Irrational Behavior and Economic Theory

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IRRATIONAL BEHAVIOR AND ECONOMIC THEORY[1]

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I. INTRODUCTION

ALTHOUGH it has long been agreed that traditional economic theory "assumes" rational behavior, at one time there was considerable disagreement over the meaning of the word "rational." To many, the word suggested an outdated psychology, lightning-fast calculation, hedonistic motivation, and other presumably unrealistic behavior. As economic theory became more clearly and precisely formulated, controversy over the meaning of the assumptions diminished greatly, and now everyone more or less agrees that rational behavior simply implies consistent maximization

of a well-ordered function, such as a utility or profit function.

Strong and even violent differences developed, however, at a different level. Critics claim that households and firms do not maximize, at least not consistently, that preferences are not well ordered, and that the theory is not useful in explaining behavior. Some theorists have replied that economic theory is valid only as a broad tendency, not in each specific instance; some noted that the "proof of the pudding is in the eating," and argued that this theory gives useful predictions even though decisions do not "seem" to be rational; still others claimed that only rational behavior has much chance of surviving a very harsh competitive world.

The purpose of this paper is not to contribute still another defense of economic rationality. Rather it is to show how the important theorems of modern economics result from a general principle which not only includes rational behavior and survivor arguments as special cases, but also much irrational behavior. No matter what the intent, some readers might believe that the effect of this dem-

[1] My greatest debt is to A. A. Alchian for the stimulation provided by his article of more than a decade ago ("Uncertainty, Evolution and Economic Theory," *Journal of Political Economy*, LVIII [June 1950]), and for comments on various drafts, beginning in the summer of 1957. I am also indebted to M. Friedman for insightful oral and written statements (see "The Methodology of Positive Economics," in *Essays in Positive Economics* [Chicago: University of Chicago Press, 1931]) on economic rationality, to seminar groups at Columbia, the National Bureau of Economic Research, North Carolina State College, UCLA, and Stanford, and to Z. Griliches, H. G. Johnson, H. G. Lewis, J. Mincer, P. J. Nelson, and G. J. Stigler. I alone am responsible, however, for any remaining errors.

1

onstration is to provide another and more powerful defense of economic rationality. I believe it does provide an important defense of the *theorems* of modern economics, although, of course, the only ultimate defense is an empirical one, and no new empirical materials are introduced. Since, however, these theorems are shown to be consistent also with an extremely wide class of irrational behavior, a defense of them is not necessarily a defense of individual rational behavior. Indeed, perhaps the main conclusion of this study is that economic theory is much more compatible with irrational behavior than had been previously suspected.

Although economists have typically been interested in the reactions of large markets to changes in different variables, economic theory has been developed for the individual firm and household with market responses obtained simply by blowing up, so to speak, the response of a typical unit. Confusion resulted because comment and analysis were directed away from the market and toward the individual, or away from the economist's main interests. Those arguing that rationality is only a broad tendency, or that only a few units need behave rationally in order for markets to do so, were well aware of the difference between market and individual levels of analysis. Unfortunately, however, one can equally well argue that irrationality is only a broad tendency, or that only a few units need behave irrationally in order for markets to do so. An argument supporting rationality at the market level must imply that rational unit responses would tend to outweigh irrational ones. This paper clearly distinguishes between the market and individual levels and produces such an argument implying rationality at the market level. Perhaps

it will help shift the analytical interests of economists toward the same level as their substantive interests.

Section II first presents the traditional theory of household choices and then shows why its main implication—that market demand curves are negatively inclined—can also be derived from a wide variety of irrational behavior. Section III develops similar arguments for firms, and IV summarizes the discussion and adds a few additional implications.

II. HOUSEHOLDS

Traditional theory.—Traditional theory assumes that households choose the best collection of commodities consistent with the limited resources available to them. To determine which collection is "best" a preference or utility function is introduced with the properties that any collection A always gives more, less, or the same utility as any other collection B (the consistency assumption), and that if A is preferred to B, and B to C, A must be preferred to C (the transitivity assumption). The best collection produces more utility than any feasible alternative. This theory is usually illustrated geometrically by the diagram shown in Figure 1: commodity X is plotted along the horizontal axis, the "other" commodity Y along the vertical axis, AB is the budget line and OAB defines the feasible collections, and preferences are represented by the set of equal utility or indifference curves. The best collection must be on AB at the point p where AB is tangent to an indifference curve.

A change in relative prices or real income would change the location of the best collection, and the fundamental theorem of this theory is that the demand curve for any commodity, real income held constant, must be negatively in-

clined. In Figure 1 a change in the budget line from AB to CD increases the relative price of X and reduces that of Y, and attempts to hold real income constant by holding the ratio of money income to a Laspeyres price index constant.[2] This is the method most commonly used in empirical demand studies to separate relative price from real income effects. The best collection is changed from p to p', and the fundamental theorem states that p' is to the left and above p, or less X and more Y is chosen. Since the demand curve of a market with many households is usually obtained by horizontal summation of the individual demand curves, it would simply be a blown-up or macroscopic reproduction of the individual micro curves and, consequently, would also be negatively inclined.[3]

Market demand curves of many commodities have been extensively investigated empirically and almost invariably are found to be negatively inclined,[4] as predicted by traditional theory, while household demand curves, on the other hand, have seldom been investigated and little is known about them. Other implications of utility theory[5] have almost never been empirically investigated at

either the market or the household level and are of little practical use.

The utility approach to household decisions has been extensively criticized ever since its conception, although both formulation and criticism have changed drastically over time. Today, critics either deny that households maximize any function or that the function maximized is consistent and transitive. In effect, they
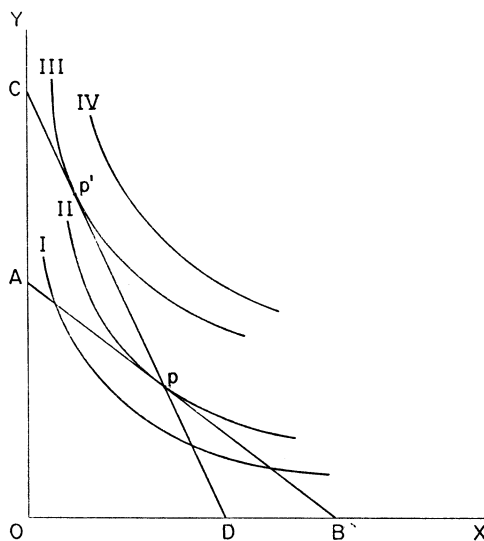

FIG. 1

deny that households act "rationally" since rational behavior is now taken to signify maximization of a consistent and transitive function.[6]

How can these extensive criticisms be reconciled with the fact that the main implication of utility theory—that market demand curves would be negatively inclined—has been consistently verified empirically and found extremely useful in practical problems? Perhaps one ex-

[2] It is well known that real income would be approximately held constant in the sense that households would tend to remain on the same indifference curve.

[3] Even if household demand curves were interdependent the market curve would tend to be negatively inclined, but more or less elastic than the average micro curve, depending on whether "bandwagon" or "snob" effects predominated.

[4] Widespread confidence in the universality of negative market curves has, however, resulted in some "cheating." Other findings are often simply not published or altered until more "reasonable" findings emerge.

[5] The whole set of implications can be summarized in the negative semi-definiteness of a certain quadratic form. See, e.g., P. A. Samuelson, *The Foundations of Economic Analysis* (Cambridge, Mass.: Harvard University Press, 1947), p. 114.

[6] See, e.g., W. Edwards, "The Theory of Decision Making," *Psychological Bulletin*, LI (July, 1954); reprinted in *Some Theories of Organization*, ed. A. H. Rubenstein and C. J. Haberstroh (Homewood, Ill.: Richard D. Irwin, Inc., 1960).

planation is that the assumptions of a theory are often "tested" individually rather than as a whole, or what amounts to the same thing, rather than by their implications. Surely another is that many criticisms are really aimed only at the normative implications of utility theory. In this paper I suggest a reconciliation along very different lines; principally, by showing that negatively inclined market
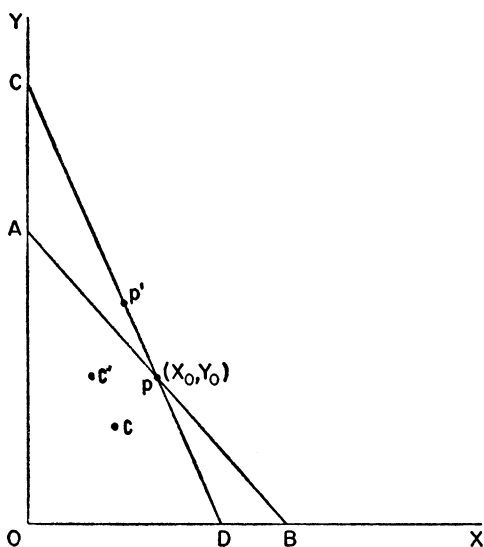

FIG. 2

demand curves result not so much from rational behavior per se as from a general principle which includes a wide class of irrational behavior as well. Therefore, households can be said to behave not only "as if" they were rational but also "as if" they were irrational: the major piece of empirical evidence justifying the first statement can equally well justify the second.

A general approach.—Economists have long been aware that some changes in the feasible or opportunity sets of households would lead to the same response *regardless of the decision rule used.* For ex-

ample, a decrease in real income necessarily decreases the amount spent on at least one commodity, and the average percentage change in expenditures on all commodities must equal the percentage decrease in income. These theorems, although "obvious" and "arithmetic," have been extremely useful in practical problems. It has seldom been realized, however, that the change in opportunities resulting from a change in relative prices also tends to produce a systematic response, regardless of the decision rule. In particular, the fundamental theorem of traditional theory— that demand curves are negatively inclined—largely results from the change in opportunities alone and is largely independent of the decision rule.

Since the budget line CD in Figure 2 has a higher relative price for commodity X and a lower price for Y than does AB, the set OCD inclosed by CD offers more opportunity to consume Y and less opportunity to consume X than does the set OAB. If point p represents the amounts of X and Y (X_0, Y_0) that would be chosen from OAB by a particular decision rule, OCD can be said to offer smaller opportunity to consume more than X_0 of X and greater opportunity to consume more than Y_0 of Y than OAB does. *If the amount of any commodity chosen by a decision rule were positively related to its availability*, less X than X_0 and more Y than Y_0 would necessarily be chosen from OCD. Demand would be negatively related to price for all such decision rules, no matter how they differed in other respects.

The traditional theory of rational behavior is easily shown to be a rule that depends on the effect of a change in relative prices on the distribution of opportunities. In equilibrium a rational household would gain the same utility from

spending an additional dollar on any commodity. A change in relative prices would shift marginal as well as average consumption opportunities toward relatively cheaper and away from more expensive commodities because a dollar now buys more of the former and less of the latter. Consequently an additional dollar at the old equilibrium position would add more utility if it were spent on the former than the latter. Hence rational households would have an incentive to change their consumption, along with the opportunity set, toward relatively cheaper and away from more expensive commodities.

Not only utility maximization but also many other decision rules, incorporating a wide variety or irrational behavior,[7] lead to negatively inclined demand curves because of the effect of a change in prices on opportunities. This will be demonstrated with two models of irrational behavior that encompass both a wide and an allegedly "realistic" class of behavior. On the one hand, households are often said to be impulsive, erratic, and subject to never-ending whim, and on the other hand, inert, habitual, and sluggish. One view alleges that momentary impulses beget a confusing array of undirected change, the other that the past permits little current change or choice. Between these two extremes lies a wide spectrum of irrational behavior, partly determined by the past and partly by current impulses.

If the implications of such behavior are to be fully developed, the attributes of "impulsiveness" and "inertia" must be given a precise and quantitative formulation. To that end, impulsive behav-

ior will be represented by a probabilistic model in which decisions are determined, so to speak, by the throw of a multisided die; inert behavior by a model in which decisions are determined by the past whenever possible (the meaning of this clause is fully developed shortly); and intermediate behavior by a weighted average of these extremes. I believe these models do effectively capture the spirit of the strongest and most frequent criticisms of utility theory, although this cannot be rigorously shown. In any case, they vividly illustrate how irrational choices can also be systematically affected by a change in the distribution of opportunities.

Impulsive households are assumed to act "as if" they only consulted a probability mechanism: no preference system or utility function is consulted. Indeed, to eliminate any vestige of utility maximization, it is assumed that every opportunity has an equal chance of being selected.[8] Although the consumption of a single household could not be determined in advance, the average consumption of a large number of independent households would almost certainly be at the middle of the opportunity set, which is also the (mathematically) expected consumption of a single household. If opportunities were initially restricted to the budget line AB in Figure 2, the average consumption of many households would be close to p, the midpoint of AB, with different households uniformly distributed around p.

A change in relative prices which held a market-weighted Laspeyres price index constant would rotate the budget line

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[7] Any deviation from utility maximization is considered "irrational" in this paper: a more precise or philosophical definition is not required for our purposes and is not attempted.

[8] Zvi Griliches pointed out to me that this model was also presented in a very brief appendix to the article by R. L. Marris, "Professor Hicks' Index Number Theorem," *Review of Economic Studies*, XXV (October, 1957), 25–39. The Appendix is said to be based on a conversation with Harry Johnson.

through p, the point representing market consumption.[9] The line CD represents a compensated increase in the price of X, and points would now be chosen at random along CD instead of AB. Each household could be anywhere on CD, but again the average location of many independent households would almost certainly be at the middle, represented by p' in the figure. It should be clear geometrically and is easily shown algebraically that p' is not to the left and above p by accident: a compensated increase in the price of X always shifts the midpoint of the budget line upward and to the left, while a compensated decrease shifts it downward and to the right.[10]

The fundamental theorem of rational behavior, that market demand curves are negatively inclined, is, therefore, also implied by impulsive behavior, at least in markets with large numbers of households. The expected demand curve of each household must also be negatively inclined, although many actual individual curves would not be.[11] Both expected and actual market demand curves are negatively inclined because of the effect of a change in prices on the distribution of opportunities. An increase in the relative price of X shifts opportunities away from X, increases the fraction of those with less X than in the initial position, and thereby increases the probability that an impulsive household would reduce its consumption of X. And what is simply more probable for a particular household becomes a certainty for a large number of independent ones.

Consider now a model of inertia: wherever possible, households consume exactly what they did in the past. Point p can again represent the average consumption of a large group of households faced with the budget line AB, and CD the line resulting from a compensated increase in the price of X. Households initially in the region Ap could remain there indefinitely after the price change, the budget line. Some, however, would also have to be initially in the half-open region pB, unless all were at p, and they could not remain there indefinitely after prices changed, no matter how much they wanted to, because pB would be outside the new opportunity set OCD. Obviously, households forced to adjust are not by accident precisely those with an above average consumption of X, for an increase in X's price shifts opportunities away from X.

If the average household in pB had been consuming more than OD of X, the average amount of X consumed by all households would necessarily decline. Those in Ap would not change, and those in pB would have to reduce their X since OD is the maximum X permitted by the budget line CD. In general, the larger the change in relative prices and the larger the dispersion among house-

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[9] Since utility maximization is not assumed, a compensated price change could no longer be said to hold the level of utility (approximately) constant. The important point for our purposes, however, is that empirical studies usually separate price from income effects in this way, and the negative slope of empirical demand curves is a valid and important regularity, regardless of whether utility "really" has been held constant.

[10] Since the midpoint of any budget line is given by $(I/2P_x, I/2P_y)$, where I is money income and P_x and P_y are unit prices, a compensated change in the price of X much change the midpoint of X in the opposite and that of Y in the same direction.

[11] An individual demand curve is more likely to be negatively inclined the greater the number of price observations and the longer the time period covered by each one. Averaging over prices or time is as effective in cancelling out erratic behavior here as averaging over households is in a market.

holds,[12] the more likely is it that the maximum X permitted by the new budget line would be smaller than the average in pB. Although the adjustments made by households in pB cannot be determined precisely until a decision rule is specified, their consumption of X would probably decline even when not arithmetically necessary: a wide variety of decision rules would do this because they were consuming relatively large amounts of X, and the opportunity set shifted away from X. The conclusion is warranted, therefore, that a group of inert consumers, along with rational and impulsive ones, would tend to have negatively inclined demand curves.

A broad class of irrational behavior, including inert and impulsive behavior as extreme cases, would be encompassed by a model in which current choices were partly determined by past ones and partly by a probability mechanism.[13] In other words, these choices are a weighted average of those made by impulsive and inert households. Since market demand curves at both these extremes would tend to be negatively inclined, the market curves of any weighted average would also tend to be. So all behavior in this class would reproduce the fundamental theorem of rational behavior.

A utility maximizing household would necessarily have negatively inclined compensated demand curves and a consistent and transitive "revealed" preference system. A compensated change in prices to an irrational household, on the other hand, would have very different effects. For example, a compensated change to a single inert household, rather than to

a group of them, would not cause any change in consumption; and although an impulsive household would tend to have negatively inclined demand curves and consistent and transitive revealed preferences, there would be many exceptions. The market demand curve in markets with many irrational households would, however, be negatively inclined, and the market's revealed preference system could be said to be rational (consistent and transitive) in the sense that a compensated change in prices would push the market outside its initial opportunity set.

Hence the market would act as if "it" were rational not only when households were rational, but also when they were inert, impulsive, or otherwise irrational. This analytical statement must be distinguished from the frequently encountered arithmetical statement that a market would behave rationally even if only a few households did, assuming always that the average consumption of other households did not move perversely. The same arithmetic demonstrates that a market would behave irrationally even if only a few households did, again assuming that the average consumption of others did not move "perversely." Our statement goes beyond arithmetic and stems from an analysis of the responses of rational and irrational households.

A "representative" household would act rationally even when actual ones did not if "representative" simply indicates a microscopic reproduction of market responses. Economists have gone further and constructed also a theory of an actual household that is simply a microscopic reproduction of the market. Observed market behavior is used to infer unobserved household behavior without any recognition that a theory of the

[12] Average consumption in pB is positively related to the dispersion around the over-all average represented by p.

[13] Mathematically this model is a first-order Markov process.

household need not simply reproduce the market because market rationality is consistent with household irrationality. If we may join the trend toward borrowing analogies from the currently glamorous field of physics, the theory of molecular motion does not simply reproduce the motion of large bodies: the smooth, "rational" motion of a macrobody is assumed to result from the erratic, "irrational" motions of a very large number of microbodies.

Patterning the theory of households after market responses was not only unnecessary, but also responsible for much bitter and rather sterile controversy. Confidence in market rationality misled some into stout defenses of rationality at all levels, while confidence in household irrationality misled others into equally stout attacks on all rationality. What has apparently been overlooked is that both views may be partly right and partly wrong: households may be irrational and yet markets quite rational. If this were generally recognized, critics might be more receptive to models implying rational market responses, and economic theorists to models permitting erratic and other irrational household responses.

Utility analysis does not imply that market demand curves necessarily have sizable elasticities; nevertheless, rational behavior is popularly believed to produce sizable responses in at least some markets. Perhaps, therefore, it would be useful to show that irrational households can produce sizable as well as negative elasticities. The market response of inert households depends on the dispersion among them, the change in prices, and the response of those forced to adjust. If the price of X rose by 10 per cent, if households were uniformly distributed along the initial budget line, and if those forced to adjust reduced

their average consumption to the midpoint of the new budget line, market demand would decline by about 30 per cent, giving a high elasticity of -3.[14] A smaller price change or a larger dispersion would yield a still higher elasticity. It is also significant that a large group of erratic households must have unitary elastic market demand curves.[15] So the broad class of irrational behavior explicitly discussed in this paper can generate sizable market elasticities, and thus can reproduce this attribute of "rational" behavior as well.

Inert households in the region Ap in Figure 2 were forced off the boundary and into the interior of the opportunity set by a shift of the budget line from AB to CD. Although "commodities" can sometimes be usefully defined, and usually are defined, so that households must necessarily be on the boundary, I would usually prefer to treat this as an ad-

[14] Initially, average consumption of X would be $X_0 = I/2\,P_x$; subsequently, it would decline to

$$X_1 = 1/2\left(\frac{I}{4P_x}\right) + 1/2\left(\frac{I}{2.2P_x}\right) = \frac{31}{88}\frac{I}{P_x},$$

so

$$\frac{X_1 - X_0}{X_0} = \frac{\frac{31}{88} - \frac{44}{88}}{\frac{44}{88}} = -.3\,.$$

[15] The amount of X consumed would be given by the function

$$X = k\frac{I}{P_x},$$

where X is market demand and I market income. A compensated change in the price of X would hold constant the ratio of market income to a Laspeyres price index. That is,

$$\frac{I}{P} = c,$$

hence

$$X = k'\cdot\frac{P}{P_x},$$

or

$$X\cdot\frac{P_x}{P} = k'\,.$$

ditional implication of rational behavior. Thus utility-maximizing households would be on the boundary not because of a definition, but because utility would be maximized (as long as the marginal utility of at least one commodity was non-negative). Even if "expenditures" were defined so that the entire income had to be spent, irrational households might not "consume" it all because some "purchases" might be lost, spoil, or accumulate unused. These households would be located in the interior of their opportunity sets if the commodity space referred to "consumption" rather than to "expenditures."

Our assumption that opportunities are (at least initially) restricted to the budget line must go if the effect of "inefficient" consumption is to be investigated. Inefficient impulsive households might assign equal probabilities to all points in the opportunity set, not just to those on the boundary. The average consumption of a large number of these households would almost certainly be at the set's center of gravity, with households uniformly distributed around this point. Since a compensated change in prices would shift opportunity sets and thus centers of gravity away from commodities rising and toward those falling in price, these households would also have negatively inclined market demand curves. For example, point c in Figure 2 would be the center of the set OAB, and c', to the left and above c, would be the center of OCD.[16] Inefficient inert households would be initially distributed throughout the opportunity set. They too would tend to have negatively inclined market curves because a compen-

sated change in prices would still force those consuming relatively large amounts of commodities rising in price to change, presumably toward a smaller consumption of these commodities. So an extension of irrational behavior to cover inefficient consumption does not alter the conclusion that irrational households would tend to have rational market responses to a change in prices.

III. FIRMS

The analysis can easily be extended to the demand for inputs by interpreting X and Y in Figure 2 as inputs rather than commodities, and AB and CD as equal outlay rather than equal income lines. A fundamental theorem of rational behavior is that a compensated increase in the price of X would reduce the amount of X employed with a given outlay: less X would be employed with the outlay line CD than AB. The applicability of Figure 2 is a hint that this theorem is derived not so much from rational behavior itself as from the general effect of a change in relative input prices on the distribution of employment opportunities. Even irrational firms would tend to respond "rationally" to a change in input prices; for example, a large number of impulsive firms would on the average be located at point p when faced with AB and at p', to the left and above p, when faced with CD.[17]

Figure 2 could not be directly applied to the demand for inputs if total outlays were permitted to vary because outlay

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[16] The set OCD differs from OAB only because ApC differs from BpD ($OApD$ is common to both). Since ApC is to the left and above BpD the center of OCD must be to the left and above that of OAB.

[17] Just as a group of impulsive households would produce compensated commodity demand curves having unitary elasticity, so impulsive firms would produce compensated input demand curves having unitary elasticity, or exactly the same as that produced by firms maximizing profits subject to Cobb-Douglas production functions. It is rather amazing that these implications of Cobb-Douglas functions, which have been extensively acclaimed, should also result from the simplest model of impulsive behavior.

lines could not then serve as budget lines. More generally, since the traditional analytical distinction between households and firms is that firms are not supposed to be subject to budget constraints,[18] our analysis of irrational households would seem to have little relevance to irrational firms. As long as the assumption of profit maximization is maintained, firm decisions can legitimately be analyzed without recourse to budgetary constraints, and the traditional distinction is valid. But as soon as other decision rules are permitted, the existence and importance of a budget constraint become patently clear, and the traditional distinction is blurred and perhaps even vanishes.

In my judgment the great achievement of the "survival" argument advanced by Alchian and others[19] is not a demonstration that surviving firms must act as if they were trying to maximize profits, for counterexamples can easily be developed, but rather a demonstration that the decisions of irrational firms are limited by a budgetary constraint. Indeed, the survival argument is really simply a special case of a general argument, developed for households in Section II, linking the behavior of all economic units to the distribution of their opportunities. Thus firms could not continually produce, could not "survive," outputs yielding negative profits, as eventually all the resources at their disposal would be used up.[20] For exactly the same reason households could not continually consume, in this sense could not "survive," outside the region covered by incomes.

In both cases the word "survive" simply refers to a resource constraint on behavior and does not literally distinguish "life" from "death," although some households and firms may actually die from trying to "live" beyond their means. Had the meaning of survival in this context been understood, numerous pointless discussions of the application of biological survival theories in economics could have been avoided.
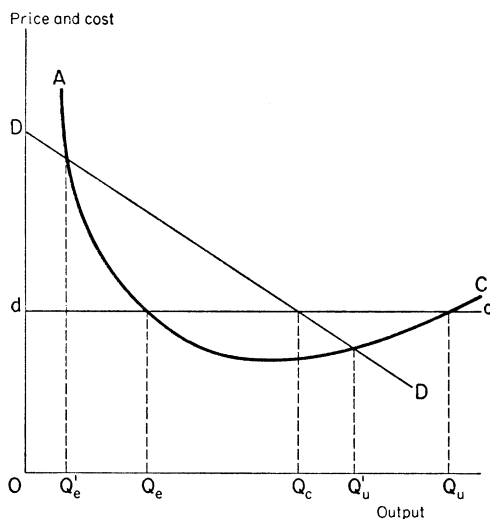

FIG. 3

Since the region inclosed by the income constraint is called the consumption opportunity set of households, the region of non-negative profits can appropriately and naturally be called the production opportunity set of firms. For example, households with the budget line AB in Figure 2 have the consumption opportunity set OAB, and firms with the average cost curve AC and demand curve dd shown in Figure 3 have the production opportunity set Q_eQ_u. Just as households choose their consumption subject to the limitation that they spend no more than the available income, so firms can be assumed to choose their output subject

[18] See, e.g., H. Hotelling, "Demand Functions with Limited Budgets," *Econometrica*, January, 1935, pp. 66–78, and P. Samuelson, *op. cit.*, p. 218.

[19] See references in n. 1.

[20] More generally, firms could not survive if the sum of profits and net income from other sources was less than zero.

to the limitation that they spend no more than the maximum profit which could have been earned. The entire amount, so to speak, would be spent at outputs yielding zero profits; nothing would be spent if profits were maximized; and a positive but less than the entire amount would be spent at any other admissible output. The traditional conclusion that firms are not subject to a budget constraint is clearly valid when profits are maximized: nothing would be "spent" and so no constraint could be operative. With any other decision rule, however, a constraint on total expenditures might be operative because something would be spent.

A change in cost or demand conditions would change production opportunity sets and force even irrational firms to respond systematically. Many variables influence these sets, and I have not tried to determine the response of irrational firms to changes in all of them. It is instructive, however, to consider explicitly some differences between monopolistic and competitive outputs: a well-known theorem is closely associated with profit-maximizing behavior, and even skeptical readers might be impressed by a demonstration that a wide variety of irrational behavior would reproduce this theorem.

Industrial costs would be the same as a firm's, except for a difference in units, in industries having many independent, identical firms, but the industrial demand curve would be more elastic than the firm's. The AC curve in Figure 3 can, therefore, measure both industry and firm average costs, DD industry and dd firm demand conditions. Line DD is drawn so that the competitive equilibrium of profit-maximizing firms occurs at a price of Od and a per firm output of OQ_c, where presumably mar-

ginal costs equal price. If the industry became a completely monopolistic cartel, DD would measure firm as well as industrial demand and dd would no longer be relevant. A famous and ancient theorem states that, if profits were always maximized, output per firm under the cartel would be less than OQ_c.

Completely impulsive firms would assign an equal probability to all available outputs and select one at random: no marginal cost function would be consulted and certainly no attempt would be made to equate marginal cost and marginal revenue. If the industry was "competitive," these firms would be uniformly distributed along the opportunity set Q_e, Q_u with an average output almost certainly at the midpoint. Let Od again be the equilibrium price and OQ_c average output, where OQ_c is now simply the midpoint of Q_e Q_u and not necessarily a point equating marginal cost to price. Cartelization would shift the firm's demand curve to DD and shift the opportunity set to the left of Q_e Q_u to Q'_e Q'_u. If outputs were again chosen randomly, firms would be uniformly distributed along Q'_e Q'_u and average output would almost certainly be at its midpoint, which is to the left of OQ_c.

In the same way inert and many other kinds of irrational firms can be shown to reproduce these famous theorems of neoclassical economics. The fundamental explanation is that a change from competition to monopoly shifts the production opportunity set toward lower outputs, which in turn encourages irrational firms to lower their outputs. At best only of indirect importance is the effect on the marginal revenue function, the explanation always given for profit-maximizing firms.

Our discussion of changes in input prices and the degree of competition in-

dicates that irrational firms can give very rational market responses, and this seeming paradox offers a solution to the heated and protracted controversy between marginalists and anti-marginalists. Confidence in the irrationality of firms induced the latter to conclude that market responses were also irrational, while confidence in the rationality of markets induced the former to conclude that firms were also rational. Apparently few realized that both kinds of "evidence" could be valid and yet both inferences invalid, so that each side might be partly right and partly wrong. Basically, what is missing in the controversy is a systematic analysis of the responses of irrational firms; in particular, of how opportunity sets and thus the decisions of irrational as well as rational firms are affected by changes in different variables. For such an analysis reveals that irrational firms would often be "forced" into rational market responses. Consequently, anti-marginalists can believe that firms are irrational, marginalists that market responses are rational, and both can be talking about the same economic world.

IV. SUMMARY AND CONCLUSIONS

Economists have long recognized that consumption opportunities of households are limited to those costing no more than the income available, but not that production opportunities of firms are limited in *exactly the same way* to those yielding non-negative profits—or to a somewhat larger set when income is also received from other sources. This neglect results from the almost exclusive concern with profit-maximizing firms, for they and they alone are not affected by the constraint on production opportunities. If firms maximized utility rather than profits[21] or behaved irrationally, the con-

straint on opportunities would be as real to firms as to households. The word "firm" in this context includes foundations and other private non-profit organizations, governments, and persons choosing occupational and industrial employment as well as "commercial" organizations. Opportunity sets apply, then, to all decision units with limited resources.

Even irrational decision units must accept reality and could not, for example, maintain a choice that was no longer within their opportunity set. And these sets are not fixed or dominated by erratic variations, but are systematically changed by different economic variables: a compensated increase in the price of some commodities would shift consumption opportunities toward others; a compensated increase in the price of some inputs would shift production opportunities toward others; or a compensated decrease in the attractiveness of some occupations would shift employment opportunities toward others. Systematic responses might be expected, therefore, with a wide variety of decision rules, including much irrational behavior.

Indeed, the most important substantive result of this paper is that irrational units would often be "forced" by a change in opportunities to respond rationally. For example, impulsive households would tend to have negatively inclined demand curves because a rise in the price of one commodity would shift opportunities toward others, leaving less chance to purchase this one even impul-

[21] See A. A. Alchian and R. A. Kessel, "Competition, Monopoly, and the Pursuit of Pecuniary Gains," paper given at the Universities–National Bureau Conference on Labor Economics, April 22–23, 1960, and my *The Economics of Discrimination* (Chicago: University of Chicago Press, 1957), chap. iii.

sively. Other irrational households would likewise tend to have negatively inclined demand curves, irrational firms negatively inclined demand curves for inputs, and irrational workers positively inclined supply curves to occupations.

If irrational units, nevertheless, often respond rationally, what accounts for the deep and prolonged animosity between marginalists and anti-marginalists, Veblenites and neoclassicists, and other groups differing in the degree of rationality attributed to economic decision units? The major explanation undoubtedly is that formal models of irrational behavior have seldom been systematically explored—in particular, to determine how changes in opportunities impinge on irrational behavior. A subsidiary explanation is that little attention has been paid to the distinction between group or market and individual responses. This distinction is unnecessary in traditional theories of rational behavior because a market's response is usually simply the macro-version of an individual's response. A group of irrational units would, however, respond more smoothly and rationally than a single unit would, and undue concentration at the individual level can easily lead to an overestimate of the degree of irrationality at the market level.

When market responses of irrational units sometimes differ substantially from the responses of rational units, empirical evidence on actual responses would be crucially important in assessing the extent of individual rationality. The kind of evidence traditionally used, the negative slope of market demand curves or the positive slope of market demand curves or the positive slope of market supply curves, is equally consistent with individual irrationality and cannot discriminate between them. Inadequate attention has been paid to gathering relevant evidence apparently because opportunity sets and their effect on the market responses of irrational units have been inadequately appreciated.

I explicitly analyzed only simple models of irrational behavior in which current choices were partly determined by past ones and partly by probability considerations. Much additional work is required to formulate rigorously other models and to determine their implications. Although many of these would surely differ, an important area of agreement would result from common responses to shifts in opportunities. Such is the main lesson to be learned from this paper.