Microeconomics
and x-efficiency theory:
If there is no crisis,
there ought to be

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In a recent biography Eleanor Dulles reports on her experience in a New York hairnet factory circa 1920. “The owner of the factory never came out there, he just sat in New York and took the money.... The manager was a very sharp type. I told him I could increase production, so I worked out an incentive scheme whereby for a 50 percent increase in production they could make 30 to 40 percent more in wages.... The girls really began to put out. They got very much interested in their work, and the good ones were soon earning 16 dollars and more a week.”

To her astonishment, the manager didn’t like it.

“T’m not going to have those girls thinking they are good,’ he said. ‘I’m going to get rid of the good girls. I didn’t pay them to get above themselves.’”

“He deliberately slowed down supplies and made things awkward for the smarter girls, so they just lost spirit and left.”

The story is instructive from a number of viewpoints. First, it describes a situation that cannot be explained on the basis of conventional microeconomic theory, since the factory was not minimizing costs, nor maximizing output for the size of the work force. Second, it illustrates the different objectives of the factory owner vis à vis
the factory manager. This is unquestionably a case where management was made aware of a way of increasing output and yet chose not to use it.

While it is rare to find such instances documented so clearly and graphically, this type of situation is not at all atypical. In 1974 in the United Kingdom (as a result of a coal strike), the Conservative government of Prime Minister Heath restricted manufacturing to a three-day week for six weeks. The result was that although labor and capital was utilized no more than 60 percent of the time, output was more than 80 or 90 percent of its normal level.

Neither of these situations is explained by conventional economic theory. In neither case were costs minimized, and in both instances the opportunity to utilize resources could have been improved considerably. This failure of conventional theory points up the need for a theory that enables us to examine, analyze, and predict instances where this type of inefficiency exists.

Conventional microeconomic theory is concerned with allocative or market efficiency. However, there are no markets inside productive organizations. We cannot simply assume that such organizations handle their affairs as well as they possibly can, as the conventional cost-minimization assumption implies.

What I have called “X-efficiency theory” is concerned with the type of inefficiency resulting from missed opportunities to utilize existing resources within productive organizations. (Since at an early stage in my research I was unable to find an adequate name for this type of inefficiency, I simply called it “X-inefficiency.”) This theory attempts to analyze such inefficiencies and to determine their consequences. It is concerned with all types of non-allocative inefficiency.

Clearly it is more than organizational efficiency we are talking about. It addresses the type of inefficiency that takes place within households, as well as the inefficiency displayed by private enterprises and by governments. Basically, what is involved are all types of inefficiencies resulting from the complete or partial lack of motivation to use economic opportunities as effectively as they might be used. To the non-economist it may appear surprising to learn that standard economics does not cover this type of inefficiency. Yet in fact, it is assumed away by the maximization postulate, and especially by its corollary, the cost-minimization assumption.

The field of economics is divided into two broad approaches: macroeconomics and microeconomics. Macroeconomics deals with large aggregates: savings, investment, GNP, the money supply, and
so on. Most of the grand problems of an economy, such as unemployment and inflation, are treated from a macro viewpoint. Newspaper and television economics, and a great deal of current controversy, is in terms of macro-magnitudes and macroeconomics.

However, most of what economists study, and the foundations of economics, falls into the realm of microeconomics. Micro is concerned with individual markets and the determination of price in such markets. Central to this is the theory of the supply and demand of particular goods. But behind supply and demand there is a theory of human motivation—a theory of how economic units behave. Essentially the conventional theory says that economic units try to do as well as they possibly can when they make economic decisions—in other words, they "maximize." This assumption means that, for production of goods and services, firms minimize costs per unit of output for a given scale of operation. Further, the theory asserts that it makes no difference whether such units are individual consumers, many-person households, one-man firms, or large, many-person enterprises. That is, the existing theory states that demand and supply relations determine what goes on in markets. It goes further to state that demand and supply relations are determined by the standard economic theory of decision making—that is, maximizing profits or utility, and minimizing cost. It is this latter position that we question. If there is a crisis in microeconomics it is with respect to the decision superstructure and how the superstructure affects our view of economic life.

Is there a "crisis" in micro theory? Several recent presidents of the American Economic Association and a recent Nobel Laureate have lectured economists on the shortcomings of microtheory. That is, there has been some concern in "high places." Yet this does not prove that the average economist is concerned about the nature and content of microeconomics. Quite the reverse is probably the case. Certainly the content of teaching in this area has not changed much in the last three or four decades. There is little evidence that there is any feeling of crisis.

What I will argue is that if there is no general erosion of confidence in conventional microeconomics, there ought to be. Briefly and bluntly, I feel that as economists:

1. We do not know the extent of our knowledge. We have a theory that appears to apply to everything. It is formal and universal. (By way of contrast, well developed sciences such as physics, chemistry, and microbiology know to a considerable degree where their knowledge is on solid ground and where it is either lacking,
vague, or uncertain.) There is, of course, a great deal that economists do understand about the behavior of the economy. Yet, obviously we do not know everything in microeconomics. Most curiously we do not know what we know. That is, with regard to various aspects of economics, economists cannot say "these aspects are what we know to be true, and these aspects we know little or nothing about." If a discipline after two centuries of intellectual activity still does not know what it knows, it cannot be said to be in a good state, or based on a solid foundation. Surely this fact alone should engender a feeling of crisis, or at the very least signs of concern.

2. A great source of difficulty involves the interpretation of the maximization postulate. Some interpret it as a behavioral or factual postulate; others interpret it tautologically. To my mind, the former is the proper interpretation. Yet we know of cases under which it is untrue—circumstances under which people do not maximize. The tautological approach implies that all behavior represents maximization, whatever the nature of the behavior. It says people always maximize, but that they may have complex and hidden objectives. This goes counter to the sensible notion that the definition of maximization as a term must admit non-maximization as a possibility. Furthermore it goes counter to the major scientific tenet that assertions can be criticized on the basis of factual or experimental data. The tautological approach immunizes the postulate, and many implications of the theory of which it is a part, from all possible criticism.

3. There is something basic missing from the conventional theory which is found in reality. In reality there exists the possibility of differential degrees of motivation. Yet the standard theory implicitly assumes that people are always fully motivated (maximization). Observation of the real world shows us that this is simply not the case. Some people are less motivated than others; and the same people appear to be more motivated in some circumstances than in others. Economic behavior, the amount and nature of effort that people put forth in their economic affairs, is in response to such differential degrees of motivation. Furthermore, different environments create and affect the degree of motivation that exists in different contexts. These elements influence to a significant degree the costs of production and output in the economy. The theory as currently constructed cannot handle "differential motivation." The Dulles hairnet factory story, and the three-day-week experience, are examples that fit a differential motivation postulate and contradict full motivation (i.e., maximization).
X-efficiency theory

All well-formulated theories in science are based on postulates (i.e., assumptions). In formal presentations the most important postulates are specified in advance. Consider two of the critical postulates of traditional microeconomics: 1) maximization and 2) the production function. By maximization (or the rationality postulate) we usually refer to the idea that decision units try to do as well as they possibly can, given their objectives. Thus, it is usually assumed that enterprises try to maximize profits; most important this implies that they attempt to minimize costs for a given output. The reader should note that it is the cost minimization postulate that, in a basic way, X-efficiency theory questions.

The production function postulate says that there is a unique relationship between inputs and outputs. To some economists it seems obvious that businessmen are sensible, and that sensible businessmen will know what they are doing—hence they will want as much profit as possible, as low costs as possible, and they will know the relation between any particular aggregate of inputs and any particular aggregate of outputs. Is this really so? Should we base our theories on these notions?

Even though these assumptions are sanctified by at least a century of tradition, there is nothing holy about them. In most sciences, especially in response to new findings, new postulates are considered, and new models or “pictures” of the world are developed, to try to account for phenomena that were not well explained on the basis of the previous model. This is the spirit in which I have attempted to develop X-efficiency theory. With this in mind, let us look at one element not well handled by standard theory—the process of production.

Let us go back to the hairnet factory example. Clearly there was no unique relation between the number of people hired and output. Furthermore, the management did not choose to minimize costs. Now let us look at the problem of production from a more general viewpoint. Clearly it is not the number of machines, the amount of space, the amount of materials, nor the number of people hired that determines output. What is critical is the amount and nature of the effort that the individuals hired put forth. Yet effort as such is not a variable in standard microtheory. Hence, in X-efficiency theory we focus on effort as a major variable, and relate it to the motivational system within the enterprise. Thus we assume that there is no unique connection between inputs purchased and output produced. Just putting people on the payroll does not by itself produce
results. We have to examine what it is that people do within the enterprise and why they work the way they do, in order to understand productivity. Hence a very basic assumption that we will employ is that effort is, to some degree, a discretionary variable for all enterprise members. In other words, our theory assumes that to some extent individuals can choose 1) some of their activities; 2) the rate at which they carry out these activities; and, 3) the quality of their effort. The nature of the choice each individual makes will depend on the motivational system.

In contrast to the standard assumption of maximizing behavior, we assume non-maximizing most of the time. Maximization is a special case, in our view. Thus, most individuals are looked upon as non-maximizers most of the time. For example, most students will not study very effectively on most occasions, but their effectiveness increases as soon as there is the external pressure of an important examination. In a similar way, we assume that most individuals will move toward maximizing behavior as external pressure increases. Of course, we must also take into account the internal pressure that is part of an individual's personality. There may be some individuals whose personality is such as to approximate maximization all of the time. However, we will assume that this is the exception rather than the rule.

How does non-maximization work itself out in practice? There are two parts to normal decision making. First, in the flow of events most activities are handled on the basis of habit, routine, or well-entrenched conventions. These terms overlap. The first problem is to determine what changes in circumstances activate decision making. Once explicit decision making is activated, we then have to consider how such decisions are made. We cannot capture all of the details or specifics of every individual's decision-making procedures. However, we believe they are likely to fall into three categories. The first we have already mentioned, namely habits, routines, and conventions. The second is decisions according to imperfect and partial calculating procedures. Finally, there is a class of procedures which comes close to complete calculation. This last approximates maximization.

Most of the time decisions are not activated. When changing circumstances cause external pressure to become sufficiently great, activation takes place. At first, most individuals will fall back on a convention or a habit as a solution to the decision problem. If the pressure of the importance of the decision is sufficiently great, there will be a shift towards partial calculation. The greater the apparent
cost (or pressure) of incomplete calculation, the greater the shift towards a more complete procedure. Thus, in general the degree to which any decision procedure deviates from maximization depends on the degree of external pressure.

A concept related to the existence of pressure is that of *inert areas*. The concept of inert areas postulates that only if external pressure (or external cost) is sufficiently high, will behavior change. For instance, many people will continue to smoke cigarettes knowing that it is bad for them, but a slight heart attack will lead some of them to quit. The event increases pressure and activates an explicit decision activity. Something akin to the use of the inert area idea is the suggestion that upper and lower bounds exist within which routine behavior takes place. An extreme example of behavior within an inert area (or inertia) is described in the Russian 19th century novel, *Oblomov*. When we first meet the hero, Oblomov, he is in bed despite the fact that a number of business and social problems require the type of attention that can only be given to them out of bed. Some 300 pages later Oblomov’s problems have not diminished yet he has not moved out of bed. (So as not to spoil things for those who have yet to read Goncharov’s classic, I will refrain from indicating what happens after page 300.)

The last postulate we consider is the concept of *effort entropy*—a type of organizational entropy. As in physics, entropy is viewed as a measure of disorder. More specifically, we look upon it as representing the degree of insufficient coordination with presumed enterprise objectives. Once again the existence of pressure is central. As more pressure for coordination flows from the top there is likely to be a greater degree of coordination. If a decrease in pressure occurs, then—up to a point—there will be a related increase in effort entropy, and a decrease in X-efficiency.

**Implications of X-efficiency theory**

The consequences of these assumptions will depend on the environment within which the enterprise operates. The external environment puts pressure on the executives of the enterprise, who in turn transmit pressure to other members of the firm further down the hierarchy. Under a high degree of competition, if sustained over a long period of time, the external pressure may be sufficiently great that the result may approximate cost minimization. However, many markets are imperfect. They provide *shelters* from competitive pressure. Probably the hairnet factory reported on by Eleanor
Dulles was of this type. Of course, firm managers, and owners, desire shelters. It was already noted by Adam Smith, over two centuries ago, that when businessmen get together they frequently attempt to work out agreements on prices or other market conditions—that is, to work out sheltered arrangements.

In sheltered environments there is no necessity for business firms to minimize costs. There is no reason for management to transmit pressure from the top down through the various layers of the hierarchy in order to foster the most effective effort levels. The non-maximization and inert-area postulates imply that once employers choose effort-activity-quality routines that are non-optimal they will continue with such routines. Hence cost minimization will be the exception rather than the rule.

Important implications of our postulates have to do with the relations between cost and price. It is frequently stated that if the cost of some input, say labor, increases, the cost of output must increase accordingly. But this does not necessarily follow. If there is a rise in the cost of some input but at the same time the pressure on management to be more effective increases, resulting in more effective effort choices, then this may engender a reduction of X-inefficiency and a decrease in costs. One thing is clear: There is no necessary relationship between the percentage increase in costs of inputs (labor, raw materials, machinery, etc.) and the percentage increase of the cost of the output. The cost of the output can turn out to be very much smaller, or not rise at all.

In the Fall 1979 issue of The Public Interest, Richard L. Freeman and James L. Medoff argued that while unionization resulted in increased wages, in 75 percent of the cases unionization also resulted in a 20 to 25 percent increase in productivity per man. Here we have a set of fairly clear-cut cases where increases in the cost of the input did not result in an equal increase in the cost of the output. It is possible for no increase in cost to result. The reader will recall that in the hairnet factory example, the cost of the increased wages was less than the increase in productivity.

It is of special interest to note that an increase in the price of a product will not necessarily leave costs unaffected. In the mainline theory, it is assumed that the price of a product and the costs of production are separate matters. In X-efficiency theory, an increase in the product price that comes about as a result of an increase in “sheltering” may be associated with an increase in costs of production.

Professor Primaux of the University of Illinois compared the cost
per unit of output of the 49 cities in the United States that have two electric-utility companies with the cost per unit of output of all other cities which have only one. The single electric-utility city is the norm. Electric utilities clearly constitute a sheltered industry. In the two-company cities each company faces competition from the other company. If the standard theory is correct, there should be no difference in cost (after making an adjustment for scale) between the two-company cities and the single company cities. If, on the other hand, X-efficiency theory is correct, the less sheltered case (two companies) should have lower costs. Primaux found that, in fact, the 49 two-company cities had about 11 percent lower costs.

It is conceivable that the retardation in the productivity growth of the American economy which has taken place in recent years is not only a contributor to inflation but to some degree a consequence of it. An inflationary atmosphere permits business enterprises to pass cost increases on. Higher prices result because there is relatively little fear of a competitive disadvantage, since other firms are in similar circumstances and behave in a similar fashion. In other words, the inflationary atmosphere allows managers to be somewhat less concerned about transmitting pressure within the firm towards cost containment, since the alternative of price increases which pass on X-inefficiency is readily available. A recent television program (60 Minutes, NBC, December 9, 1979) discussed the automobile-insurance-fraud rackets, specifically organized frauds caused by false accident reporting. A lawyer involved in some aspect of the problem was asked why the insurance companies did not do more to investigate the possibility of fraud. His reply was that it is easier for the insurance companies to pass through to its customers the costs of fraudulent claims in the form of higher rates. Obviously, there is no pressure to minimize costs.

Our theory argues that in order to understand productivity changes we have to understand how the economic environment operates as an incentive towards more or less effective effort levels. After all, our real standard of living, on the average, depends on productivity per man. This in turn will depend on the organization of markets, the nature of the economic units within these markets, and how the environment influences incentive structures. Mainline theory does not really study such questions because it does not address itself to the non-market production activities within the firm, the impact of sheltered environments on motivation, and the significance of differential motivation. X-efficiency theory focuses on these considerations.
A standard conclusion of conventional theory is the desirability of expanding international trade in accordance with the comparative advantages in production of each country. The general idea is that if a country can specialize in those things which it produces at relatively lower resource costs, and trades them for those things which it produces at higher resource costs, it is better off than if it tries to produce all products on its own. Even if Canadians could grow both apples and bananas, it would require so many more resources to grow bananas than apples that Canada is better off growing apples and trading them with some Central American country for the bananas which grow easily there. This argument for trade, which has been around for several centuries, is valid. However, according to X-efficiency theory a more important gain from trade may also result from the importation of products similar to those produced reasonably well in the country in question. Such imports put pressure on local producers to produce at lower costs than would otherwise be the case. Thus Americans may gain from the importation of foreign automobiles since imports put pressure on American manufacturers to maintain higher levels of productivity and/or higher quality standards than would otherwise be the case.

From some viewpoints the impact of X-inefficiency on the retardation of economic growth may be of greater importance than the underutilization of resources at any point in time. Growth depends on the introduction of innovations. Its essence is to go counter to the maintenance of routine procedures. Of course growth takes effort, but it is a special kind of effort—that type which redirects existing effort levels. Thus the atmosphere of a sheltered environment which is conducive to relatively high costs is also likely to reduce the incentives for management and workers to introduce new types of machinery and new techniques. Considerable deviation from maximizing behavior is likely to be inimical to innovation. Furthermore, inertia has to be overcome in order to introduce innovations, and at certain levels of disorganization (effort entropy) it is likely to be extremely difficult to introduce innovations effectively. At this point we do not wish to suggest a theory of innovation; rather, we simply want to indicate how the categories we have developed can be used to analyze environments in which the introduction of innovations is likely to be difficult as against those in which innovating is easier.

Bureaucracy, and especially governmental bureaucracy, is a significant problem area usually ignored by economists. Bureaucracy also exists in private organizations. It is a product of organization,
size, and complexity, and is therefore not limited to government. However, keeping in mind that 30 to 40 percent of the gross national product is attributable to the activities of government, it seems appropriate that economists analyze the organization of government's economic activities as we do that of private enterprises.

The principal-agent relationship is especially diffuse in bureaucratic organizations. This single fact is a major element of bureaucracy and helps to account for some of its characteristics. Whom does the governmental bureaucrat really work for—the citizenry? Bureaucrats rarely, if ever, take orders from the citizenry directly. Nor do they attempt to determine their appropriate objectives on the basis of the desires of the citizenry. Clearly bureaucratic careers do not depend on behavior that primarily considers the aims of the principal. Between the true principals and the agents there are a host of elected politicians, political appointees, and civil servants who interpret and reinterpret the nature of the task to be carried out. The environment within which agents have to choose their effort levels is surrounded on the one hand by negative rules of accountability, and on the other by rules and conventions which define the privileges of the civil service. Frequently one gets the impression that the demands of the citizenry play a minor role in influencing the actual performance to "their" agents.

It is most important to keep in mind that governmental activities are completely sheltered from competition. The Post Office and many other agencies even have rules that make competitive activities illegal. Even when the nature of the service is determined by the context, the environment, or legislation (e.g., picking up and delivering mail), the lack of pressure from the environment permits a very wide range of inefficiencies. Calculations of inefficiency are not usually made, but in the few cases in which this has been done, such as in a recent study comparing government versus private garbage collection, it was found that government collection cost, on the average, 61 percent more than private collection. The point is that, normally, if government becomes expensive we cannot shop around elsewhere for competing services.

It is not my intention here simply to delineate various aspects of bureaucracy. Rather it is to suggest that the arguments just stated would follow for bureaucracies in almost any large organization, be it public or private, which are sufficiently sheltered from competition.

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1 See E.S. Savas, Policy Analysis, Winter 1977.
How important is X-inefficiency for the economy as a whole? It is hard to say. The ideas are too new and as yet no one has attempted to work out a careful assessment. But there are a lot of partial data floating around from particular studies. While the question might be raised whether they are representative, I feel we do have enough data to make a preliminary "back of the envelope" type of assessment about the order of magnitude of X-inefficiency. If unionization can increase productivity by 20 to 25 percent; if instances of monopoly show cost differences of more than 10 percent; if we presume that the government sector is considerably less X-efficient than the non-government sector—then it is not a wild guess to expect the production sector to be only, say, 70 percent as X-efficient as it could be.

But households are also X-inefficient. To what degree do households spend their money and use their goods less well than they could if they were maximizing? Suppose it is 85 percent of maximum X-efficiency. The X-efficiency of the economy is the product of household X-efficiency and production X-efficiency. For the numbers assumed, this implies that the economy is operating only 60 percent as well as it could be. While these numbers should not be taken too seriously, in my view they are not beyond reason.

A micro-micro approach

We have contrasted the X-efficiency approach with that of the mainline microeconomic approach which assumes that business enterprises minimize costs per unit of output. If firms do not minimize costs, then this is a basic source of inefficiency in the economy, one which is likely to be significantly larger than any other source. The figures suggest that the magnitude of X-inefficiency at any one time in the United States may be between 20 to 40 percent of net national product. Figures developed by T. Y. Shen (University of California, Davis) suggest that X-inefficiency may be even higher in developing countries. Contrary to the conventional theory, firms in developing countries do not merely substitute labor for capital. Shen found that these countries not only used more labor in the same industries for the same products as advanced countries, but also more capital. While using more capital they also use, in some cases, between

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2A recent paper by three Dutch economists, Arie Kapteyn, Tom Wansbeek, and Jeanine Buyze, "Maximizing or Satisficing?", *The Review of Economics and Statistics* (November 1979), estimates that in Holland consumers purchasing durable goods did only about 75 percent as well as they would have had they been maximizing.
three- to ten-fold more labor than was used in technologically advanced countries. The long-run impact on growth is likely to be of greater importance than the short-run slack.

X-inefficiency also exists in households. If household budgets are not handled optimally, an equal social loss is involved. The total loss due to X-inefficiency, then, will grow rapidly as household or production efficiency decline.

Clearly the magnitudes of X-inefficiency are extremely important. In my view the theory necessary to explain them must deviate from the postulates of profit maximization, utility maximization, and cost minimization—the most strongly held beliefs of a large segment of the economics profession. Reluctance to relax the maximization assumption deprives the profession of a research pathway that can lead to discoveries of significant economic pathologies. There ought to be, to a greater extent than there is, a questioning of the current direction of work.

The implications for research of the approach presented here differ from those of the neoclassical theory. We suggest that a great deal can be learned by going more deeply into the decision procedures and motivations that exist within firms. That is, we recommend a micro-micro approach. This means studying in detail what the standard theory simply assumes. In a sense this would take us in the same direction as physics and microbiology—towards the study of smaller and smaller fundamental entities. This approach brings some elements of economics closer to the subject matter of business schools. Economists, however, would continue to look at these matters from a different viewpoint.

Some of our findings are different from the implications of standard theory. According to X-efficiency theory, 1) cost minimization will be the exception rather than the rule; 2) increases in input prices need not result in increases in output costs; and, 3) raising the price of the product may increase cost through the operation of increased effort entropy. Thus inflation may be a cause, in part, as well as a result, of cost increases.

While our findings are different in some cases, they do not always point to different policy directions. The conventional theory views the expansion of international trade as a good thing on comparative advantage grounds. X-efficiency theory also sees it as beneficial because it puts pressure on domestic producers to lower costs. For reasons that are too technical to present here, it seems likely that the X-efficiency improvements would be considerably greater than the comparative advantage benefits. On the other hand, in contrast
to the conventional view, X-efficiency theory suggests that profits are not a good indicator of efficiency if production takes place in sheltered environments. Thus, it would probably not be good public policy to control natural monopolies such as electric utilities by controlling the profit rate. X-efficiency holds that incentives must be provided for operators to reduce costs toward the minimum.

Finally, the X-efficiency approach is in the spirit of the development of models based on different postulates than those already existing—a conventional procedure in many sciences. Relaxing the maximization postulate would permit the study of different types of economic activities, including those undertaken by governments, in terms of a continuum of environments which provide different degrees of motivation toward efficiency of performance. In general, once the cost-minimization postulate is dropped, X-efficiency theory opens the way for the analysis of cost-containment problems and countermeasures.