and second theorems of welfare economics in graphical form, and the second article covers the standard reasons for market failure – the failure of the market to be efficient in the allocation of resources. One of those reasons for market failure is, of course, the existence of public goods, and Samuelson's (1954, 1955) classic articles were assigned. Another reason is non-pecuniary external effects in production, and Ralph Turvey's (1964) article on fisheries was assigned. Index number theory reentered the discussion, and Hicks (1940) was included on the reading list. The debate between Hicks, Nicholas Kaldor, and Tibor Scitovsky over the measurement of changes in welfare was included.

The course concluded with a lengthy section on market structures. The Yale approach was to emphasize that the theory of perfectly competitive markets was inadequate to explain behavior in many cases. The taxonomy of market structures that was introduced placed monopoly at one end and competition at the other end, but also introduced product differentiation. Pure competition and monopolistic competition were given equal status at that other end. In between monopoly and competition were pure (undifferentiated) oligopoly and differentiated oligopoly. The critical empirical magnitude in all of this was the cross-elasticity of demand on one firm's product with respect to prices charged by other firms. The entire book by Chamberlin (1933) was assigned, as were selections from Joan Robinson (1933), Triffin (1940), and Fellner (1960). Fellner (1960) covered the Cournot and Bertrand theories of firm interaction.

Abba Lerner's (1934) classic article on the concept of monopoly and the measurement of monopoly power and Paul Sweezy's (1939) article on the kinked oligopoly demand curve were assigned, although Harberger (1954) on the measurement of resource misallocation under monopoly and Stigler's (1947) empirical dismissal of the empirical importance of the kinked demand curve were not. The

course concluded with an introduction to game theory based on the article by Leonid Hurwicz (1945) and sections from Fellner (1965). Additional readings included a chapter from Thomas Schelling's (1960) book *The Strategy of Conflict*.

It is clear from this brief survey of the microeconomics course at Yale that measurement was the basic theme – measurement of production functions, cost functions, demand functions, changes in economic welfare, and interactions between firms. In some cases the empirical work implied was aimed at testing hypotheses that could be rejected, but in other cases the empirical work was the measurement of economic concepts that did not involve hypothesis testing (e.g. changes in economic welfare). As Professor Brainard recalls (2008), methodology sometimes was included in the Yale course (but not always). Professor Koopmans – who had moved from Chicago to Yale in 1955 – had published an essay on methodology that included a critique of Friedman's (1953) essay. Whether it was included in the basic course, it is likely true that most students at Yale eventually read the statement from Koopmans (1957, pp. 139–140) that

Before we can accept the view that obvious discrepancies between behavior postulates and directly observed behavior do not affect the predictive power of specified implications of the postulates, we need to understand the reasons why these discrepancies do not matter.

Professor Brainard (2008) recalls that class time was also devoted to discussion of testing theories “in a world where there is a surfeit of theories” and “a paucity of evidence testing their distinctive differences.”

## VI. READING LIST OVERLAP

Given that courses at Chicago and Yale covered much of the same topics, but from different perspectives, to what extent did the reading lists overlap? The answer is that there was little overlap in specific reading assignments. Consider topics in turn.

In consumer theory both courses assigned Book III of Marshall (1920) and Part I of Hicks (1946). It is clear that the Hicks presentation of the basic theory of consumer choice was the standard reading in the days prior to the use of graduate textbooks (although Henderson and Quandt (1958) was available), and Marshall was the classic selection that graduate students should read. Yale students were assigned no more of Marshall (1920), but Chicago students were assigned to read much more. Alchain's (1953) expository article on the meaning of utility measurement was assigned in both courses. Otherwise, the reading lists on consumer choice have no specific items in common.

There were no readings in common for production, although Friedman's lecture notes included Cassels on the law of variable proportions, and the Cassels (1927) piece was assigned at Yale. Viner's (1931) classic on cost curves and supply curves was assigned in both courses.

Distribution was covered as a separate topic at Chicago, while it was included as part of production theory at Yale. Chapter 6 from *The Theory of Wages* by Hicks (1933) was assigned in both courses (and chapters 1-5 were assigned at Chicago).

Chamberlin's (1933) presentation of his theory of monopolistic competition was assigned at Chicago, but so was Stigler's critique of Chamberlin. The entire Chamberlin book was assigned at Yale, but Stigler's critique was not. Triffin (1940) was included as an optional reading at Chicago and key chapters were assigned at Yale – where Triffin was a faculty member. Chapter 2 of Robinson (1933) was assigned at Chicago. This chapter is simply a graphical presentation of demand, marginal revenue, average cost, and marginal cost. Chapter 11, the chapter that compares the output under competition and monopoly, was assigned at Yale.

Lastly, Friedman's (1952) article on the 'welfare' effects of an income tax and an excise tax were assigned in both courses. This was the only item by Friedman on the Yale reading list. But it should be mentioned that there were no readings by William Fellner on the Chicago reading list.

As noted above, the Chicago price theory course did include a selection from Keynes (1936) on investment and several articles on the IS-LM model. These items were included in the macroeconomics portion of the economic theory course at Yale. The entire *General Theory of Employment, Interest, and Money* was assigned in this course at Yale (and students were given the opportunity to display their detailed knowledge of it on the PhD exams). Students at Chicago in the second money course studied Keynes and the macroeconomics text by Martin Bailey (1962), which provides an exhaustive treatment of the IS-LM model. But similarities and differences in training in macroeconomics are not the topic of this paper.

## VII. CONCLUSION

This paper has compared the basic courses in microeconomics that were taught to graduate students in the 1960s at Chicago and Yale in order to gain insight into the two schools of thought that these departments exemplify. The courses in microeconomics were selected because the differences in approaches to macroeconomics are well known, while the disagreements about microeconomics perhaps are not as clear to the contemporary observer.

The essential differences come down to disagreement about how knowledge in economics is produced. The Chicago School followed closely Milton Friedman's essay on the methodology of positive economics. Positive economic knowledge is produced by formulating economic models (based on known facts) and testing the predictions of those models. The models are based on general assumptions about consumers and firms, and these assumptions need not correspond closely (or maybe not at all) to "reality." The predictions are tested against data not used in the formulation of the models, and those statistical tests must be designed to provide the model the opportunity to fail. Progress is made as models are found to fail and are replaced by improved models. The graduate training at Chicago emphasized the Marshallian partial equilibrium model of perfectly competitive firms and markets as the engine for the advancement of positive economics, a choice that is also consistent with a conservative philosophy. As Friedman noted (1949, p. 473), for Marshall economic theory was an "... engine for the discovery of concrete truth." The general methodology advanced by Friedman does not necessarily lead to the conclusion that this particular theory should be emphasized. Indeed, Friedman (1953, p. 10) stated that



The choice among alternative hypotheses equally consistent with the available evidence must to some extent be arbitrary, although there is general agreement that relevant considerations are suggested by the criteria of 'simplicity' and 'fruitfulness,' themselves notions that defy completely objective specification.

Clearly the members of the Chicago School thought that, since Alfred Marshall had worked out the basic theory decades before, it had stood the test of time. Newer entrants, such as the theory of monopolistic competition, were more complicated and not fruitful. Chicago price theory also did not include the new welfare economics (or the old welfare economics, for that matter) because it was seen as not producing testable hypotheses.

The basic course at Yale was a survey of microeconomic theories that emphasized measurement. Hypothesis testing was implied in some places, but in other instances the point was to measure an economic phenomenon. The section of the course on production emphasized both positive and normative economics. The estimation of a production function involves testing hypotheses, of course, but (for example) linear programming is a normative technique. It tells us what to do to be efficient both in general terms and in specific applications. The estimation of demand functions is testing hypotheses, but it is also the measurement of substitution and income effects so that consumers' surplus can be measured. Furthermore, the theory of welfare economics and the theory of index numbers are used to make normative statements based on measurements that do not involve hypothesis testing. The theory of perfect competition had special status in microeconomics at Yale because of the basic theorems of welfare economics. But considerable time was devoted to an array of theories of imperfect competition because it was thought that such theories were needed to explain the behavior of many firms and industries in the contemporary market economy. Theories of externalities and public goods were also emphasized. The market was seen as failing to be efficient in numerous specific situations.

One similarity of the Chicago and Yale courses has not been emphasized in this essay. In both courses students solved problem sets and took examinations in which the idea was to "think like an economist" about problems that were new to the student (and in some cases had not been solved already in the literature). Indeed, former students in both programs recall the emphasis on solving problems.

At Yale the perfectly competitive economy had normative significance because of the theorems of welfare economics, but the existence of imperfect competition, externalities, and public goods produces inefficiency in the allocation of resources – which means that there is room for an improvement in welfare in the sense of the "new" welfare economics. In short, the survey of microeconomic theory that was taught was in line both with the normative approach of maximizing social welfare and with the goal of increasing positive economic knowledge.

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