Giving Marginal Analysis a More Realistic Footing

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Abstract:

Alchian questions the validity of profit maximization as a realistic assumption in marginal analysis. Alchian's proposed viability hypothesis attempts to maintain the validity of marginal analysis without the use of profit maximization. This paper evaluates Alchian's hypothesis in light of competing economic theories. It is concluded that algorithmic profit seeking based on entrepreneurial judgment through economic calculation is the only criterion that is realistic and that validates the long run results of standard marginal analysis to a full extent.

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In Uncertainty, Evolution, and Economic Theory (1950), Alchian questions the validity of profit maximization as a realistic assumption in marginal analysis. Profit maximization implies perfect foresight but, from the perspective of a realistic decision maker, every potential course of action has multiple possible outcomes.

Alchian is concerned with the fact that under realistic conditions of uncertainty there is no perfect foresight, there is no universal outcome distribution comparison method, and the decision maker cannot determine which course of action leads to maximum profit. Since profit maximization is unrealistic, reliance upon it constitutes a weakness in economics.

He introduces the viability hypothesis, shifting the focus of the economic process from the mechanism that determines action to the mechanism that determines success and survival, with the intention of maintaining the validity of the results of standard marginal analysis even when the profit maximization assumption is not.

Alchian's viability hypothesis consists of the proposition that the action determination criterion of the individual firms does not matter to the long run results of the model as long as there is a filtering process that eliminates the unprofitable firms. He contends that even random behavior will ultimately yield the same general results as profit maximizing behavior.

Alchian is right in pointing out that the concept of profit maximization is flawed and unrealistic, but he is wrong to try and mend the issue by shifting the entire weight of economic theory upon the profit and loss mechanism rather than striving to incorporate a

more realistic and reliable concept of action determination. His fatal mistake is a fundamental failure to understand the extent to which the profit and loss mechanism is itself reliant upon the proper action determination mechanism.

The first to publish a criticism of Alchian's viability hypothesis was Penrose (1952). Her initial point of criticism focused on the argument that Alchian's viability hypothesis is flawed because a biological analogy is inappropriate in economics. She also pointed out that the possibility of economists knowing which firms would survive implied in the predictive power of marginal analysis is tantamount to the possibility of knowing how to achieve profit.

Alchian brushed off the criticism in a comment (1953) by clarifying that his hypothesis stands on its own and that the biological analogy is merely illustrative and argued that knowing the conditions for survival is not the same as knowing how to achieve them in a given specific context.

It was in her rejoinder (1953) that Penrose strengthened her criticism and came closest to the point that will be developed in the present work. She pointed out that for viability to yield the same results as marginal analysis with profit maximization, intense competition is necessarily a *deus ex machina* assumption. She argued that competition is not a reasonable assumption for a model based on random action.

In a methodological discussion of positive economics, Friedman (1953) affirmed the effectiveness of Alchian's viability hypothesis as an auxiliary validator of the results of marginal analysis. He

provided two analogies for support. The leaves in a tree grow as if they were trying to capture the optimal amount of sunshine and a billiard player makes his shots as if he knew how to calculate the optimal trajectory, even though neither of them do.

In a publication aimed at promoting the uncertainty theory of profit, Weston (1954) criticized Alchian's alternative to profit maximization as a decision making criterion. Accepting Alchain's argument that it is not possible to maximize from a set of distributions with a range of variance, Weston argued against defaulting to random behavior.

Weston found Alchian's imitation, adaptation, and innovation acceptable but insufficient. He emphasized the need to include judgment. He argued that even under conditions of uncertainty, as long as decision makers can estimate probability distributions of alternative outcomes, they will adopt a minimax strategy:

> While a situation of uncertainty implies that income maximization is not an appropriate goal or criterion, it does not imply that rational behavior will not be effective. Imitation, adaptation, and innovation are examples of rational strategies in the face of uncertainty. Subjective probability opinions may be formulated; but flexibility, diversification, and safety margins will be employed as well. These are all elements of a minimax strategy. They likewise involve the exercise of judgment and are influenced by the utility preference systems of the decision-makers.

In one of the sections of his doctoral dissertation, Winter (1964) questioned the extent to which Alchian's viability hypothesis validates the results of marginal analysis. His primary criticism of the viability hypothesis focused on the lack of distinction between

actions and rules of action, and on the lack of a dynamic analysis. He argued that the filtering process could not eliminate non-maximizing behavior fast enough to eliminate it completely.

Alchian is not entirely clear about the extent to which he believes his viability hypothesis validates the results of marginal analysis. It is presumably a contention for a full extent of validation of long run results. A full extent validation requires that two conditions are the same in the end state of a viability model with random behavior as in the equilibrium state of standard marginal analysis with profit maximization: (a) the internal characteristics of the set of firms, and (b) the composition of output.

This can be tested through comparing these conditions in two versions of a simple model where the only variation in the setup is the action determination criterion. There is the random case and the maximizing case. For the sake of simplicity, let there be two firms, two inputs, and two outputs. Either output can be produced with any combination of the inputs.

The price of each input is positively related to the amount used by both firms. The price of each output is negatively related to the amount produced by both firms. There is only one optimal ratio of outputs that yields maximum overall revenue and one optimal ratio of inputs that yields minimum overall cost, so there is only one configuration of inputs and outputs that yields an overall maximum profit.

The firms face two choices: the composition of their input and the composition of their output. When a firm makes choices that result in higher costs than revenue, its output is counted as part of total output but the firm is eliminated.

Table 1	Single Output A	Both Outputs	Single Output B
Single Input X	X A	X AB	X B
Both Inputs	XY A	XY AB	XY B
Single Input Y	Y A	Y AB	Y B

In both cases there is a range of possible outcomes. To visualize the differences between the ranges, let the optimal ratio of inputs as well as the optimal ratio of outputs be one to one. Let the options be simplified to producing one output or both outputs in equal parts and using only one input or both inputs in equal parts. Each firm has nine possible combinations of choices as shown in Table 1.

Table 2	**X A**	**X AB**	**X B**	**XY A**	**XY AB**	**XY B**	**Y A**	**Y AB**	**Y B**
X A	U U	U P	B B	U P	U P	P P	B B	P P	**M M**
X AB	P U	B B	P U	B B	P P	B B	P P	**M M**	P P
X B	B B	U P	U U	P P	U P	P P	**M M**	P P	B B
XY A	P U	B B	P P	B B	P P	**M M**	P P	B B	P P
XY AB	P U	P P	P U	P P	**M M**	P P	P U	P P	P U
XY B	P P	B B	P P	**M M**	P P	B B	P P	B B	P U
Y A	B B	P P	**M M**	P P	U P	P P	U U	U P	B B
Y AB	P P	**M M**	P P	B B	P P	B B	P U	B B	P U
Y B	**M M**	P P	B B	P P	U P	U P	B B	U P	U U

If both firms produce the same single output with the same single input, the price of the input exceeds the price of the output and both firms are unprofitable. If both firms produce the same output and use different inputs or if both firms produce different outputs using the same input, the prices of the inputs and outputs are the same and both firms break even. Table 2 shows all possible outcomes.

In the maximizing case, the firms always coordinate to one of the outcomes in which both are earning maximum profit. In the random case, all combinations are equally probable. With a single iteration, there is only an 11% probability of a maximizing outcome. Table 3 shows the probability distribution of outcomes after a single iteration.

Table 3	Maximizing	Random
M M	100%	11% (9/81)
P P		34% (28/81)
B B		25% (20/81)
P U or U P		25% (20/81)
U U		5% (4/81)

To allow multiple iterations in the random case, the rule is that the surviving firms repeat their combination of choices and the eliminated firms are replaced by a firm that will again randomly select a combination of choices. In the cases in which both firms achieve maximum profit, some profit, or break even, they both survive

and an end state is reached. Here pure random behavior is abandoned because the surviving firm persists in its previous combination rather than randomly producing a new one.

The probability of both firms being perpetually unprofitable tends to 0%, though this stable disequilibrium is still possible. Table 4 shows the probability distribution of outcomes when the double elimination outcome is iterated out of existence. In the cases of one elimination, it is also possible for the successor of the eliminated firm to perpetually select the combination that leads to its elimination. Table 5 shows the probability distribution of outcomes towards which the system tends at an infinite amount of iterations.

Table 4	Maximizing	Random
M M	100%	12% (9/77)
P P		36% (28/77)
B B		26% (20/77)
P U or U P		26% (20/77)

Table 5	Maximizing	Random
M M	100%	16%
P P		52%
B B		32%

What this exercise shows is that viability does not guarantee profit maximizing outcomes. Random behavior is most likely to lead to a suboptimal equilibrium. For the 16% chance of end states where in

this example both firms happen to achieve maximum profit, the two conditions for validation, characteristics of the firms and composition of output, are indeed the same. The probability of obtaining this type of outcome would shrink as more firms, more inputs, more outputs, and less restricted choices are added to the model.

For the other 84% chance of end states that in this example yield suboptimal equilibria, condition (a), the characteristics of the firms, is satisfied in a tautological way: firms which avoided elimination have the characteristics of a profitable firm. Condition (b), the composition of output, is not satisfied. In the suboptimal equilibria, output is of a lower amount and inferior combination as compared to the maximizing case because a portion of the available inputs goes unused or a portion of the possible output goes unproduced.

Based on this comparative analysis, Alchian's viability hypothesis does not validate the long run results of standard marginal analysis to a full extent. It merely half validates them in a very narrow sense. Thus, Alchian was wrong to default to random behavior.

To understand why Alchian's viability hypothesis does not work, it is necessary to turn to some ideas that predate the entire discussion on viability but seem to have gone overlooked. For someone who is recognized in some circles as a big name in price theory, Alchian appears to have neglected to apply any of it in this case.

Prices do not appear out of the ether, they are the result of real transactions. Moreover, the imputation from consumer goods to factors of production, from outputs to inputs, is not automatic. Price adjustments are effected through the actions taken by both the consumers and the firms. Mises (1949) puts the matter quite clearly:

> It is impossible to think away or to eliminate from the market process the men actuating its operation. One cannot deal with the market of consumers' goods and disregard the actions of the consumers. One cannot deal with the market of the goods of higher orders while disregarding the actions of the entrepreneurs and the fact that the use of money is essential in their transactions. There is nothing automatic or mechanical in the operation of the market. The entrepreneurs, eager to earn profits, appear as bidders at an auction, as it were, in which the owners of the factors of production put up for sale land, capital goods, and labor. The entrepreneurs are eager to outdo one another by bidding higher prices than their rivals. Their offers are limited on the one hand by their anticipation of future prices of the products and on the other hand by the necessity to snatch the factors of production away from the hands of other entrepreneurs competing with them.

The notion of purely random behavior as a basis for the market process is purely inane. Random decisions cannot self coordinate toward better and fuller use of the factors of production and toward better and fuller satisfaction of the consumers. A profit and loss selective process in a world of random behavior cannot systematically yield efficient outcomes because the prices that determine whether a firm earns a profit or a loss are themselves the result of a random process.

Alchian's limited concept of purposeful action based on imitation, adaption, and innovation is not sufficient either. Merely

trying not to be unprofitable still yields systematically suboptimal results. Viability is an invalid basis for marginal analysis because it fails to yield outcomes tending toward those of marginal analysis. Profit maximization is an invalid basis for marginal analysis because it is impossible in reality for decision makers to have perfect foresight. Having invalidated both known sources of validity for marginal analysis, it would be discourteous to not offer an alternative, leaving marginal analysis invalid.

For a realistic decision making criterion to serve as the systematic theoretical validator of marginal analysis, wisdom may be found in Weston and Mises. Algorithmic profit seeking based on entrepreneurial judgment through economic calculation is the best alternative.

This version of profit seeking accounts for uncertainty and tends toward maximizing outcomes. The decision maker starts by doing nothing and is then confronted with the option of doing something. Given what he knows about the world at the moment of making the decision and what he expects the future to be like, he uses economic calculation to determine whether doing something or doing nothing will generate more profit. He then picks the option that he believes will earn the higher profit, until another option presents itself and the process is repeated with a new set of knowledge. The algorithmic criterion stops when no additional options worthy of being taken, given the knowledge of the decision maker, present themselves.

Algorithmic profit seeking makes prices and profit and loss selection significant. The prices of inputs are bid up through the

process and the prices of outputs are bid down through the process. It is not an automatic optimization of a set of equations whose real parameters are unknowable. The market process does not require its participants to have full knowledge and foresight, it merely requires them to systematically aim to earn more profit through each decision in order to systematically coordinate them toward optimal outcomes.

When algorithmic profit seeking is tested through the simple model described above, it generates the same outcomes in one iteration that the modified random case generates through infinite iterations, without the possibility for stable disequilibria. This happens because even if the firms have no knowledge of the desired ratio of output, they coordinate their use of inputs in the present towards full employment. By the second iteration they get feedback from consumer preferences and are able to coordinate toward a maximizing outcome.

Alchian's profit selection theory based on random behavior is invalid despite his insightful critique of profit maximization. His viability hypothesis as an alternative to profit maximization as a decision making criterion is also invalid. Instead of viability, algorithmic profit seeking based on entrepreneurial judgment through economic calculation should serve as the systematic validator of marginal analysis. It is the only criterion that is realistic and that validates the long run results of standard marginal analysis to a full extent.

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