Douglass North, "Structure and Change in Economic History"

Chapter 7

The First Economic Revolution*

I

For more than a million years after men and women had become distinguishable from other animals, they roamed the earth hunting and gathering plants. The evidence available, while scanty, makes clear that Paleolithic man had a lifestyle that distinguished him from lower animals, although like theirs, his ability to survive was affected by the vagaries of nature. Man lived in small groups or bands; caves, or sometimes simply the open, were his dwelling places. The groups had to be ready to move whenever they had exhausted the animal or plant supply in an area.

During this long era of hunting and gathering there developed many variations of man's lifestyle and culture. Examples of Paleolithic man's artistry are to be found in the Dordogne Valley in France, where depictions of animals and hunting scenes still survive on the walls of caves. While this Magdalenian culture has been viewed by archeologists as the most brilliant achievement of the Pleistocene period, there is evidence of a developed culture in other parts of Europe as well. Archeologists have found tools and weapons engraved or carved with animal or floral designs;

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small figurines (Venuses) have been found that accentuate the pregnant features of women; and burial sites suggest that prehistoric humans were concerned with life after death. Despite these artistic and aesthetic achievements, however, man lived very much as other animals, taking from nature what he could kill or gather. The limits of livelihood were fixed by a resource base which he could not yet improve; he could exist only within the earth's biological constraints.

Approximately ten thousand years ago, humans began to develop a settled agriculture: to herd and breed animals and to cultivate plants for food. The results of a developed ability to increase the resource base amounted to a fundamental economic revolution. The transition from hunting and gathering to settled agriculture, which the archeologist V. Gordon Childe termed the Neolithic Revolution, fundamentally altered the rate of progress of human beings. It led to an enormous acceleration in the process of learning, which accounts for the extraordinary developments in, say, the past ten minutes of man's chronological history in contrast to the previous twenty-three hours and fifty minutes.

Making sense of this change is extremely difficult and to some degree must be conjectural. There is, of course, no written word to provide evidence and only a few artifacts survive. Nevertheless, the brilliant detective work of archeologists has helped us a great deal, and the combined efforts of botanists, biologists, geologists, physicists, and geographers have given us a number of clues to help us reconstruct, however tentatively, what must have taken place.

Before examining this first economic revolution it is well to outline that generally accepted significant evidence about man's prehistoric past with which a theory of the revolution should be consistent.

1. The development of settled agriculture occurred approximately ten thousand years ago, but man is distinguishable from other animals more than one million years ago. The rate of material progress of man has accelerated dramatically since the development of agriculture.

2. This development appears to have occurred independently in such areas as the "Fertile Crescent," Meso-America, and probably Peru, North China, and others, and at different times.[1]

[1] For essays providing evidence on the timing and location of agricultural development see Struever (1971).

3. The spread of agriculture took thousands of years. The rate of spread across Europe appears to have averaged only about one kilometer per year. (L. L. Cavalli-Sforza, 1974)

4. The extinction of a variety of large animal species occurs in the later Pleistocene period. Some two hundred species have been listed as disappearing. (Paul Martin and N. E. Wright, 1967)

5. Before the development of agriculture man had begun to exploit a wider source of food. Larger animals played a lesser role in man's diet, and small animals, fowl, shellfish, snails, nuts, and seeds played a larger role. This exploitation is called the Broad Spectrum Revolution. (Flannery, 1968)

6. Human population increased and man migrated into new regions; the most dramatic was his movement into the New World and into Australia. (Davis, 1974)

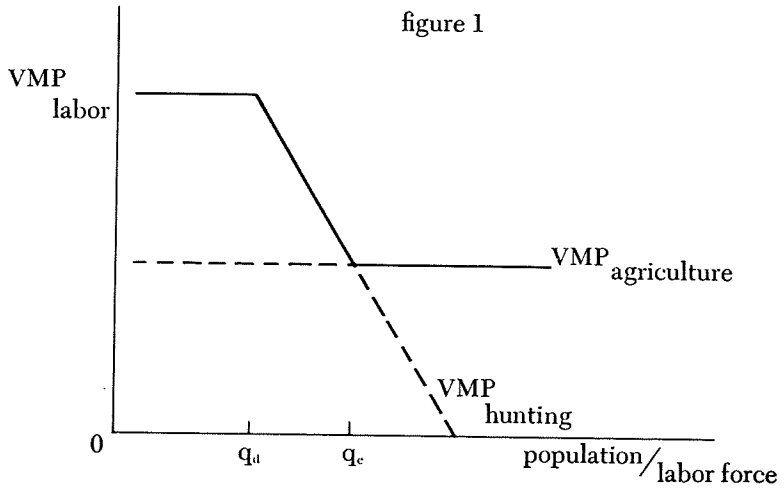
II

Let me begin by examining, within the context of a comparative static economic model, the conditions that would account for the First Economic Revolution. The purpose of this model is to derive the conditions under which the scarce labor resource of the band would shift from its traditional occupation of hunting/gathering to agriculture.[2] The major resource of the band, it is assumed, is the labor of its members. The band may choose how to employ its labor to produce the goods and services desired. It will attempt to allocate resources in the manner that will maximize the value of the scarce labor resource and, therefore, the economic welfare of the group. In the absence of a market to determine the relative prices of the two kinds of output (hunting/gathering or agriculture) the band's preferences will establish these relative valuations. I assume for purposes of analysis that they remain unchanged. Hence, the marginal product of labor or the opportunity schedule in each activity becomes the crucial variable in the band's determining how it will allocate its labor between the two sectors.[3]

[2] The term "band" is adopted from Colin Renfrew (1972: 363). See his discussion of the anthropologist's distinction between band, tribe, and state: 363–65.

[3] Throughout this section I am assuming that man actually possessed sufficient knowledge of plants and/or animals to have engaged in cultivation and/or herding prior to the actual transition. I shall derive from the model what these conditions were. In the final section I shall relax this assumption in order to demonstrate that the results will be the same once exclusive property rights are created. What I am asserting is that the invention of agriculture is not the most important issue. Rather, it is the incentive change resulting from exclusive property rights that will inevitably create agriculture.

figure 1



Initially assume that the work force is fixed. The opportunity for labor in the hunting sector is the value of the marginal-product schedule for labor in hunting.[4] Assume also that the stock of resources is biologically determined and, therefore, subject to diminishing returns as hunting effort is increased.[5] Thus, the value of the marginal-product schedule in hunting when graphed will after a period of constant returns (oq_a in figure 1) eventually slope downward. The relevant downward-sloping portion of the demand for labor in the hunting sector is $q_a \cdot q_e$ in figure 1. The agricultural sector, reflecting the abundance of land at this time suited to this purpose, exhibits constant returns to

[4] Hereafter "hunting" should be understood to mean hunting/gathering.

[5] A more precise assumption is a model that specifies a biological growth law for animals. See Smith (1975), who suggests a model consistent with the analysis in this chapter. The distinction is that Smith provides a formal and elegant comparative static model. This is an essay in economic history which attempts to describe the time-path of the transition from hunting/gathering to agricultural society and identify the institutional changes that were required to make the transition. More specifically, it attempts to explain the characteristics of development that archaeologists have discovered.

scale for additional units of labor. Thus, the relevant portion of the demand for labor in agriculture is the horizontal section beyond q_c. The total effective demand for the band's labor can be viewed as the solid line in figuire 1. This schedule, when combined with the quantity of labor available, determines the marginal-value product of labor and how the available labor will be allocated between the two sectors.

Man would devote his efforts exclusively to hunting if the value of the marginal product of labor in hunting after fully employing all the available labor is still above the value of the marginal product of the first unit of labor employed in agriculture. This would occur if the size of the labor force was, in figure 1, q_c or less.

Assuming that for a time the size of the work force remains below q_c, then there are only two parametric shifts that can result in the reallocation of labor from hunting to agriculture. One would be a shift to the left of the value of the marginal product of labor in hunting reflecting a general decline in productivity in this sector. If such a shift took place, then the band would reallocate to agriculture that portion of the work force previously devoted to hunting whose output was now below what it would be if employed in agriculture. This result also implies a decline in the band's standard of living.

A second parameter shift that would reallocate labor from hunting to agriculture would be an upward shift in the value of the marginal-product schedule for labor in agriculture reflecting an increase in the productivity of labor in this sector. A shift of this nature would have some of the same results as described above: the productivity of a portion of the work force previously employed in hunting would now be higher if reallocated to agriculture, and so a transfer of labor would occur. The standard of living of the band in this event, however, would rise. If either or both of these parameter shifts were pronounced enough, the effect would be to transfer all of the labor out of hunting into agriculture. If we allow the labor force to grow while holding the opportunity schedules for labor constant in each sector, then a transfer of labor to agriculture would eventually result. If the initial work force were less than q_d on the graph, then additions to it after reaching that point would result in declining marginal productivity of labor employed in hunting. This would continue until the labor force reached q_c on figure 1. Thereafter,

additional increments to the labor force would be added to the agricultural sector under our assumptions with no further reductions in the marginal productivity of labor. Eventually, if population continued to expand with each addition being allocated to agriculture, that sector would come to dominate economic life.

In sum, there are three changes that could account for the transition from hunting to agriculture. Individually or acting in concert, a decline in the productivity of labor in hunting, a rise in the productivity of labor in agriculture, or a sustained expansion of the size of the labor force could have resulted in the transition of man from being exclusively a hunter to increasingly a farmer.

III

Archaeologists have advanced a number of explanations to account for the shift from hunting to agriculture. Each of them offers some insight into this transition and can be accounted for in terms of the above model; but no one of them is completely satisfactory—either because it does not account for the evidence summarized above or because its theory is incomplete. V. Gordon Childe (1951) maintains that with the recession of the last ice age the climate was radically altered. The Near East and North Africa, which once had been adequately watered, verdant areas filled with wild animals and plants easily available to humans, became relatively desiccated. As a result, available food supplies, both animals and plants, were concentrated near the water holes and oases that survived. In these few oases man was in close contact with animals and plants. He could observe them carefully and was in a position to protect some of the animals from their predators. Grass-eating animals gradually became domesticated as humans found it to their advantage to protect and herd them and to provide them with grass and grain.

Childe's theory, considered within the context of the historical evidence presented above, rests on a change in the environment which produced a decline in the natural resource base including the extinction of animals. A decreased natural-resource base suggests a decline in the productivity of labor employed in hunting, which in turn necessitated man's acquiring greater control over the remaining resources in order to survive. In the process man learned how to increase the productivity of this labor in

agriculture, forced to do so by the decline in his hunting opportunities. Childe's explanation consists of a shift to the left of the VMP_H (value of the marginal product in hunting) so that some part of the population would gain by shifting into agriculture.

The Childe theory has been criticized on two grounds. First, why did this development not occur after prior glacial recessions? Second, and perhaps more substantive, historical meteorologists have not found that the climatic changes coincide with the timing and location of shifts into agriculture. Furthermore, climatic change did not always accompany the disappearing of a species. Nor does Childe's hypothesis explain the rate of adoption of agriculture or the expansion of human population in the Neolithic period. Nevertheless, it is likely that climatic change did reduce the resource base and lead to increasing relative scarcity of plants and animals in some areas.

A second theory, the so-called nuclear-zone theory, has been advocated by Robert J. Braidwood (1963). The nuclear-zone theory of Braidwood rests on a view of cultural development in which man becomes gradually better acquainted with the plants and animals around him. Braidwood defines a nuclear zone as "a natural environment which includes a variety of wild plants and animals both possible and ready for domestication." Braidwood (1960) summarized this theory as follows:

> The food producing revolution seems to have occurred as the culmination of the ever-increasing cultural differentiation and specialization of human communities. Around 8,000 B.C. the inhabitants of the hills around the Fertile Crescent had come to know their habitat so well that they were beginning to domesticate the plants and animals that they had been collecting and hunting. . . . From these nuclear zones, cultural diffusion spread the new way of life to the rest of the world.

Braidwood's explanation consists of a shift upward of the VMP_A (value of the marginal product in agriculture). An appealing aspect of Braidwood's nuclear-zone theory is that in some areas the plants and animals were probably better suited initially for domestication than in others. Moreover, Braidwood stressed that man did not suddenly acquire an intimate knowledge of plants and animals, but learned it gradually and inevitably. What is missing from Braidwood's explanation is any causal nexus for change. Braidwood's description is not a complete explanation of the cause, the timing, the independent development, or the slow spread of settled agriculture; the rise

in population; or the extinction of certain animal species. It is obvious that getting to know plants and animals well is not a sufficient condition for the agricultural revolution even though it appears a necessary one.

These two theories do not consider population growth as an integral part of the explanation of man's transition to agriculture. A third theory, by Lewis R. Binford, elaborated by Kent Flannery, does. In this theory, population expansion via immigration puts pressure upon the resource base and creates competition among rival groups for survival. Binford (1968) speculates that in particular areas, different socio-cultural groups produce a disequilibrium:

> From the standpoint of the population already in the recipient zone, the intrusion of immigrant groups would disturb the existing density equilibrium system and might raise the population density to a level at which we might expect diminishing food resources. This situation would serve to increase markedly for the recipient groups the pressure favoring means for increased productivity. The intrusive groups, on the other hand, would be forced to make adaptive adjustments to their new environment. There would be strong selective pressures favoring the development of more efficient subsistence techniques by both groups.

Flannery (1969) elaborates on Binford's explanation in a study detailing the process which may have occurred. He ascribes to population pressure changes in hunting and gathering patterns: man turned from larger mammals to smaller ones and eventually from gathering to the development of agriculture.

The Binford and Flannery explanation consists of an expansion of population beyond q_c and, as a result, a part of the population shifting to agriculture. It suffers, however, from having no demographic theory on which to base the explanation, nor does it provide any explanation of why population expansion led to the development of agriculture.

IV

The model presented here assumes that when prehistoric man was presented with the choice between two alternatives, he would tend to choose the one that made him better off. I do not suggest that this assumption accurately described the behavior of any one individual or band of prehistoric men. In a world of uncertainty it is impossible to know a priori which choice is the

"correct" one. Instead, as many bands faced a similar decision, a few of the groping responses to a new situation would turn out to be the "correct" ones in terms of the struggle for survival; that is, these decisions made the band materially better off, hence increasing its chances for survival vis-à-vis other bands. The bands that select the "correct" alternative, whether consciously or by chance, will be favored by a process of natural selection. Other groups initially selecting other actions and as a result doing less well will over time either change over to the techniques of their more successful rivals or perish.[6]

Prehistoric man, as postulated by the simple comparative static-equilibrium model presented above, had two basic alternative employments for his secure labor. Those bands which chose the alternative that maximized the value of production would over time be favored over those that did not. The simple comparative-equilibrium model with which I began this chapter is therefore acceptable as far as it goes. That model, however, is incomplete for our purposes in that it does not explicitly consider the nature of the existing property rights within which prehistoric man existed; nor does it include any demographic hypothesis. Since the existing structure of property rights channels man's economic behavior, the individual will find it in his interest to behave differently under one set of rights than under another. Prehistoric man employed his labor in conjunction with natural resources to produce his living. The natural resources, whether animals to be hunted or vegetation to be gathered, were initially held as common property. This type of property right implies free access by all to the resource. Economists are familiar with the proposition that unconstrained access to a resource base will lead to its inefficient utilization. This inefficiency as the demand for the resource increases eventually leads to the depletion of the resource. The depletion can take the form, in the case of a reproducible resource, of a reduction in the biological stock below the level required for sustained yield harvesting.

This instance is an example of incentive failure caused by cultural or institutional (property rights) inadequacies. The individual or band has an incentive to ignore certain costs which results in the resource being overutilized and perhaps even its continued existence endangered.

[6] The scarcity of resources guarantees competition which in turn ensures that observable behavior consistent with the wealth-maximization hypothesis will emerge via the selection process, if not as a result of conscious design.

Let us examine the situation where several bands compete for the same commonly held migratory animals. The animals are valuable to the bands only after they are captured. The band then has the incentive to exploit the resource to the point where the value of the last animal killed is equal to the private costs of killing it. The collection will continue until all of the income the scarce resource would have earned under private property rights is dissipated.[7] That is, in a competitive situation no band has any incentive to conserve the resource, since the animals left to reproduce probably would be taken by its rivals. The stock of animals thus could be placed in danger of extinction. The crucial element causing this inefficiency is the lack of any barrier to the exploitation of the commonly owned resource base. Individuals or bands enter the hunt when they perceive their private returns to be greater than the benefits of doing the next best thing. The result is too many hunters. After some level of exploitation, the size of the stock would begin to decline, thus raising costs (reducing productivity) to all hunters. The opportunity for labor in hunting schedule (VMP_H) shifts back; this fact, however, will not dissuade new hunters from joining the hunt as long as their productivity in hunting remains above what it would be in their next best alternative, agriculture.

It has been shown that if some of the potential entrants are excluded from utilizing the resources not all of the income will be dissipated (Cheung 1970). Thus, primitive agriculture, which must have been organized as exclusive communal property, had the advantage over hunting in terms of the efficiency of the property rights. It is inconceivable that, from the very beginning, the first farmers did not exclude outsiders from sharing the fruits of their labors. Furthermore, the band was probably a small enough group to monitor easily the activities of its members to ensure that collective behavior did not overutilize the scarce protected land resource held in common by the group. Thus, the band in principle at least could have exploited its opportunities in agriculture by constraining its members with rules, taboos, and prohibitions, almost as effectively as if private property rights had been established.[8] We shall see that this difference

[7] The classic article developing the common-property resource model is by Gordon (1954). See also Smith (1975) and Cheung (1970).

[8] Economists' solutions to the common-property dilemma are a user charge, a change to private property, or enforcing rules of behavior. See Smith (1975).

between common property rights in hunting and exclusive communal rights in agriculture is crucial to an explanation of the First Economic Revolution. The hunting sector must be considered within the framework of a common-property resource and the agricultural sector as exclusive-communal property regulated so as to border upon private property in its influence upon man's behavior.[9]

The difference in the nature of the two types of property rights governing hunting and agriculture respectively has important implications for the effect technological change would have upon the band's welfare in the long run. There is no doubt that prehistoric man was inventive. The progress made in the development of tools is ample testimony to this fact. Learning by doing and by experimentation characterized this era. Under incentive provided by conditions of scarcity, man concentrated his efforts on one task, became more proficient at doing it, and discovered ways to do it better.

The long-run influence of these changes upon the economic well-being of prehistoric man would be very different if these improvements were applied to activities where common property rights prevailed than they would be if improvements were applied to activities where exclusive communal rights ruled. The short-run effects are similar. Technological change which improved man's productivity in hunting would make hunting initially more rewarding relative to the alternative of agriculture (the opportunity for labor schedule in hunting, the VMP curve in figure 1, would shift out). The same would be true of a technological change in agriculture which shifted the VMP_A curve upwards, hence making agriculture a relatively more rewarding pursuit. Over the long run, however, the increased rewards to pursuing agriculture would remain while those in hunting would be dissipated by the effects upon the resource base of increased effort in that area. The opportunity for labor schedule in hunting would initially shift out, attracting more resources into hunting and hastening the depletion of the stock of animals held as common property, eventually causing the schedule to shift to the left of its original position. The different types of property

[9] While there is no evidence that property rights existed over megafauna in Palaeolithic times, there have been widespread attempts to establish such rights amongst hunters in subsequent eras—Smith loc. cit. The costs of measuring and enforcing such rights have their contemporary counterpart in the case of whaling.

rights in hunting as against agriculture ensure that technological change would eventually cause a shift of labor into agriculture.[10]

V

Another crucial element in the analysis is a hypothesis about man's prehistoric demographic performance. It is clear that the number of people upon this earth has increased through time but not either continuously or at a constant rate. The secular trend is upward but the trend has been uneven and at times even interrupted. A complete explanation for the fluctuations in the human population is beyond my task here. However, detailing some of the elements that such an explanation would contain is necessary for our purposes.

The simple arithmetic of population change over the first million years suggests a very slow rate of growth. But it does appear that population did grow. Thus, despite probable setbacks during climatic changes, fertility tended to exceed mortality.[11] So long as the standard of life was above a certain level, there was a tendency for man to increase in numbers. The trend would have been upward despite the effects of factors that periodically would tend to increase mortality. This line of argument runs directly counter to the observations of anthropologists who have discovered that contemporary Stone Age tribes tend to have stable populations. In addition, the level of population maintained by such tribes seems well below that which would damage the resource base. This modern observation has suggested to anthropologists and archaeologists that the view of population dynamics developed above is inappropriate and should be rejected in favor of an assumption that prehistoric humans tended toward a homeostatic population.

There are several difficulties in making this extension from modern Stone Age tribes to their historical antecedents. Let us examine the conditions under which a homeostatic population could be established and maintained. First, fixed resources must be present to create diminishing returns to additions to the population. Second, exclusive communal property rights to the

[10] Another way of viewing this process is that technological change in hunting would reduce the private costs of hunting, increasing the rate of exploitation of the common property resource, hence hastening the overexploitation of the resource.

[11] See Coale, "The Human Population" (1974).

resource must exist to eliminate competition between rival groups. And, third, some form of communal regulation of access to the resource must exist to regulate the economic behavior of members of the group.

The first must exist or additions to populations would impose no cost upon the group—hence no reason for the group to attempt to limit population. The second and third are necessary if the common property result is to be avoided. Suppose for the moment that one band was engaged in exploiting a common resource and had succeeded in limiting its population to the level that did not threaten the resource. Then suppose another band appeared which desired to share the resource. The ability of the first band to exclude the second is surely a function of the size of its population. The larger the population, the better its changes of successfully excluding others. Thus the bands that do not attempt to limit their population will tend to dominate those that do when they come into contact with one another. A homeostatic population can exist only among isolated bands. Indeed, that is where they are found today—in areas remote from the rivalries of other peoples.[12]

In the world of prehistoric man those bands that attempted to adjust their population to the size of the local resource base would eventually lose out to those bands that encouraged large and increasing populations, even if it meant migration and the subdivision of the band. Thus, the human population of the prehistoric era had built into its behavior, whenever the standard of living permitted, a collective tendency for population to grow.

VI

Now let us look at this model in the context of the evidence developed by the archaeologist and anthropologist. Humans lived in small bands that had to be ready to move whenever the local food supply dwindled. Small children and old people were a burden. Humans lived in whatever natural shelters they could find as the band moved after the animals being hunted. There is little evidence of permanent villages, although a few half-buried huts have been found. As population grew over the million or so years of man's history as a hunter, bands divided and subdivided

[12] Modern-day survivals are discussed in Binford (1968).

and migrated in search of food. At first man hunted the larger animals. A number of kill sites with great quantities of bones have been found, indicating that the hunting tactic of driving large animals over a cliff was employed. It is possible that man's increasingly efficient ability to hunt the great cold-weather animals—the mammoth and the woolly rhinoceros as they retreated northward—contributed to their extinction in the period between 25,000 and 12,000 years ago.[13] About 30,000 years ago, population expansion pushed humans across the Bering Strait from Asia into America. Thereafter, they moved throughout that land mass. Coincident with the appearance of humans was the disappearance of several species of large animals.

Let us put this very general description into our economic framework. Initially, this was a world in which the supply of animals and plants upon which man could feed appeared endless. As human population expanded and threatened the supply of foodstuffs in a given area, bands would subdivide and move to new areas, thus gradually spinning off new groups. This process is described by anthropologists as an open-donor system. In terms of the model this was a world of constant returns to an increasing labor force, so that growth in population resulted in a proportionate increase in output. This world of constant returns persisted as long as there was empty land of equal productivity for a growing population to exploit. So long as this condition existed, there was no incentive to attempt to delineate exclusive ownership over plants or animals. We should expect, however, that groups that found themselves inside the population frontier would initially try to develop stable relationships between the population of the band and the resource base since they were bounded by other bands and as yet had no way to expand the resource base. Such population groups would attempt to reach precisely the kind of homeostatic relationships that the anthropologists have described as existing among contemporary primitive societies. These bands would limit fertility by taboos, infanticide, and various other means in an attempt to keep the relationship between the population and the resource base constant. Moreover, we should expect that these bands attempted to develop a set of customs and rules to regulate hunting, and in a way that would maintain stability. This

[13] For an economic analysis of this phenomenon, see Smith (1975).

attempt is due to fail for the reasons discussed above: a homeostatic population can exist only among isolated bands.[14]

Once population had expanded to the point where the resource base was fully utilized, then any further increase in population led to a decline in the marginal produce of labor in hunting/gathering. Nevertheless, given the characteristics of competing tribes and a common property resource, population would continue to grow. I can illustrate the consequences in figure 1 above. Population expansion to q_a could occur without a diminution in the stock of the resource base, but further increases produced diminishing returns. Big animals increasingly became scarcer and gradually man was forced to search for new sources of food among the lower orders of animals. We do know that beginning about 20,000 B.C. man began to adapt himself to different kinds of animals and plants to eat (Flannery 1969). This era can itself only have been a transitional phase because as population pressure continued to grow and compete for these common property resources even they would become increasingly scrace and relatively more "costly" in labor time to gather.

The solution to the common-property dilemma in which prehistoric man found himself was the development of exclusive communal property rights. While animals and plants remained abundant relative to the demands of the human population, there was no incentive to incur the costs of establishing property rights over them. It is only during this transitional phase of increasing scarcity that it became worthwhile to incur the costs necessary to develop and enforce property rights that could limit the rate at which the resources were exploited.

The evolution of property rights has historically consisted of first excluding outsiders from harvesting the resource and then devising rules that limit the intensity of exploitation of the resource by insiders. As Flannery points out (1968: 68), "We know of no human group on earth so primitive that they are ignorant of the connection between plants and the seeds from which they grow." In terms of figure 1, when population reached q_c additional labor could be more productively used in cultivation and herding. Prior to reaching this point, as the marginal return to hunting diminished, more effort would be spent in gathering. At some point, it is a logical step for the band to attempt to find

[14] In Meso-America the Broad Spectrum Revolution appears to have occurred after about 5,000 B.C.

a naturally fertile area, settle, and repel new arrivals. Bands living inside the frontier thus became increasingly sedentary. As the population of these bands grew, the natural resources of the area were exploited more intensively.

It is interesting that the viewpoint of Flannery described in the above quotation has led some anthropologists and archaeologists to suspect that the first domestication of plants and animals did not occur where they were naturally in abundance. Instead, they reason, domestication would first have occurred where the natural harvests were less rich because if man could obtain sufficient wild wheat by gathering, he would not have bothered to cultivate. Harlan and Zohary comment (1966), "Why should anyone cultivate a cereal where natural stands are dense as a cultivated field? . . . farming itself may have originated in areas adjacent to rather than in the regions of greatest abundance of wild cereals."[15] This argument ignores the fundamental dilemma of growing population pressure and the common property resource problem. It is more likely that man found rich areas where there was an abundance of wild grain that could be harvested with a sickle and then began to defend these areas against intruders. Thus, we would speculate that the intensive wild cereal cultivation, which in Jean Perrot's view (1966) was practiced by the semi-sedentary Natufian culture in Palestine, is a more likely step toward the development of domestication than the alternative of growing the seeds on marginal land.[16]

The evidence concerning the Natufian culture suggests that it is likely that agriculture was an already existing alternative to hunting. The independent developments of agriculture in different parts of the world and the slow rate of its spread northwest across Europe seems to be consistent with this assumption. But it is important to note that even if new knowledge were necessary to engage in cultivation and herding the basic argument that exclusive property rights will raise the incentive to acquire new knowledge is not damaged. The explanation sketch in this section can be read either as a story of the shift to an already known alternative or as one in which bands developed property rights over rich stands of wild grain and then had the incentive to acquire the knowledge necessary for cultivation

[15] Harlan and Zohary (1966: 1074–80).
[16] Perrot (1966).

and domestication. Probably the first step was the establishment of exclusive territory such as has been observed among primitive bands and tribes in modern times. Demsetz (1967), citing the anthropologist Eleanor Leacock, describes the creation by the Montagnais Indians of exclusive hunting territory for beaver in response to the growing demand by the Hudson Bay Company.[17] An exclusive territory could be established at relatively low cost for plants and nonmigratory animals, but only at much higher cost for migratory animals. Once exclusivity was established, weeding, primitive irrigation, and seed selection would gradually develop in a trial-and-error process of learning by doing. The productivity of cultivation thereby increased and the marginal-value product of labor employed in agriculture shifted upward.

The difference between cultivation and domestication is a subtle one. The latter implies a genetic alteration in the plant or animal to improve its value to humans.[18] Two famous examples from prehistory were the evolution of emmer and einkorn wheat from the shattering to non-shattering form and the modification of wild sheep to a quieter, more tractable animal. Both instances of domestication may have come about as accidental results of the selection process. But under exclusive property rights the rewards from domestication would encourage the trial-and-error process of seed and animal selection.

There is no implication that the transformation from hunting to agriculture occurred rapidly. The evidence accumulated by archaeologists suggests that it required a substantial period of time. The transition occurred as a result of persistent population pressure which produced changes in the relative scarcities of the resources exploited by prehistoric man. In response to these developments, individual bands began to attempt to exclude outsiders from access to the resource base. In the process such bands became sedentary. The establishment of exclusive communal property raised the bands' return to attempts to increase the productivity of the resource base. Many groups probably failed to make this transition, but some by luck or chance managed to make the transformation; it is from these beginnings that we see the development of civilization and economic growth that has occurred in the ten thousand years since.

[17] See, however, the caveat by McManus (1972) which indicates that a group survival criteria overcame the individual internal allocation. Smith (1975) describes a number of anthropological studies of primitive property rights.

[18] For a discussion of cultivation and domestication, see Isaac (1970).

The First Economic Revolution was not a revolution because it shifted man's major economic activity from hunting and gathering to settled agriculture. It was a revolution because the transition created for mankind an incentive change of fundamental proportions. The incentive change stems from the different property rights under the two systems. When common property rights over resources exist, there is little incentive for the acquisition of superior technology and learning. In contrast, exclusive property rights which reward the owners provide a direct incentive to improve efficiency and productivity, or, in more fundamental terms, to acquire more knowledge and new techniques. It is this change in incentive that explains the rapid progress made by mankind in the last 10,000 years in contrast to his slow development during the long era of primitive hunting/gathering.