The High-level Equilibrium Trap

Mark Elvin treats the problem of economic stagnation in the traditional Chinese rural economy as resulting from obstacles to *technological* innovation. In application to agriculture, Elvin's formulation may be put in these terms: why did the Chinese economy not succeed in introducing technological innovations into the process of cultivation, thereby increasing the productivity of agriculture? Elvin does not maintain that Chinese technology stood still during the medieval period.[1] But he does hold that technical advances just managed to keep pace with population increase and resource depletion, with the result that welfare (per capita income) remained fixed (Elvin 1975:87).[2] Technical breakthrough did not occur in spite of extensive commercial development, extensive production for the market, and considerable levels of scientific knowledge.

Elvin proposes to explain the persistence of technical stagnation in the late traditional economy in terms of his notion of a high-level equilibrium trap. The following passage is formulated in terms of handicraft cotton production, but is equally applicable to farm technology.

> Why at some point did the economy not generate a demand for cloth that was rising fast enough to smash through the institutional and structural barriers to invention? . . . The Chinese economy as a whole was caught in what may be called a high-level equilibrium trap: a situation to which most of the usual criteria of "backwardness" do not apply, yet characterized by a technological immobility that makes any sustained qualitative economic progress impossible. (Elvin 1972:170)

In its simplest form, Elvin describes the trap in these terms: technology had developed to the fullest extent possible (in agriculture and water transport, for example) without a discontinuous jump involving application of modern scientific inputs (Elvin 1973:305-6, 312).

> The hypothesis that only inputs created by a fairly advanced stage of an industrial-scientific revolution . . . could have saved her agriculture from sharply diminishing returns to new methods, new

[1] Elvin describes several important technological advances: the windmill, incubation box, cocoon drying techniques, hothouses, cellars for cotton spinning, new fertilizers and food plants, new navigational techniques, and spectacles.

[2] Note that this conforms to Perkins' estimates as well.

> investment, extra inputs and new use of resources, thus seems more plausible. (Elvin 1973:309)[3]

Thus Elvin's account has at its core a view about the prerequisites of technical innovation; he explains the failure of economic revolution in China as the consequence of the absence of the necessary preconditions of technical innovation.

Elvin summarizes his explanation of technical stagnation under one broad framework--the high-level equilibrium trap. But in fact his analysis identifies a number of separate factors, some of which are interrelated and others independent:

- population pressure on resources, particularly land;
- an oversupply of cheap labor, favoring labor-intensive innovations;
- market efficiency and market size;
- the organization of the unit of production (farm, business, cottage industry) and the incentives which this organization presents to various participants;
- a lack of available innovations which are both economically and technically feasible.

In the following I will briefly survey the main arguments concerning each of these factors and then consider whether the high-level equilibrium trap is one trap or many; does Elvin's formulation and application of the concept change with context? And we will consider whether the HLET is a valid or useful analytical concept for economic history. Does it identify a specific economic circumstance, or is it rather a metaphorical concept which can be loosely fitted to a wide variety of different circumstances?

Limits to the refinement of practice

Elvin holds that most elements of the HLET model in application to agriculture may be illustrated in terms of a functional relationship between labor and output indicating the efficiency of the production process (figure 1). At any given time in the development of an agricultural system the process of cultivation may be characterized in terms of the techniques available (forms of fertilizer, techniques for processing the soil, implements for cultivating and harvesting, techniques of crop storage, etc.); the forms of organization

[3] See also Dwight Perkins' argument to much the same conclusion.

and labor use in use; and the forms of labor skill available. The options available in each of these categories constitute the universe of possible forms of cultivation in those historical circumstances; and different cultivators can select different mixes of techniques, skills, and organizational forms through which to cultivate their crops.

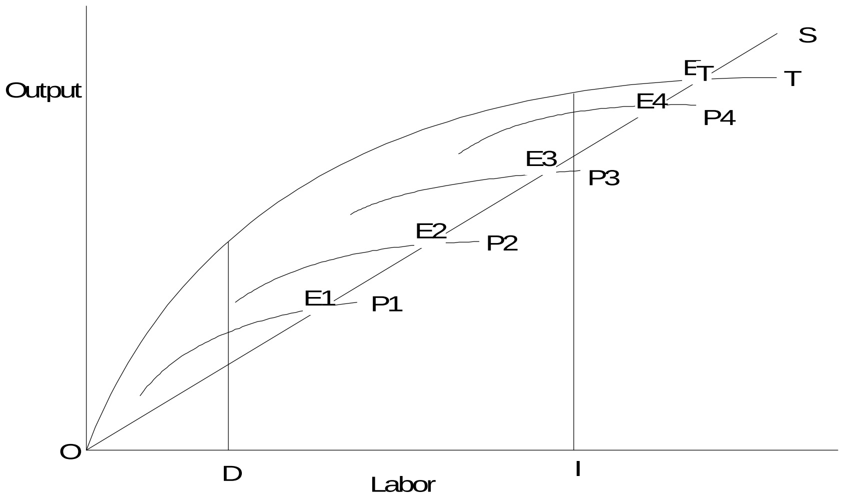

Figure 1. The high-level equilibrium trap

In his analysis of figure 1 Elvin makes several simplifying assumptions: most importantly, he assumes that the total cultivated land area is fixed and that the types of techniques available for cultivation are fixed and unchanging. There is a hidden dynamic assumption which should be identified as well: that population will tend to increase to the point that existing agricultural techniques and practices will just satisfy subsistence needs. On these assumptions, farming efficiency can only be affected by choosing more efficient mixes of available techniques over less efficient. Elvin refers to alternative mixes of available techniques as a “practice.”

Figure 1 represents output as a function of labor inputs for a given set of techniques of production. Each curve P_i represents a different practice, or mix of inputs per acre (labor, capital, fertilizer; Elvin 1972:171), and the curve plots output for a given level of labor input. Curve OT represents the potential output feasible for the optimal mix of all factors; it is the ideal limit of the given technology. The shape of each curve represents the workings of diminishing marginal returns in agriculture: given that land is fixed, adding one worker to the production process increases the aggregate output, but less and less the more labor is already invested in the process.

The line OS represents the level of output needed to satisfy the subsistence needs of a given quantity of labor (population). The break-even point for any given curve P_i is reached when the curve crosses line OS (the subsistence level); no more labor can be absorbed into the process of cultivation and still produce enough grain to satisfy the subsistence needs of all cultivators. Thus the points of intersection E_i represent population equilibrium points; no further population growth can be absorbed within the existing agricultural practice. (Let us refer to these points as “zero-surplus equilibrium points.”) And the distance between a given curve and line OS represents the surplus produced using a given mix of techniques and quantity of labor.

The significance of the movement from P_1 to P_2, then, is that the latter curve represents a more efficient mix of traditional techniques (practice); for a given input of labor the output of grain is greater than for the same labor using practice P_1. We may thus look at the progression from P_1 to P_2, P_3, etc., as a historical progression through which cultivators “fine-tune” the resources and techniques available to them.[4] Each refinement produces a greater aggregate output for a given level of input, and is capable of supporting a larger population of cultivators.

There is a limit, however, to the extent to which refinements of practice can increase efficiency and support a growing population: the curve OT. “When the point E_T is reached is this escape route barred: increased inputs of labor, capital, and organization yield no returns. Pre-modern technology and practice are both at a maximum” (Elvin 1972:172).

On this account E_T is the high-level equilibrium trap. It is a point of equilibrium in that it represents the circumstances in which the largest population can be supported at the subsistence level consistent with a given set of agricultural techniques. Elvin has postulated tendencies towards fine-tuning agricultural practices and increasing population; E_T is the point at which this process comes to a rest. If population increases further, some people fall below subsistence levels and the population decreases. Second, E_T is a high-level point in that it represents the most efficient possible use of existing agricultural techniques, leading to the largest possible output capable of satisfying subsistence needs of the population.

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[4] "The constant managerial decisions needed for fine technical tuning were thus in the hands of those closest to the process of production and most directly motivated to take them effectively" (Elvin 1982:14).

In what sense, though, is E_T a *trap*? It is a trap in one obvious but weak sense: there are no further modifications of practice which are possible which would further increase productivity.[5] But the term “trap” (and Elvin's own usage in other contexts) implies more than this; it suggests that there is a set of obstacles specific to the circumstances of the HLET which will prevent technical development and which would not have blocked technical change at an earlier point in the development. But the model has taken as a premise the fixity of techniques; therefore by construction it is impossible for the model to explain why technical change should be blocked. Being at E_T does not prevent technical change any more than any of the E_i do, however. All E_T represents is the point at which no further gains can be derived from improving the “mix” of existing technologies.

This analysis suggests that the arguments supporting figure 1 must be narrowly limited to this conclusion: *If* a system arrives at E_T (a point of local maximum for available technology), then it will be incapable of escaping from E_T without an exogenous shock. But there is nothing inherent in these arguments which should lead us to the conclusion that a traditional society will in fact arrive at E_T; it is equally possible that there will be a continuing incremental improvement in technical as well as practical resources. It may be that this limitation is consistent with Elvin's intentions. He may merely intend to assert that traditional China had in fact arrived at a condition perilously close to P_T, and not to assert that there was a necessary underlying logic of development which led him to that condition. But if so, the explanatory power of the analysis is greatly reduced.

Thus this formulation does not explain technical stagnation, but rather presupposes it; a priori, one might suppose that technical innovation (in the form of a new seed stock, a more efficient plough, or an inexpensive and efficient irrigation pump) is an exogenous variable which may occur at any time. Inventions of these sorts would have the effect of shifting curve OT upward and generating a whole new series of intermediate curves as cultivators experiment with the mix of the newly available techniques. And one might hold that this sort of innovation is equally likely throughout the series of E_i.

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[5] It might be more accurate to call this a "dead-end" or "cul-de-sac."

The “no-surplus” trap

In order to interpret E_T as a trap we must make a further observation: technical innovation generally requires capital investment (new implements, new water management projects, etc.), and capital investment requires a surplus product in the hands of a cultivator who has an incentive to make these investments. The cost of technical innovation, moreover, extends beyond the cost of the new technology itself to the social costs of the educational, scientific, and technical establishment. If an agrarian system reaches E_T, however, there is no surplus available to fund research and investments. Through an extended process of fine-tuning of practices leading to an optimal mix of traditional techniques, *and* through the tendency for population to increase, there has emerged a system in which cultivation just barely manages to satisfy subsistence needs of the whole population. Finally, for reasons described above, there is no cost-free escape from this condition (no new arrangement of existing techniques which could allow for the creation of a capital fund). This circumstance implies that it will be impossible for the system to finance technical innovation.[6]

We may summarize this version of the HLET in these terms:

1 Rising population and progressive refinement of traditional techniques leads to an economy in which there is no surplus available to fund technical research and capital investment.

It should be evident that this aspect of the argument has a highly malthusian character. This argument depends crucially upon the assumption

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[6] N. C. R. Crafts offers an account of English economic development that appears to presuppose much the same mechanism: "A number of features of the economy aided fixed capital formation. It has been argued that population growth was restrained by a number of 'preventive checks' on fertility (e.g. delayed marriage), which prevented population size from reaching the maximum consistent with subsistence and thus allowed a surplus to exist which might be used for investment in industry. The surplus, moreover, was distributed very unequally, as it is in most economies. . . . Beginning much earlier but becoming evident in the eighteenth century were new financial institutions, such as the country banks or mercantile credit from foreign trade or the new government debt, which expedited the channelling of the surplus into capital formation" (Crafts 1981:4).

of population increase to the level of marginal subsistence.[7] As the system approaches this point, the social surplus diminishes to zero and the system is incapable of rescuing itself from its condition of low per capita income. If we modify this assumption about population growth, however, then the conclusion does not follow that the system described has entered an equilibrium effectively blocking the emergence of new and more efficient techniques of production.

There are several points at which the “no-surplus” trap is vulnerable. First, it might be argued that population increase will stop before it reaches the point of marginal subsistence. In this case there is a potential surplus available for investment. And in fact, as Kang Chao points out, it is virtually impossible for a population to reach E_T, since it would require perfectly equal distribution of the available product in order to support the whole population at the bare subsistence level (Chao 1986:6-7). This latter assumption, however, “can be achieved only with the help of a redistributive mechanism so powerful as to be an impossibility in any society” (Chao 1986:7). Chao argues that the relevant point is rather point F (figure 2), the point at which the marginal contribution of labor is equal to the subsistence wage. If this argument is correct, however, then we should predict, against Elvin, that population increase will stabilize at a point at which a surplus still exists over and above the minimal subsistence needs of the population.

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[7] "There were several reasons why such an equilibrium became established in China between the fourteenth and the eighteenth centuries. The most important of these was the growing pressure of population on arable land. This meant that the surplus product available for generating demand above the level of subsistence was progressively reduced" (1972:170).

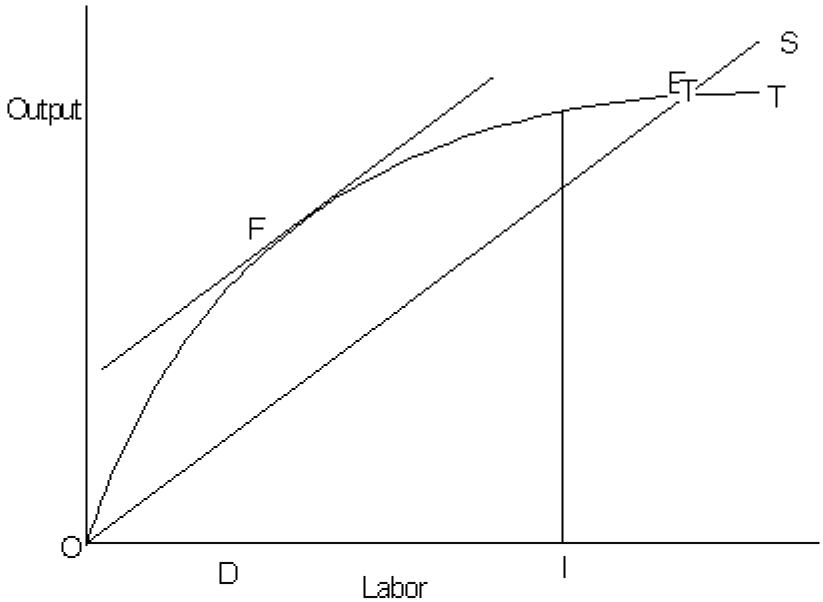

Figure 2. The Chao model

Source: Chao: 1986:7

This point brings in its train a second: we might accept the point that per capita incomes are driven to a low level but reject the conclusion that the social surplus disappears, by reintroducing class and surplus extraction: landlords push peasants to even lower incomes and acquire a surplus product through rent. This would block Elvin's conclusion of a stationary trap, since it would provide a source of possible capital investment funds.

The no-surplus trap presupposes a very low level of stratification in the rural economy: the vast majority population is involved in small-scale cultivation or handicrafts, and income on each unit of production is driven to the level of bare subsistence. This is an unreasonable assumption, however; there persisted significant stratification of land and wealth throughout Chinese rural history. These inequalities rested upon a system of surplus extraction through rent, usury, and taxation; the surplus-extraction system permitted landlords, moneylenders, and the state to confiscate most of the rural surplus for their own use. Victor Lippit shows (1978, 1987) that it is plausible to conclude that roughly 30% of the rural product was available as potential surplus within the traditional economy; and surplus-extraction institutions successfully made this surplus available to the state and a small class of relatively affluent landowners, merchants, and officials. If this account is approximately correct, then the obstacle to technical innovation is *not* the absolute absence of investment funds; so we need to ask what prevented persons who controlled the available surplus from investing it in rural development. And this question, in turn, suggests that we consider a surplus-extraction model for understanding local class relations and incentives.

Finally, we might question the assumption that technical innovations are always costly, demanding high levels of surplus to be discovered and incorporated. Without this assumption, E_T is not an inescapable equilibrium point either.[8]

The "self-exploitation" trap

There is a way of treating the previous two points which brings them together: the processes described as "fine-tuning" of traditional practice lead naturally to a large population and a low wage rate; this encourages the emergence of labor-intensive techniques; and given the low wage, capital-intensive techniques cannot compete. Given, though, that technical innovation is typically labor-replacing and capital-intensive, the demographic process means that technical innovations will not be able to compete with traditional techniques. Call this the "cheap labor" trap.[9] This point is particularly relevant in virtue of the organization of traditional Chinese agriculture around small family units. For a distinctive feature of peasant agriculture in contrast to capitalist agriculture is its relation to labor power.[10]

> The supply of labor power in a peasant household was largely a given factor at any one time. This is of course the basic difference between the textbook peasant and the textbook capitalist entrepreneur, who varies inputs of both capital and labor as profitability dictates. For a peasant, the fundamental economic decisions revolved around the question of how to make the best use of the labor available to his family. (Elvin 1982:29)

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[8] Huang gives a series of such examples.

[9] As we will see below, Huang criticizes this argument on the ground that there were possible technical innovations which were not labor-replacing but merely enhanced the contribution of each worker.

[10] This point was extensively developed under the framework of "self-exploitation" by Chayanov.

Along the lines of this observation, it is rational for the peasant family to continue to expend labor time on the process of production, even when the marginal contribution of labor is extremely low; whereas a capitalist would not find it in his interest to apply the same levels of labor. The result is that the product of peasant production--whether agricultural or handicraft--may have a lower price than the same product produced under conditions of true wage labor.

On this account, a high-level equilibrium trap in agriculture resulted from an oversupply of cheap labor that led to relatively high levels of output in agriculture through intensive and extensive use of labor inputs. Capital-intensive innovations could not compete. This point can be formulated as follows:

2 Production organized around the use of abundant cheap labor depresses the potential profits from more efficient technologies to the point where no entrepreneur has the incentive to introduce the innovation.

Size of markets

There is a complementary but distinct component of this analysis of technical stagnation having to do with the absolute *size* of the Chinese domestic economy. As we have seen, the efficiency of the market system made it unnecessary for large cotton merchants to take control of the production process. Elvin also holds, however, that the sheer size of traditional Chinese markets for staple commodities tended to swamp the emergence of potential innovations in production.[11] Traditional techniques plus efficient marketing system had satisfied existing demand; and it was not feasible to significantly increase market for cheaper goods (since tens of millions of Chinese were already consuming goods through traditional avenues). Therefore technical innovations could not provide any spectacular advantages for the innovator.

> Another aspect of the trap was the huge size of the Chinese economy. . . . The consequence of great size combined with

[11] "Another aspect of the [high-level equilibrium] trap was the huge size of the Chinese economy. . . . The consequence of great size combined with economic unity was that, in absolute terms, a much larger stimulus was needed to provoke a response than in . . . the 18th-century British economy" (Elvin 1972:172).

economic unity was that, in absolute terms, a much larger stimulus was needed to provoke a response than in . . . the 18th-century British economy. (Elvin 1972:172)

Here once again Elvin has in mind a fairly specific point about the economic incentives and opportunities confronting the potential innovator. "The basic idea is that stimulus to invention in the economic field usually takes the form of a change in the pattern of supply and demand. This change creates both new difficulties and new opportunities" (Elvin 1972:169).

Technical progress within Elvin's framework

In order to test the degree to which the considerations identified so far in theory constitute an obstacle to technical progress, let us briefly consider a comparable model which *does* embody continuing technical change. Figure 3 modifies Elvin's original construction by incorporating a series of more productive technologies T_i, each of which is embodied in a series of practices $P_{i,j}$.

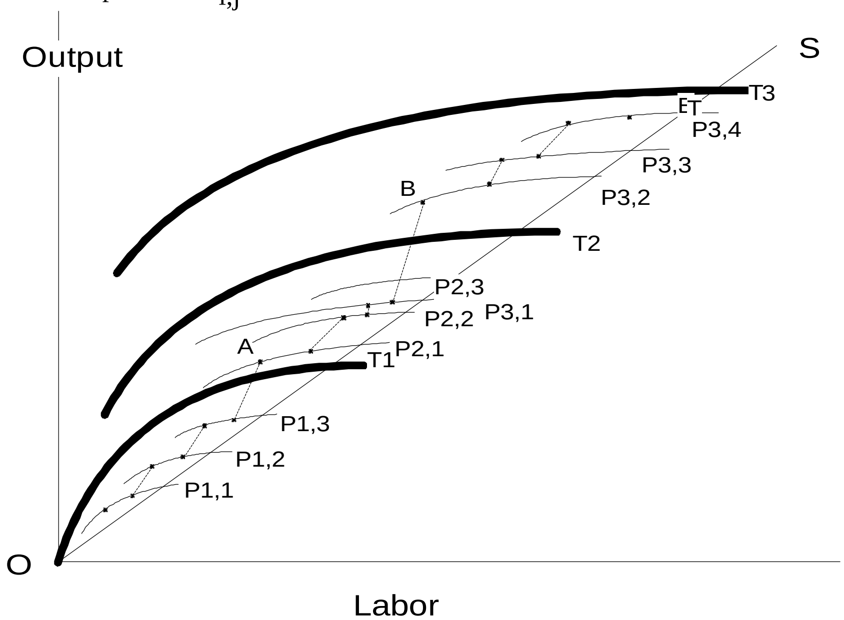

Figure 3. Technical progress

This model incorporates a time line, represented by a series of time points on the several curves. In general the temporal progression represents population increase within a given technology and practice; approach towards the zero-surplus equilibrium; and then a step to a more efficient practice, giving rise to a larger surplus. This figure also represents transition from a lower to a higher stage of technology (unlike Elvin's scheme in figure 1). This technical transition is illustrated at points A and B.

There are several noteworthy features represented in this chart. Note first the order of practices $P_{2,1}$, $P_{3,1}$, and $P_{2,2}$. Though $P_{3,1}$ represents an inherently more efficient technology, it is a younger--and therefore less well-tuned and efficient--practice than $P_{2,2}$. This embodies the situation described in figure 2. In order to incorporate T_3, therefore, it is necessary for the system to take a step back in efficiency.

Second, unlike Elvin's original scheme, there is no upper bound to output built into this scheme. Rather, there is an open-ended series of technologies (T_i) each of which permits a higher level of output and efficiency. Elvin's scheme gives the impression of the system tending unavoidably towards E_T; whereas this scheme leaves it open that there may be continuing upward progress through the introduction of new technologies.

The main significance of this diagram is that it illustrates a pattern of technical change which plausibly avoids the high-level equilibrium trap. Transitions between practices, and from one technology to another, occur while there is still a comfortable surplus capable of funding the transition. Moreover, it is possible to imagine a concrete economic reason for expecting practical and technical innovations in these circumstances: population pressure is increasing the price of subsistence goods, giving producers greater incentives to produce goods more efficiently and to survey the technological horizon for new techniques of production. Moreover, there is no theoretical reason to suppose that new technologies will not continue to appear, thus permanently preventing arrival at the ultimate high-level equilibrium trap.

The efficiency trap

Elvin uses a different and stronger sense of “trap” in this same essay when he shifts briefly from agriculture to water transport.

> Pre-modern water transport in China went through the same kind of evolution as agriculture. By the early twentieth century it could carry most goods more cheaply than railroads over comparable

> routes. When the modern transport revolution came to China, its full effects were reserved for the peripheral inland areas not served by good water transport. (Elvin 1972:172)

This is a puzzling observation because the point seems to be quite unlike what has gone before. In the former case traditional agricultural techniques were assumed to be intrinsically less efficient than technologically more advanced alternatives; but population increase and small surpluses led to the conclusion that these more efficient new techniques could not be funded. In this case, by contrast, Elvin is describing circumstances in which traditional techniques are so efficient that technologically more sophisticated alternatives cannot compete efficiently. In this case the traditional technology prevents the emergence of new technology for a straightforward economic reason: traditional water-transport systems imposed lower transport costs than did the technologically superior railroad.[12] It is therefore inappropriate to describe this circumstance as a “trap”; there is no economic reason in the present to prefer the high technology over the traditional system.

This finding changes, however, when we consider the prospects for future growth of productivity. By assumption the existing traditional technology (TT) is at its limit of efficiency; no further gains may be extracted from it. The modern technology (MT) is more costly in the present, and therefore will not be introduced. MT, however, is capable of extensive further enhancement, so that if it were adopted the eventual cost of production would be substantially lower than that associated with TT. These assumptions are schematically represented in figure 3. The left-most curve represents the improvements in efficiency over time witnessed by the traditional technique (through fine-tuning of practice). Efficiency is represented here as a falling unit price of the good being produced. Curve MT represents the potential efficiency of a competing modern technology. Now consider the point T_1 from the point of view of the manager of the firm (farmer, factory owner, cottage weaver). Let us suppose further that the time between T_1 and T_2 is significant (five years). At T_1 it is more efficient to use TT than MT: the unit price of the good is lower using traditional techniques. Moreover, this price advantage will persist for an extended

[12] This experience is not unique to China. Manchester depended upon a canal system to bring raw cotton from Liverpool to the mills. A rail link was established in the 1830s; but for the next half century the transport cost by rail was higher than that by canal, and the volume of traffic on the two systems reflected this difference.

period of time. Even if we assume that the manager can foresee the improvements in efficiency promised by MT, he will be incapable of introducing the new technique unless he can absorb the increased cost of production for five years.

Now TT *does* represent a trap: by its superior efficiency in the present it blocks the emergence of technologies which would develop into techniques of superior efficiency in the future. Let us formulate this point as follows:

3 In some cases traditional techniques have been so well-adjusted to the needs of the production process in the present that they are more efficient than any other technique based on superior technology. The traditional technique thus blocks the emergence of new technologies which would ultimately surpass the traditional technique.

The "production-process" trap

Let us turn to a set of arguments for the HLET which have a rather different thrust. Elvin argues that there were specific features of the organization of production in the traditional Chinese economy which impeded technical change and increases in productive efficiency. These arguments have much in common with a neo-marxist approach to agrarian change; in particular, they depend on working out the implications for innovation of a particular structure of ownership and control of the production process on the basis of the incentives and opportunities which that structure imposes on the relevant participants.

This argument connects closely the appearance and spread of innovation to the economic incentives and disincentives which confronted the various economic agents within the existing economic environment: "The inventor should have the prospect of making a profit by satisfying some particular economic need. . . . An invention will be brought into use if there is a greater profit to be had by so doing than by adopting or retaining any other known technique of production" (Elvin 1972:138). Thus innovations will occur and proliferate only in circumstances where individuals have both the opportunity and the incentive to develop the innovation; but different organizational forms present substantially different environments to potential innovators.

Elvin develops these arguments in greatest detail in application to the cotton industry in traditional China. Were there distinctive features of this industry which discouraged or impeded technical innovation? Elvin believes that there were, and that these features constitute the main cause of the technological stagnation of Chinese production.

> After the later sixteenth century the structure of the Chinese cotton industry clearly made invention less likely than before. Organization through the market instead of a putting-out system, the tendency to separate selling from producing, and . . . the disappearance of a class of manor-lords whose supervision of their serfs and tenants had given them a personal interest in technology, all combined to reduce the numbers of those equipped by experience, resources, and education to become inventors or sponsors of invention. (Elvin 1972:167)

> If, then, the rural cotton industry was based mainly on subsidiary labor, often with a marked seasonal aspect, and if it was coordinated on a large scale through a market mechanism, several deductions about the lack of stimuli for invention follow immediately. Firstly, if income from spinning and weaving constituted only a portion of the total income of a peasant household . . . it is evident that both rising and falling demand for cotton textiles would exert a much weaker pressure on the technology of the industry than in the case where workers were mostly full-time and coordinated through a putter-out. . . . Secondly, the very excellence of the market mechanism made it unnecessary for cotton cloth merchants to become directly involved in production. . . . Thus those with the keenest awareness of market forces, and possessing the capital and skills to foster new initiatives, were so situated that they were very unlikely to have any deep personal appreciation of how their product was manufactured and any ideas as to how it might be improved. Insofar as the rural cotton industry had a structure of the sort outlined above, it is possible to argue the paradoxical proposition that the countryside was both overindustrialized and overcommercialized.[13] (Elvin 1972:161-62)

These passages describe a system of commercial weaving and spinning based widespread cottage industry: vast numbers of small peasant producers and a smaller number of urban merchants who purchased the peasants' output through the market. This system has two noteworthy features. First, efficient markets permitted large cotton merchants to be

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[13] It would appear that the last line should read "underindustrialized" rather than "overindustrialized."

completely divorced from the production process; and second, production itself took the form of small cottage industry, often as a sideline to farming. The former circumstance implied that those possessing the resources needed to pursue innovation had not direct interest in doing so; whereas the latter implied that the immediate producers lacked the means necessary to pursue innovation.

Elvin thus connects the absence of technological progress in the late traditional period with the high degree of commercialization which was present. Markets worked so efficiently and on such a massive scale that wealth took the form of merchant rather than industrial capital: merchants used the market to purchase finished goods from small producers (yarn, woven goods, etc.), rather than controlling the production process directly (Elvin 1973:276 ff.). Their incentives for higher profits therefore led to increasing the scope of the market--purchasing from larger numbers of small producers--rather than increasing the technical efficiency of the process.

A second and complementary implication was that the unit of production remained small, and therefore there was little incentive or opportunity in the direction of greater technical efficiency. There was little incentive because technical innovations couldn't be economically adopted on a small scale and because cottage production was generally a sideline activity for peasants; and there was little opportunity because small peasant producers lacked the resources and education needed to discover or implement new techniques of production. Elvin describes the production side of this system in (1977):

> Farmers and their wives, pathetically short of working capital, could only spin and weave as a subsidiary occupation . . . if there were merchants to buy the cotton crop when it came on the market in the autumn and then release it to them in small quantities throughout the year, buying their finished products in return. These merchants operated what were referred to as the “cotton cloth shops in the rural market towns”, and in some places there were also “farmer-merchants” who “specialized in gathering cotton and cotton cloth and going as traders to sell it.” (Elvin 1977:447)

Thus technical innovation did not occur because economic activity was organized around large urban merchants and small rural producers. Merchants were separated from the process of production and had no immediate incentive to attempt to reorganize the production process so as to increase productivity; they could increase income by increasing the scope of purchases through the market. And the peasant producer lacked the opportunity to increase productivity through technical innovation.

Proto-industrialization

It is useful to note that this population-centered theory of economic development closely parallels recent discussions of "proto-industrialization" in European studies. Franklin Mendels describes this concept in these terms:

> "Proto-industrialization"--a period of rural industrialization with simultaneous bifurcation between areas of subsistence farming with cottage industry and areas of commercial farming without it. (Mendels 1981:176)

This theoretical framework refers to the spread of rural handicraft industries, chiefly textiles, in certain regions of pre-modern Europe under some variant of a putting-out system.[14] The proto-industrialization model runs along these lines. Population increases in the countryside, leading to a fall in the man-land ratio. Peasant families come under increasing subsistence crisis (Kriedte 1981:14). Extra-regional demand for handicraft goods (e.g., woven goods) provides an opportunity for sideline work. The income for this work is lower than subsistence or wage rates, but sufficient to keep the family above water.

Here too population increase is taken as an independent causal condition of economic change: as populations increased in dense rural areas of Europe--e.g., Flanders, Silesia, or the Rhineland--families were under increasing subsistence pressure, and small-plot farming was increasingly insufficient. In general the proto-industrialization framework is a demographic model: rising rural population density leads to pressure for peasant families to engage in sideline occupations. Simultaneously, the incomes generated by these sidelines permitted further population growth (a point also emphasized by Kriedte). Sideline enterprises--weaving, spinning, knitting--represented an avenue through which family labor could be used more fully (for example, during periods of slack labor demand in farming) in order to increase family income. But these economic circumstances entailed that urban merchants and putting-out capitalists could make use of peasant labor at a much lower rate than hired urban labor. And--like peasant farming in Chao's model--proto-industrialized sectors posed structural obstacles to

[14] There is a close parallel between Chao's analysis and the framework of "proto-industrialization" in European studies. The central discussions of this concept may be found in Mendels (1972); Kriedte (1983); and Kriedte, Medick, and Schlumbohm (1981).

technical progress (Schlumbohm 1981). It was more profitable for the putting-out capitalist to increase the scope of his activities--engage more handicrafters--than to introduce costly technical innovations (e.g., larger looms). Mendels (1981) describes rural industry as a response of desperation by peasants with too little land. It was characteristic of the densely populated, fragmented holdings of the interior of Flanders; while the more profitable farming areas of the maritime regions had almost no rural industry (linen spinning and weaving). In both cases, then, the central argument is that population pressure forces wages down, making labor-intensive techniques more profitable than technical innovation.

Elvin's model may also be usefully compared to Clifford Geertz's analysis of "agricultural involution" in Java. Geertz describes the response of traditional Javanese society to the economic pressures created by commercialization, population growth, and colonialism in these terms:

> With the steady growth of population came also the elaboration and extension of mechanisms through which agricultural product was spread, if not altogether evenly, at least relatively so, throughout the huge human horde which was obliged to subsist on it. Under the pressure of increasing numbers and limited resources Javanese village society did not bifurcate, as did that of so many other "underdeveloped" nations, into a group of large landlords and a group of oppressed near-serfs. Rather it maintained a comparatively high degree of social and economic homogeneity by dividing the economic pie into a steadily increasing number of minute pieces. (Geertz 1963:97)

Thus on Geertz's account, involution is a social response to population pressure and resource scarcity; instead of declaring part of the rural population "surplus," work roles and entitlements are redefined so as to permit each villager a continuing position within the local economy.[15] "The productive system of the post-traditional village developed, therefore, into a dense web of finely spun work rights and work responsibilities spread, like the reticulate veins of the hand, throughout the whole body of the village lands" (Geertz 1963:99).

[15] Involution is a complex result of "increasing tenacity of basic pattern; internal elaboration and ornateness; technical hairsplitting, and unending virtuosity. . . . tenure systems grew more intricate; tenancy relationships more complicated; cooperative labor arrangements more complex--all in an effort to provide everyone with some niche, however small, in the over-all system" (Geertz 1963:82).