Economic development, the family, and income distribution

Selected essays

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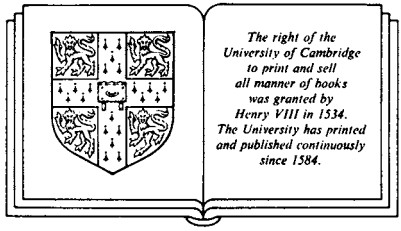

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I. Introduction

In defining the scope of this paper, we had to answer several questions. First, if one necessarily deals with a limited period in the long history of mankind from the hunting-gathering tribes to the industrial societies of 1980, what should the reference period be? Second, in reflecting on economic growth, what classes and groups of societies, in the wide range of units among which mankind is divided, should we emphasize? Third, while we cannot pursue quantitative analysis here, we should be clear as to the quantitative and related criteria of economic growth. Different criteria will result in focusing our attention on different aspects of economic growth, and on different groups of driving forces. Finally, how do we deal with "driving forces," a concept for which it is difficult to establish *ex ante* empirically observable counterparts?

However carefully considered, the answers to these questions were bound to leave us with a theme so wide as to warrant only selected reflections, rather than tested and documented conclusions. We reflect on the historical record of the last two centuries, viewing it as a distinct epoch of economic growth. Yet the period is too short, in excluding important antecedents in the earlier history, particularly of what are now economically developed countries; and too long, in encompassing changes in growth trends that cannot be adequately noted here. We emphasize the record of the currently developed countries, especially of the earlier entrants, all of which were market economies; and hence neglect the totalitarian developed countries, with their distinctive mechanism and

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drives. We gauge economic growth by the long-term rise in the volume and diversity of final goods, per capita, with some attention to sectoral structure and shifts; but exclude cases where such rise was due largely to natural resources made valuable by advanced technology elsewhere, or was attained in good part by intensified efforts of workers mobilized to involve a rising proportion of the population. Finally, we comment on selected aspects of the ways by which economic growth had been attained for the range of developed market economies just indicated, in the hope that they will at least suggest the identity and characteristics of the driving forces. The relevance of the latter to economic growth, or lack of it, in countries excluded from direct discussion here, may then be considered; but this cannot be done within the limits of this paper.

The records of growth of the currently developed market economies indicate that, despite a substantial rise in the growth rate of their population, the rate of rise in per capita income was substantially higher than in the centuries preceding their entry into modern economic growth – the entry occurring over the historical span from the last quarter of the 18th century to the recent decades. This acceleration of economic growth was associated with a number of other economic and social processes; and we select a few that seem illuminating of the driving forces involved. The impression which suggests the first topic is that modern economic growth, as exemplified by the group of countries defined above, was accompanied by, and based upon, a high rate of accumulation of useful knowledge and of technological innovations derived from it. The second important associated process was that of shifts in the production structure of the economy, in the shares of different production sectors in output, labor, and capital, with a close relation between the high rate of growth of per capita product and a high rate of shift among the various production sectors. The third major strand in the unfolding of modern economic growth was the complex of functions and influences associated with the national sovereign state.

II. Technological innovations and capital formation

By a technological innovation we mean a new way of producing old goods, or a necessarily original way of producing new goods. Since we deal here with technological innovations that have materialized, the results of unsuccessful attempts having long vanished, we assume that the new ways,

the new methods of production, were better than the old, and thus should have contributed to growing productivity, and hence to economic growth. Note that technology here is confined to control over nature (including man only in his physiological, not social aspects) for human purposes, economic purposes among them; hence the association between technological innovation and rising productivity. In the present connection, the high rate of technological innovations and their large cumulative impact on economic growth is reflected in the known succession of major innovations in a variety of fields; in the pervasiveness of new technology in extending to even the oldest production sectors (like agriculture); and in the large proportion of new goods, and of old goods produced by new methods, in the total product of developed countries.

We emphasize major technological innovations, major in that they affect large components of final consumption and of intermediate demand for reproducible capital, and thus contribute substantially to growth of product and productivity. A familiar illustration is provided by the innovations in the production of light and washable fabrics like cotton cloth, of a new industrial material like iron and eventually steel, and of a new source of industrial power like steam, the three major innovations of the "first" industrial revolution; and more illustrations could be easily provided. This emphasis focuses our attention on the long periods over which the unfolding of such innovations takes place, from the pioneering demonstrations of their technical feasibility and of their great potential as a framework for a host of subsidiary innovations and improvements; to the complementary changes that are called for in the institutional structure of the economic enterprises and in conditions of work and life of the actively engaged workers, to channel the innovation into efficient uses; to the retardation phase that follows maturity of the given innovation in the pioneer country, once its lesser potential for further cost reduction, lower price elasticity of demand, and the competitive pressures of either emerging foreign followers or of more recent innovations, make for slower growth and lessened impact on the country's advance in product per worker. These long sequences of interplay between the growth-promoting effects of the extending application of a major technological innovation, with increasingly effective institutional and human response, and the eventual exhaustion of these effects because of both internal and external pressures, represent slices of a long and complex growth process. They should be illuminating and suggestive of both the driving forces of

economic growth and of those that limit the latter, when confined to one sector of a country's economy, or even to one country, as compared with others.

The key feature of an innovation is that it is *new* – and thus a peculiar combination of new *knowledge* sufficiently useful and promising to warrant the attempt to apply it; and of *ignorance* of the full range of possibilities and improvements that can be learned only in extended application. A major invention is a crude framework, major in the sense that it is a new base to which a wide variety of subinventions and improvements can be applied – but that are yet unknown, and rarely foreseen. Clearly, one of the requirements of a high rate of technological innovation is a society (or a related group of them) that encourages the continuous production of a variety of new knowledge relevant, directly or indirectly, to problems of economic production; that contains an entrepreneurial group perceptive of such new knowledge, and capable of venturing attempts to apply it on a scale sufficient to reveal its potentials; and a capacity to generate, without costly breakdowns, institutional changes and group adjustments that may be needed to channel efficiently the new technology – with its distinctive constraints. The driving forces or permissive factors are those involved in man's search for new knowledge of nature and of the universe within which we live, including the inventive links between it and production; and the capacity of societies both to encourage technological innovations, and to accommodate them, despite the disruptive unevenness of their impact on different social groups.

The major role of rapidly advancing observational and experimental science, i.e., systematic study of the universe, in creating increasing opportunities for invention and technological innovation, is a distinctive characteristic of modern economic growth, and is directly relevant here. Whatever science discovers about the properties of the physical world is of possible application in technology, which deals with rearrangement of the physical world for human ends. Hence, the advance in the stock of useful knowledge contributes to an explanation of the continuous *succession* of major innovations and of the rising power of technology. The aspect of most interest here is the reinforcing relation between technological innovation and additions to useful knowledge, observational and experimental science among it. Once technological innovations embody new, yet incomplete knowledge, they imply an important learning process, dispelling ignorance of hitherto unknown, yet relevant, aspects of nature. This adds to the data and puzzles of science and thus stimulates further

observation and search. In addition, mass application of major inventions may generate new observational tools hitherto not available for scientific use. And, of course, the addition to economic resources made by a successful innovation may provide the wherewithal and stimulus for the search for further useful knowledge. One should stress that the contribution of a technological innovation to *learning* is most directly a function of the "ignorance" component: were the innovation based on complete knowledge of the process or material in question, no learning would have occurred and the contribution to new knowledge would have been limited to effects of cost reduction and of greater potential availability of economic resources.

A notable aspect of technological innovations associated with modern economic growth was the large volume of fixed, reproducible capital required. The demand for the latter, revealed by the capital intensity of the production of new types of industrial power and of the use of this power in the mechanization of a wide variety of formerly labor-intensive processes, was due to distinctive features of the new technology. To illustrate, if steam expansion could deliver large charges of concentrated power, with a reliability, economy, and flexibility of location hitherto unknown, the very large magnitude of physical power made available required a durable and costly envelope for controlling and channeling this power into beneficial rather than destructive uses. Also, the application of stationary steam engines to say manufacturing operations required tools of a material that could withstand continuity and high velocity of turn, again a new industrial material with a high capital intensity of output. What was true of stationary steam power was even more applicable to its use in land transport – with large fixed capital embodied not only in rolling stock but also in the roadbeds and associated facilities. But large amounts of fixed capital meant a large scale of plant and economic enterprise, with increasing economies of scale continuously pushing upwards the optimum scale involved. There was thus a direct line of connection between the greater productivity available in the new technology, the greater volume of physical nonhuman power that the latter employed in the mechanization of a variety of productive processes, the increasing demand for fixed capital that embodied and controlled the new power, and the rising scale of plant and of the economic firm unit. Somewhat different, yet essentially similar connections between the technological features of the new and changing technology, and economic implications in the way of demand for fixed reproducible capital and scale of plant and enterprise,

can be suggested for more recent clusters of technological innovations, e.g., those associated with electric power or with the internal combustion engine.

The large demand for fixed capital exercised a restraining influence on the rate of application of new technology, alongside with the limited supply of technological talent capable of exploiting the potential of major inventions through the generation of subinventions and improvements, and with scarcity of entrepreneurial talent capable of innovative organizational tasks in the mobilization of capital, labor skills, and administrative capacity. These several constraints serve to explain why over given intervals of economic growth, long enough to reveal the extent of the latter but short enough to permit observing secular changes, major technological innovations were limited to a few sectors in the economy – the identity of which changed from one period to the next. This concentration on foci of growth did not mean absence of technological advance elsewhere in the economy: it only meant a higher growth rate in the favored industries and sectors and a lower growth rate, but still increasing productivity, in the preponderant majority of others.

One should note here the changes in economic and social institutions that were required to respond to the capital demands and other corollaries of the distinctive features of the new technology. If large volumes of durable, reproducible capital and large-scale plants and hence firms were involved, new devices for mobilizing savings and of channeling them into the new uses, and legal innovations for the proper organization of investors, entrepreneurs, and workers in effective economic enterprise were called for. There was, consequently, a connection between say the emergence of steam railroads, on the one hand, and major changes in financial institutions engaged in mobilization and channeling of savings and the emergence of the modern corporation as the increasingly dominant form of organization of private economic enterprise, on the other hand. Furthermore, if the fixed capital structure of private enterprise in some sectors resulted in a kind of competition that ended up in monopoly and in spreading of the latter to other sectors, new forms of government intervention had to be devised to mitigate the undesirable effects of such a development. Thus, the unfolding of major technological innovations or of clusters of them, with their large demand for fixed capital and associated changes in size, structure, and behavior of plants and enterprises, involved a sequence of technological and institutional changes. The latter responded to the former, as an effective way of channeling the innova-

tions; but also generated trends of their own, some of which may have facilitated and others may have impeded further growth in product per capita or per worker.

This brings us to another related aspect of major technological innovations, the unpredictability of their long-term consequences. It applies particularly to *clusters* of related innovations, many of the latter major – such clusters representing innovations in the several steps of a given industry's production process from the raw material to the finished product, or the several innovations that emerge from the widening application of a new industrial material or of a new source of industrial power. It is these clusters that are important, because a technical breakthrough in one step of a production process or in one use of a new source of power is bound to stimulate related innovations in the sequence or in the range. But when we consider the long-term cumulative consequences of the unfolding of such a cluster, we find a long, interrelated chain of changes in technology and changes in institutional and social adjustments, spread over decades and occurring in a complex and changing national and international environment. It is difficult to assume that anyone at the end of the 18th century could have predicted the magnitude and character of the contributions of steam power to economic growth and structure of the advanced economies in the 19th century; or that anyone at the end of the 19th century could have foreseen the contribution, the widespread positive, and some problematical, effects of the internal combustion engine. This is not to deny the descriptive prescience of some early advocates of the great merits of science, and of science-fiction writers of the 19th and 20th centuries. It is only to emphasize that predictability of the more sober type, one that would yield acceptably firm expectations of direction and magnitude, was not possible, because the chain of connections began with a technological innovation that contained a substantial component of unknown and hence of ignorance, to be overcome only with extended application; and continued to generate a long chain of interweaving links of technological and social change in a sequence of uncertain speed and mixture of successes and temporary failures.

Given such unpredictability, the opportunity for taking steps in good time to maximize the positive contributions of a major innovation and to forestall or minimize the negative, was narrowly limited. This meant that there was little automatic about growth based on the cumulative contributions of technological innovations: the latter could generate pressures and bottlenecks, which could be resolved, but which could also mean delays

and breaks in the resulting growth. A record of a high rate of sustained economic growth, powered largely by technological innovation, implies that the society has sufficient capacity to overcome either technological or institutional bottlenecks without incurring such heavy costs as to reduce the advance of net product per worker.

In the discussion so far I chose to emphasize the sustaining elements in technological innovation in their feedback relation with the advance of systematic observational and experimental knowledge; the interplay of technological change with social changes and innovations; the elements of unpredictability and hence of occurrence of bottlenecks and delays; and the pattern of exhaustion of growth opportunities within a sector or a country that once benefited from a cluster of major technological innovations. This is a selective view, and the discussion fails to touch upon a variety of important related aspects. Some of these can be listed as illustrations of unanswered questions.

The discussion above failed to deal with the possibility of a trend – from empirically derived innovations, with inventive response to pressing bottlenecks suggesting necessity as the mother of invention, to invention and innovation that were applications of new knowledge to the production of new goods where invention was the mother of what eventually became a deeply integrated necessity. The discussion also neglected the difference between the mixture of new knowledge and ignorance associated with a major innovation in a *pioneer* country, from that faced in a *follower* country, which can profit from greater knowledge attained by the pioneer but must make up for its greater backwardness in attempting to exploit the already known but still new technology. Above all, the discussion failed to deal directly with the old, and still persisting, issue of the limits imposed by scarcity of natural resources relative to the growth of world population and its needs. The issue could be posed at least in the sense that, advanced economic growth having so far been limited to not more than a quarter of world population, modern technology could afford to be generous in its use of natural resources. Such use might not be feasible with the widening spread of economic growth to rising proportions of mankind, with resulting challenges that perhaps could not be met easily. The omission of the first two topics was due largely to difficulties of summarizing diverse and incomplete evidence; while the last topic involved long-term projections, requiring venturesome assumptions concerning feasible advance of science and technology.

III. Structural shifts

The high rate of increase of product per worker or per capita, characteristic of modern economic growth, was inevitably associated with a high rate of structural shifts. These were changes in the shares of production sectors in the country's output, capital, and labor force, with implicit changes in shares of various labor-status groups among the gainfully engaged and in the conditions of their work and life; of different types of capital and forms of economic enterprise; and in the structure of the country's trade and other economic interchanges with the rest of the world. The implications of such structural shifts for the changing position of the several socioeconomic groups were particularly important, because the responses of these groups to the impacts of advancing technology shaped modern society.

The shifts in the proportions of population actively engaged in the several production sectors, the latter distinguished by different types of product, of production process, and, particularly important here, of conditions of work and hence life of the actively engaged, were due to several complexes of factors. One was the differential impact of technological innovations, which, over any limited secular period, tended to be concentrated in a few industries, old or new. Another was the differing income elasticity of domestic demand, in response to the cost-reducing effects of advancing technology in the old goods and to the availability of new goods. A third was provided by the shifts in comparative advantage in international trade in tradable goods. In the long run, technological advance was all-pervasive, affecting old as well as new sectors; so that, e.g., the decline of the share of labor force in agriculture was due to a combination of low income elasticity of domestic demand for its product, the advance of labor productivity within the sector, and the adverse shifts in comparative advantage in trade with less developed countries.

The consequences of rapid shifts in the distribution of the economically active population (and their dependents) among the several production sectors were numerous, and crucial in the transformation and modernization of developed countries. One major consequence was the discontinuity, the disjunction between the sectoral attachment of successive generations – of a magnitude that could not be accommodated by differences in rates of natural increase or by differing changes in labor force participation proportions. If, to illustrate, the share of total labor

force attached to agriculture declined, over a two decade period, from 50 to 43 percent, a not unusual drop, and total labor force grew over the period by 30 percent, the result was that the agricultural labor force grew from 50 to 55.9 or less than 12 percent, while the nonagricultural labor force grew from 50 to 74.1, or over 48 percent. Such differences in growth rates of what we take to be employment opportunities in the two sectors could not be accommodated by lower rates of natural increase or by a more rapid drop in labor force participation proportions in the agricultural sector. In fact, as the rates of natural increase and labor force participation proportions declined (with the spread of lower birth rates and lower labor force participation proportions among the young and the old), they declined less among the agricultural, rural population than among the nonagricultural, urban population. Even if we assume the same growth rate of 30 percent over the two decades for the initial agricultural and nonagricultural labor force, the indicated migration of labor force between the two sectors would amount to 65.0 minus 55.9, or 9 percent of total labor force at the start of the period. But this is only part of the process: change of attachment and intergenerational migration would be amplified by the higher rate of natural increase and slower decline in labor force participation proportions among the slowly growing, more traditional sectors and occupations; a more detailed sectoring would increase the calculated migration streams; and the latter would have occurred *within* sectors, between the smaller scale, more traditional units and the larger scale, more modern firms.

Associated with this large volume of internal migration and mobility, both spatial and inter- and intrasectoral, was the rise in requirements in education and skill for the succeeding generations of workers. This trend was largely powered by the demand of advancing technology for a greater capacity on the part of the economically active population to deal with the application of new knowledge to production problems. But it was also partly a response to the increase of the migratory component within the additions to labor force supply: migrants had to be evaluated in terms of their potential capacities in the performance of their production tasks, and such evaluation had to be based on objective criteria, if only for lack of information concerning their personal "roots." Yet the shift to overt criteria of capacity to perform, away from criteria of social status and origin, was essentially due to the doubt that the status and social affiliation of the parental generation conveyed adequate assurance as to the performance capacity of the younger generation.

The decline in the importance of status and the rise in the weight of objectively tested criteria of capacity and skill of the person was, like many other modern trends, qualified by exceptions and discrimination that represented survival of earlier and more traditional views. Yet the significance of this trend, and its connection with the increasing contribution of new knowledge and technological innovation to economic growth, and with the disjunction between the sectoral attachments of the older and the younger generations, cannot be denied. It was manifested in, and strengthened by, the demographic transition, the shift from the more traditional to modern patterns of population growth. In this transition, reduction in mortality, due either to higher income levels or to scientific advance in medical arts or to both, was a crucial step, particularly in that it most affected mortality in the infant and the younger ages. It was combined, after some lag, with reduced birth rates, the latter reflecting the growing need for greater human capital investment in the younger generation. This involved the parental generation in greater input for the benefit of children, reversing the earlier traditional views of the children being for the benefit of family and older generation. This also meant that it was the younger generation that was the carrier of the new knowledge, acquired by formal education and by learning on the job – neither of which was secured from the blood-related parental generation.

One could argue that there was, partly in consequence of the trends mentioned, a deauthorization of the traditions carried by the older generation. If so, structural shifts under discussion were an important strand in the whole process of modernization, in the movement away from the premodern and hence to us traditional views – as was the case with the effects of science on traditional religion, or with the emphasis on man as the master of his destiny on traditional views concerning sources of political and social authority.

The suggested connection between new-knowledge originated technological innovations and rapid structural shifts, on the one hand, and changing views on the role of man within society, on the other, is particularly relevant because the shifts among the socioeconomic groups were not without breakdowns and conflicts. If a technological innovation rendered a major group of older handicraft firms obsolete, or if a combination of advancing labor productivity and low income elasticity of demand for products of agriculture displaced large groups of agricultural workers, the rate of impact could easily have resulted in prolonged and costly technological unemployment. If established groups, attached to

large economic sectors, suffered, or foresaw, contraction in the share and role of their base in economic society, with the possibility of shift problematic and costly, they were likely to resist by using political pressure to slow down the process. If the classes that were in power in premodern society observed reduction in the economic base of their power because of the emergence of new foci of growth, the natural reaction was to resist the change, unless promised assurance of retention of some part of former power by enforceable action of accepted social authority. Historical illustrations abound of such conflicts, engendered by the unequal impact of modern economic growth on the several socioeconomic groups, and of resulting resistance by some of these groups to modernization and growth. If these conflicts were to be resolved so as to preserve a sufficient consensus for growth and change, and yet not at a cost that would retard it unduly, some resolution mechanism was needed – acceptable to, and consistent with, the modern view on man and society.

This mechanism was the national sovereign state, a form of social organization that relies on a sense of community, of belonging together, of common interest, among its individual and group members, in order to serve as overriding arbiter of intranational group conflicts; as authoritative referee among new institutional devices needed to channel advancing technology into efficient use, or to mitigate the negative effects of economic change in order to reduce resistance to growth. The secularization and strengthening of the national sovereign state played a strategic part in modern economic growth. It proved to be so far, with some qualifications, the one form of organization of society that, while discarding the status-bound discriminations of traditional authority of religious and religiously anointed royalty (and aristocracy, or castes, etc.), preserved a unity and centralization of decisions compatible with the modern view on man as the basic source of social authority. Considering that the modern state was meant to formulate and advance the short- and long-term interests of the society over which it was sovereign, its major role in setting the rules and monitoring the conditions for economic growth is hardly surprising. We shall return to this topic in the next section.

There is another series of implications of the changes in conditions of work and life of the various socioeconomic groups in modern economic growth – bearing partly on comparative valuation of different types of final goods that comprise net product, partly on the distinction between intermediate and final goods in defining net product under changing conditions. These implications reveal some aspects of the driving force in

economic growth, and some difficulties in measuring its full costs and benefits for guidance in generating an adequate social response.

If we think of final product as the sum of consumer outlays by individual and group consumers and of capital formation, and of the weights of physical units of these components as prices reflective of social valuation, the common finding is that weighting the final goods by initial-year prices yields greater aggregate growth than the weighting of the physical units by end-year prices. The reason for this difference, between the Paasche and Laspeyres indexes, is the negative correlation between temporal change in quantity and temporal change in price: those goods that decline in unit price relative to other prices tend to reflect greater cost-reducing effects of technological innovation – and the expected response of demand (domestic or foreign) warrants greater growth. This difference may also be expressed by saying that the earlier generation, looking *forward* to growth, values it more highly than the later generation, looking *back* at growth that has occurred. This contrast suggests one aspect of the driving force in economic growth – the tendency to value the new more highly than the old, and to treat the already established as a low cost necessity. Of course, if anything happens to affect the latter adversely, without adequate substitution, the driving pressure of the resulting bottleneck is all the greater.

The implication of changed conditions of work and life for the distinction between intermediate goods, i.e., those used to produce the final goods, and final product, results in more intricate problems. If the changed requirement for active participation in economic production is more education, should it be viewed as a capital asset – as has been argued in much of the recent literature; and if so, how does one distinguish the consumption from the capital component of educational outlay? If the requirement for modern jobs is living in urban communities, or serving as an employee rather than as a self-employed worker, should one try to estimate comparative costs of living in the countryside and in the cities, taking into account some of the positive and negative externalities in both? And how does one evaluate the net human cost (or benefit) of shifting from self-employed to employee status?

One should note that the economic accounts of even the advanced countries, from which we derive the parameters of modern economic growth, neglect every one of the questions just raised. All we have so far are experimental analyses by individual scholars. But the important point is not statistical lacunae: it is the inevitable presence, in a society