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THE LIMITS TO GROWTH: A REPORT FOR THE CLUB OF ROME

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My talk will be divided into three parts. First, I will briefly describe the conclusions of the much publicized report for the Club of Rome: The Limits to Growth. Second, I will describe the model employed to make the calculations -- not so much from a technical point of view but to give you a feeling for the reasoning involved. And the last part will point out that though the model is extremely naive it nevertheless contains an important germ of truth.

THEIR CONCLUSIONS

The conclusions of The Limits to Growth can be paraphrased as follows: The world is headed for a great depression, the likes of which will make the 1930s seem like a mild downturn. Not only will there be a larger and more prolonged reduction in production and employment, but this depression will be accompanied by widespread starvation and disease, a large increase in death rates and an eventual decline in the world's population. Why is such a depression more or less inevitable unless action is taken now to stop population and industrial growth? "Exponential growth," which results in a doubling of the world's industrial output every ten years the authors claim, cannot be sustained because if we do not exhaust our resources we will

kill ourselves with pollution! Furthermore, Meadows and Company claim that the negative feedback required to slow down growth to a sustainable rate will come too late to avoid a major depression.

Why will the feedback come too late? As an analogy, think of a thermometer as a device for supplying positive and negative feedback for putting coal on a fire to keep one's house comfortably warm: when the temperature is below sixty degrees, say, the thermometer supplies positive feedback for putting more coal on the fire. On the other hand, when the reading is 75 degrees negative feedback is provided, which is to say, you already have put too much coal on the fire. But suppose that as you put more and more coal on the fire the temperature does not go up more or less continuously. You shovel coal on to the fire for an hour and it goes up only two degrees, and then within a fifteen-minute period, the temperature shoots up to 75 degrees. In this case, you receive negative feedback but it comes too late to prevent the house from becoming overheated. And the authors assume that the negative feedback from growth at exponential rates is something like the negative feedback from putting too much coal on the fire. By the time the feedback is received the economy is overheated in the sense that it is growing at a far greater rate than can be sustained. Consequently a serious depression becomes more or less inevitable.

THE MODEL

The authors advertise their approach as "systems dynamics." A "dynamic system," according to their definition is one which is capable of responding to both positive and negative feedback. An

example in terms of their description would be a captain of a ship who made short-term predictions on the basis of observing the interaction between his ship and the waves; after which he makes corrections, to keep the ship on a prescribed course. Or to take another example, let us imagine a person has observed that when putting coal on the fire there is a delayed response between shoveling the coal and a comfortably warm room. And suppose further that the person has adjusted his coal shoveling strategy to take into account this observation. If we define a "dynamic system" as one which responds to both positive and negative feedback then the shrewd coal shoveler, who constructs a theory for shoveling coal by observing reality, qualifies as a "dynamic system."

However, there seems to be some disagreement between MIT and Caltech people on how to define "dynamic behavior." In terms of my concept of "dynamic economics," a system which responds to both positive and negative feedback would be called a "cybernetic system" but not a dynamic system. In my terms, to qualify as a "dynamic system," it is essential to be able to respond to negative feedback by discovering alternatives that the person in question simply could not have predicted beforehand. For example, let us assume that a husband is confronted with a serious matrimonial dilemma: either he must discover a more effective way for dealing with his mother-in-law -- or he must find a new wife. And let us further suppose that with necessity knocking on his door the husband puts his imagination to work to discover an alternative he could not have predicted beforehand. Such a husband would qualify as a genuine "dynamic system." Or to take as another example a captain of a ship who makes new discoveries in the

face of dealing with unexpected conditions. He, too, can be described as a dynamic system, because the essence of dynamic behavior is dealing with the unexpected.

In short, whereas Meadows and Company define dynamics in a manner which is compatible with physical reality, I define a dynamic system to include a diversity of people with respect to their "openness" -- their ability to accept and deal with new circumstances. At the one end of the scale are those people whose behavior is strikingly similar to a "closed cybernetic system": because they are quite as predictable as computers, such people have an almost zero ability for dealing with dilemmas. Most accountants fall in this category, just as do many lawyers. At the other end of the scale are people with a high degree of "openness" due to a great capability to engage in dynamic behavior. For example, as Mayor of New York, La Guardia did so well when dealing with dilemmas that he can be said to have approximated the characteristics of a "predictably unpredictable dynamic system." It could never be predicted just how he would overcome this or that dilemma, but you could bet that in something like four out of five cases he would come up with a satisfactory resolution.

Obviously, "openness" not only requires imagination to use hints from previous experiences to construct new hypotheses but also a sensitivity to negative feedback coupled with a sufficient sense of self-confidence to enable actions to be taken on the basis of equivocal indicators. In short, the essence of dynamic behavior is that it cannot be programmed on a computer. And the fact of the matter is that if man were as predictable as the MIT model assumes, he would never have escaped from the Stone Age! Man would still be hovering in caves while the lions ruled the Earth!

PREDICTING THE FUTURE

Granting that the model of dynamic behavior I subscribe to is very different from the Meadows and Company model, how different would my predictions of the future be from theirs? By way of introducing this topic, I want to note that without defining "dynamic behavior" in the way I have, it would be impossible to explain the economic development of the United States. From 1900 to 1950 something like 7/8 of our growth occurred as a pure productivity increase and only 1/8 can be explained in terms of the growth of the conventional inputs: land, labor and capital. In other words, 7/8 of our growth came about as a result of improvements in the menu of technological alternatives. Moreover a better and better menu not only permitted increases in productivity in this country, but many others as well.

This remarkable economic development of the United States must be explained in terms of a true dynamic model -- and not a cybernetic model. And it simply could not have occurred if American entrepreneurs did not have the ability to anticipate shortages of one kind or another and to take action upon them before they became serious problems for society as a whole.

In fact competition between highly dynamic firms worked so remarkably well in bringing about smooth progress that many economists feel there was a more or less automatic hidden hand at work -- a hidden hand which will assure more or less automatic progress in the future. However, to my way of thinking it is quite as naive to believe in an automatic progress model, which assumes heaven on earth, as it is to believe in a cybernetics model which assumes that unless man renounces all

forms of growth, his destiny is hell.

Why am I somewhat pessimistic about the automatic progress model? It is not because I believe there is a shortage of creative people in the United States. In the millions of Europeans who chose to come here during the 19th century we inherited more than our share of risk-takers. Moreover, because personality differences in people are in very significant degree genetically determined differences, America's inheritance of relatively dynamic people can be regarded as more or less permanent.

The problem is that not only America but almost all the affluent countries of the world face a shortage of risk-taking -- and with it, a low demand for risk-takers. Why is there much less risk-taking in American business firms than there was, say, ten or fifteen years ago? One reason is that the post-World War II industrial revolutions, which were the most profound of any in our previous history, have slowed down substantially. And with a slowing down in the industrial revolutions there has been a marked change in the character of American business firms. Suppose that you had observed a firm in the chemical, petroleum or aircraft industries twenty years ago and you observe the same firm today. What difference in behavior could you expect to discover? You would discover in nine cases out of ten the difference that for example can be found between a criminal law firm and a probate law firm: between a firm which loves to deal with uncertainty because the more uncertainty, the more potential alternatives it will have to defend its clients versus a firm whose main fear is the fear of unpredictability. Associated with this change, we should

expect to find firms which are more internally structured and contain less trust, and have therefore a lower capacity to engage in dynamic behavior. Moreover, just as criminal law firms and probate law firms are composed of dissimilar personalities, associated with the change in organizational behavior there has been a decided change in the kind of people in middle and top management positions. Whereas most of the leaders of the post-World War II industrial revolutions were scientists and engineers who received their training at the World War II Office of Scientific Research and Development, the new people who have taken over their positions for the most part were trained as accountants, lawyers or business administrators. In other words, the people who rise to the top today are trained to perform more or less the same function in modern society as did genetic inbreeding in medieval societies: to preserve an organization's history rather than make new history.

To be sure, this is not the first time in American history we have faced the prospect of stagnation. Just as Robert Townsend and others now describe how business organizations stifle people and strangle profits, so were there business leaders in the 1920s who made the same charges. And even earlier, the fifteen-year period before World War I was a period of stagnation -- a period in which Thorstien Veblen observed the same disappearance of entrepreneurship as we are observing today.

However, there is a real difference between the American economy today and the economy about which Veblen wrote. In 1920 neither the United States' economy nor the world economy were as interdependent as they are today. In the past whereas the dynamism of the economy

was maintained by adding entirely new products and often new industries, under today's circumstances the failure of a few large industries to engage in dynamic behavior supplies a major constraint on the dynamic performance of the entire economy. For example, suppose that the automobile, electric power and petroleum industries were incapable of engaging in any greater degree of dynamic behavior than that in which they engage today. If this be the case, and if air quality goals continue to be postponed for this reason, then more of the burden for dealing with pollution problems simply will have been transmitted from industry to the cities. Economic life in Detroit, for example, will have been made more predictable at the expense of making progress toward better air quality goals in Los Angeles more unpredictable. In the case of either pollution problems or problems of material shortages, it is impossible for an entire society to conserve its predictability. Try to spare this or that activity from change and you will find that you have transmitted the burden to someone else.

Therefore one of my reasons for feeling that progress will not be as automatic in the future as it has been in the past is that whereas automatic progress requires the talents possessed by criminal law firms -- we actually live in an economy presided over by firms strongly resembling probate law firms. And another reason has to do with our newly founded religion in America: the religion of stable growth. In the past, the overall stability of the American economy was maintained by having entrepreneurs who were willing to take genuine risks to engage in unpredictable behavior. For example when Henry Ford the First pioneered the Model-T car, he pioneered a concept of automobiles

for the masses which would have been very difficult to predict. And this action in turn played a significant role in ending the period of stagnation which began early in this century. But how does Henry Ford the Second respond to the current period of stagnation? He has responded by raising the prices of his cars and by asking the government for a tax reduction to stimulate automobile sales!

This change more or less symbolizes the change in attitudes brought about by the "stable growth religion." Under the name of "stable growth," the government goes as far as it can to completely stabilize the environment of business and union leaders, and in doing so makes the American economy more like the British economy: one whose dynamic capability is just above zero.

In summary what I have been saying is this: The Model developed for the Club of Rome is completely irrational, because it does not take human beings into account. Nevertheless it must be recognized that we live today in a highly irrational world composed of a raging advertising industry, a ranting legal profession and a lounging gentry. And such a society may not have a substantially greater dynamic capability than a closed cybernetic system.