DYNAMISM AND ENERVATION

Contrasts in India's Agrarian Economy

by

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Abstract

Modernization of agriculture has yet to occur in major regions of India. Many see equity-oriented policies by government and cooperative organizations among cultivators as the best if not only solution. Such a strategy represents an implausible departure from the historical process of agricultural development in India. A differential ecology has produced distinctive patterns of farm-level decisions, land-tenure systems, marketing arrangements, and government interventions. An endogenous growth model capturing major features of this process casts doubt on the feasibility of an egalitarian strategy. Moreover, the model provides insight into why India has not launched a more vigorous effort to develop agriculture, and what factors might induce such an effort in the future.

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1. Cooperation: Moral education or social reform

An early student of poverty in India, its causes and possible solutions, was Sir Malcolm Darling, a member of the Indian Civil Service from 1904 to 1940. Darling is best known as a champion of cooperative societies as an instrument of rural uplift. The essentials of Darling's views on cooperation are common to this day in official government documents and the proposals of scholars such as Dantwala (1986). Less widely known, and likely to be dismissed as antiquated when encountered, is Darling's (1978) attempt to understand economic behaviors as a reflection of individual character and the latter as an effect of one's cultural and especially physical environment. While Darling's work in this area is largely ignored, the project has been continued, primarily by historians, and among its potential contributions is an explanation of why, despite more than 70 years of effort, the impact of India's various forms of cooperative movement remains quite limited.

As one who lived most of his life among the cultivators of the British India Province of Punjab, now divided between the modern nations of India and Pakistan, Darling was not susceptible to the homogeneous characterizations of the peasant found in much writing on economic development. Darling's peasants could be rational or tradition-bound, industrious or indolent, thrifty or improvident depending on their background and present circumstances.

Three observations seem to have had the greatest impact on Darling's (1978, p. xxiii) conviction that cooperative societies are a "*sine qua non* of rural development."[1] The first is a disparity in productivity among farmers, suggesting a wide gap between average and potential

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[1] No implication is intended that Darling's views on cooperation were solely an induction from observations. As Clive Dewey makes plain in his introduction to the 1978 reprinting of Darling's masterwork *The Punjab Peasant in Prosperity and Debt*, Darling was an Idealist, a believer in a secular ethic of social duty (p. viii).

productivity and income in agriculture. The second observation is that attitudes and behaviors toward economic activities are learned, either through experience with one's environment or by example of one's neighbors. This suggested to Darling that successful behaviors may be diffused among cultivators and serve to improve average performance. Third is the observation that the great variability of output in India's rainfed agriculture -- rewarding reasonable efforts with an abundant harvest when the rains are well-timed and adequate but denying any return to the most extreme diligence when the rains fail -- had fostered a profligate response to the occasional bounty and fatalistic acceptance of the inevitable famine. As a result, the new opportunities being presented by government canals and higher output prices in the early decades of this century were largely squandered. Worse, the increased value of land and size of money incomes significantly boosted the farmer's creditworthiness, resulting in excessive borrowing to expand consumption still further. If prosperity was not to lead to debt and ultimate impoverishment, the peasant had to learn the one lesson missing from his training by nature: thrift. "There is one aspect of co-operation," Darling (p. 243) wrote, "which combines in a special degree both the moral and the material advantages of the movement, and that is its encouragement of thrift."

Darling's perspective, especially the notions of a gap between actual and potential output using existing resources and technology and the malleability of peasant attitudes if the effort is made to educate them, is seen over and over again in official and academic writings on Indian agriculture. The *Report of the Royal Commission on Agriculture in India* (1928) emphasized the need to promote cooperative societies throughout British India. Vera Anstey (1957, p. 170), in her text *The Economic Development of India* (first published in 1929), offered a typical statement of the technological gap thesis:

> It can undoubtedly be said that a veritable agricultural revolution could be effected by simply putting into practice the knowledge that has been gained with regard to improved varieties of crops, implements, cultural methods, and the breeding and care of domestic animals.

Anstey proceeded to devote an entire chapter to "The Co-Operative Movement" (pp. 185-206) emphasizing the educational and character-building functions of the cooperative. Writing just after India and Pakistan had gained their Independence in 1947, Harold Mann (1948, pp. 301-302), perhaps the most empirical of British India scholars, lamented the apparent failure of cooperation in most of the subcontinent. Noting that "nearly all the areas are, in a normal year, far less productive than they need be" (p. 307), Mann called for the government to commit itself and its finances to the kind of program that would later be known as community development.

It is the existence of a technology gap that lends importance to the possibilities for cooperation among farmers, whether formally organized into "societies" or somewhat vaguely encouraged to work together to achieve common goals. The gap implies that cultivators are presently inefficient. Most of the scholars whose work created the field of development economics in the 1950s shared a conviction that inefficient, traditional agriculture would be replaced, rather than reformed; its peasants converted to wage laborers, rather than modern farmers. For Darling, Anstey, Mann, and countless others, the inefficiencies of traditional agriculture were traceable to ignorance, indolence, fatalism, and exploitation by moneylenders, merchants, and landlords. Moral education through the cooperative movement, and especially its grand formulation as community development during the early years of Independence, was expected to address these obstacles to progress, along with a host of other objectives, including health, land improvement, marketing, etc. The disappointing record of community development in India and refutation by historians of the romantic vision of ancient village harmony on which it in part was based has caused the idea to fall into disrepute. In its place stands the not dissimilar notion that economic and social progress can and, perhaps, must be sought through mechanisms that promote group cooperation over individual competition, integrated planning over market-induced decisions, distributive justice over output maximization.

The assumption of a technology gap has not been without its detractors. Best known is the opposition of T. W. Schultz (1993), who had begun in the 1950s to argue that poor farmers do

not have the luxury of being inefficient. Productivity improvements in agriculture occur when farmers are presented with new knowledge and affordable inputs that are genuinely valuable. Foreign experts and scientists far removed from the cultivators' environment have been far too quick to assume that inputs and practices "proven" under controlled conditions represent profit-raising opportunities for farmers. Farmers know or rapidly discover that many of these new techniques are not superior to their traditional practices.

Dantwala (1973, pp. 275-6) has argued that, prior to the development of properly adapted high-yielding varieties (HYVs) of wheat and rice in the 1960s, there existed in India a "technological barrier" that would have prevented significant productivity gains from being realized, even if institutional and other barriers to efficiency had been removed. The "green revolution" wrought by these HYV seeds and associated techniques, however, has given new life to the notion of a technology gap. A consensus has formed behind the idea that there are vast regions in India, as in many other countries, where farmers operate well-below the technology frontier. Dantwala (1986, p. 8) is critical, therefore, of the government's failure to "launch a campaign for consolidation of holdings and co-operative approaches to all kinds of farm activities" to remove the remaining obstacles to efficient agriculture. Calling for a "total change in the social order," Dantwala (1986, pp. 477; 85) insists that bringing the benefits of technical progress to the majority of cultivators will require "a purposeful and conspicuous discrimination in favour of the weaker section in all matters of public policy and administration."

Given that cooperation in its modern guise of social reform has its own disappointing record and lacks the backing even of an historical myth, its continued viability as a basis for policy prescription is puzzling. One element in the explanation is that, while moral education seems rather an obsolete notion, the idea that exploitive relations are a principal obstacle to widely-shared economic progress has retained its currency.[2] "The only way the small can combat the

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[2] This point is expanded upon in the next section.

power and influence of the big is through co-operative action in multiple forms" (Dantwala, 1986, p. 9). Just as the original stimulus for cooperative credit societies was the usurious moneylender, cooperation is today a euphemism for an end to the ability of "big" landholders to capture the benefits of economic progress while blocking changes that might threaten their position of power. The notion of cooperation is sustained, also, by the inherent difficulty of achieving reform. When exploitation is seen as the cause of poverty and appropriate target of development strategy, any evidence that reform is not taking place is quite reasonably interpreted as confirmation that exploitive relations are indeed at work and in need of reform.

It might be expected that the model for further progress in India's agriculture would be the "green revolution" success in Punjab, Haryana, western districts of Uttar Pradesh (referenced hereafter as the "northwest"), and, to a lesser extent, coastal districts of Andhra Pradesh. The productivity and prosperity of these areas, along with isolated pockets in every state of India, mark the upper end of the technology gap that policymakers hope to close. However, modernization of agriculture was promoted in the 1960s with a deliberate focus on better-off farmers most likely to be receptive to change and commanding the necessary resources. No concerted effort has been made since to enable poorer farmers to access the new technology.

The possibility of a renewed effort by the government to achieve faster growth of agricultural output without regard to the distribution of benefits is rejected explicitly by Dantwala (1986, p. 12). Modern-day cooperators, unlike the turn-of-the-century disciples of Raiffeisen or the mid-century followers of F. L. Brayne, fear inegalitarian growth as much as stagnation.

At the same time, Dantwala recognizes that the impact of favoring prosperous farmers with the new technology has not been a significant worsening of income inequality, and poverty has declined markedly in the favored regions. Thus, opposition to application of the so-called "Punjab model" of rural development to other regions must stem from a belief that the original beneficiary states are unique; a similar strategy in other regions would simply fail or, worse, strengthen the position of the rich without reducing the suffering of the poor (Dantwala, 1986, p. 81).

It is beyond dispute that conditions in northwest India are uniquely conducive to both efficient agriculture and a relatively wide distribution of income. If the strategy which succeeded there is defined narrowly as the provision of HYV seeds and fertilizer to farmers with assured irrigation, there is little scope for a successful repeat elsewhere in India. Indeed, this has been the implicit strategy during the past three decades, and the diffusion of modern technology has been sluggish at best. Nonetheless, agricultural output has continued to grow at a modest rate, confirming that other regions of India are not immune to modernization. The question is whether cooperation offers the best prospect of moving beyond the limited efforts and results since the 1970s. An answer is suggested by an examination of the historical process through which the northwest region became ripe for a "green revolution," while the east region (comprising West Bengal, Bihar, Orissa, and eastern districts of Uttar Pradesh), despite fertile land and India's most abundant supply of water, became enmeshed in a structure of inequality and growth-suppressing power relations that has so far defied unraveling. The interactions thus revealed cast doubt on the feasibility, as well as the political acceptability, of an egalitarian strategy. Moreover, they provide insight into why India has not launched a more vigorous effort to develop agriculture, and what factors might induce such an effort in the future.

2. Caste stereotypes: Nature *and* nurture

As noted above, Darling attempted to understand the behaviors he observed as arising from individual character and, ultimately, one's environment. It is unfair to characterize the "notion of fixed ethnic types" as "the staple argument" employed by Darling (Stokes, 1978, p. 231). The *Punjab Peasant* (Darling, 1978), first published in 1925, bears the clear stamp of a moralist who believed that caste stereotypes had a factual basis. Darling was not content, however, to wield such generalizations as first principles from which firm conclusions might be drawn. His method was to observe the varied behavior of farmers and attempt to understand, especially, why some

persisted in behaviors that seemed clearly to perpetuate their meagre and insecure living standards.

The best known of the stereotypes promulgated by, though by no means originating with, Darling is that of the "sturdy Jats," heroes of the Punjab canal colonies. In a typical passage, Darling (p. 117) extolled these premier cultivators:

> Grit, skill in farming, and a fine physique are characteristics common to all, and in his new environment the Jat Sikh has reached a point of development probably beyond anything else of the kind in India. In less than a generation he has made the wilderness blossom like the rose. It is as if the energy of the virgin soil of the *Bar* [a tableland between two rivers] had passed into his veins and made him almost a part of the forces of nature which he has conquered.

The primary source of the Jat's extraordinary industriousness, according to Darling (pp. 41, 84), is the harsh environment with which the Jat has had to contend, particularly in the districts of central and south Punjab. The demands of an arid land developed in the Jat an endurance for hard and unceasing labor. The same circumstances are responsible for shaping the Ahir, who "surpass even the Jats in industry, frugality, and skill" (p. 84). Darling placed special emphasis on the "spirit of enterprise" exhibited by the Jat and similar groups in their willingness to supplement farm incomes through local nonfarm employment, military service or temporary emigration.

The role of the environment as a determinant of character is highlighted by Darling's (p. 84) somewhat strained effort to account for the Meo, whom he described as "notoriously lazy and thriftless." He continued, "One explanation of these violent contrasts in character [between Meo and Ahir] is that adversity either strengthens or weakens." Darling salvaged his argument from such vacuity a few pages later. He noted that, while both Meo and Ahir face a similar vulnerability to drought, the greater fertility of the Meos' valley settlements provides their subsistence during normal years without great diligence or investment. The sandy soil cultivated by the Ahirs, in contrast, demands hard work for every crop (pp. 90-91). Emphasizing the dependence of individual character on ethnic type, the latter forged over generations of experience, Darling pointed to the Meos' nomadic ancestors unaccustomed to settled agriculture.

> Far better would it have been, both for them and the soil, had they been compelled like the Ahirs to work hard for their living; for in a hot climate some powerful stimulus is needed to make men work, and it is often where conditions are hardest that men do best, a tendency that is reflected in the local saying -- the more land a man has, the less it produces. (p. 91)

Darling returned several times to the theme that natural riches are liable to sap human character of its finer traits. The most significant cause of inefficient agriculture, in terms both of the extent of the phenomenon and its strength in the affected areas, is the fickle bounty of the riverine tracts (*bet*) (pp. 61-65).

> The soil is often so rich with alluvial mud that a ploughing or two will secure an abundant harvest: sometimes it is not ploughed at all. . . . Yet the day may come when it will all disappear in a frothing tide, reappearing, when the muddy waters ebb, as sand. (p. 61)

In the submontane tahsil of Dasuya near the headwaters of the Beas, "The money-lender alone thrives. For him conditions are perfect: the people are too happy-go-lucky to resist his wiles and sufficiently prosperous to repay his loans" (p. 25). Significantly, the character even of the Jat is seen to be adversely affected by this environment that neither demands nor rewards effort.[3] Moreover, high average yields from the alluvial soil allow a high density of population to share in the stagnant standard of living and susceptibility to endemic diseases of a hot, moist environment. Darling saw this situation as typical of India and the explanation of the paradox that despite fertile soils and a climate conducive to bountiful harvests, nearly all of British India's 353 million people (as of 1931) had at best a low and precarious standard of living.

The view that India has been doomed by nature to a hand-to-mouth existence, to a combination of human fecundity and resigned acceptance of grinding poverty punctuated by occasional bounty and famine, was widely held by Darling's contemporaries, and is not unknown even today. No amount of direct investment in agriculture was seen as adequate to the task of

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[3] Stokes (1978, p. 233) documents the not uncommon observation in reports of British officers in India that the cultivators appeared to be "creatures of circumstance," adjusting their behavior to the incentives and constraints presented by their environment.

creating "Western" attitudes toward hard work, frugality, reproductive restraint, and progress. Darling's Idealism, expressed in the context of India as a post-Victorian white man's burden, suggested only one solution: moral education.

> Our aim, therefore, should be to free the peasant from the disabilities of poverty and ignorance and enrich him with the essentials, but not necessarily the luxuries, of civilized life. And, in encouraging him to develop his land, we should not appeal to the love of gain, for that is an ignoble end, but inspire him with the desire for things that matter, such as education and health, believing that, if this desire is awakened, the necessary effort to satisfy it will follow. (p. 259)

The similarity of this view to that which inspired attempts at community development in India hardly needs elaboration. In a striking anticipation of a common post-"green revolution" theme, Darling (p. 263) warned that "The awakened peasant will not be prepared to bear indefinitely the load laid upon him by the combination of debt and low prices, however much the debt may have been due to his folly."

Darling's perspective has been reviewed at some length, because the gulf between his views and modern thinking is smaller than is usually acknowledged. The principal difference lies in the presumed locus of the "folly" that one might hope to correct. In the second half of the twentieth century, the perpetuation of behaviors that obstruct progress in living standards is attributed almost exclusively to institutions; charges of individual malfeasance are reserved for the blatantly criminal behavior sometimes observed among the rich and powerful. Thus, the modern equivalent of moral education is social reform.

The appeal of a perspective that avoids blaming the victim is obvious. Moral aesthetics aside, an emphasis on institutionalized mechanisms that perpetuate poverty is a clear advance over the view that the poor choose to tolerate their condition until awakened through desperation or exhortation. However, if institutions are to be taken as the cause of poverty, if their reform is to be sought as its solution, it is necessary to have some idea of how institutions develop and how they are changed. Just as ethnic stereotypes were for Darling simultaneously valid and in need of

explanation, modern notions of "good" and "bad" institutions need to be situated empirically in terms of their sources and effects.

3. Dynamism: Ecology and intervention

Among the classic attempts to establish the links between environmental conditions, economic institutions, and behaviors that give rise to either dynamic progress or stagnation is Eric Stokes's (1978, pp. 228-242) essay "Dynamism and enervation in North Indian agriculture: the historical dimension." The phenomenon to be explained is the century or more of relatively rapid improvement in living standards in the western portion of the Indo-Gangetic plain (India's northwest region and Pakistan's share of the Punjab) contrasted with the at best stagnant per capita income of the plain's eastern side (India's east region and Bangladesh). Stokes focused his analysis on the eastern and western districts of the United Provinces (the modern state of Uttar Pradesh) and especially on the districts of Jaunpur in the east and Meerut in the west. His reasoning is straightforward and compelling.

Stokes began by noting the conventional explanation that the natural fertility of the east affected its human inhabitants as well as its agriculture. Its remarkable prosperity lasting into the nineteenth century was its own undoing, as increasingly land had to be withdrawn from the cultivation of cash crops in order to provide the subsistence needs of the growing population, and as subdivision and fragmentation of holdings impaired the land's productivity. The problem with the overpopulation argument, as Stokes pointed out, is that by the 1930s, after several decades of contrasting economic performance, population densities were not markedly greater in the eastern districts than in the west. There had been a difference around the middle of the 19th century apparently, since census data suggest that Meerut's population grew more than twice as fast as Jaunpur's between 1853 and 1881. But this rapid growth did not interfere with the relative dynamism of the western districts either before or following the later year. Similarly, subdivision of holdings in the east had not, even by 1951, proceeded to the point where most of the cultivated

area comprised holdings of an uneconomic size. Holdings, admittedly, tended to be seriously fragmented, but this was a problem in the west, as well. Furthermore, fragmentation of holdings posed a lesser obstacle to irrigation from the east's decentralized wells than from canals.

What, then, of the famous canal projects, such as the Ganges Canal that opened in 1854 and expanded greatly the irrigated acreage of favored districts including Meerut? Stokes responded to this argument that it seemed incapable, by itself, of explaining the large gap in living standards between Jaunpur and Meerut. The latter district actually double-cropped a smaller percentage of its cultivated area; Jaunpur made up for a lack of canals by employing its abundant labor force in lifting water from wells.

A more likely explanation of the contrast in economic performance, Stokes thought, was suggested by the much greater level of urbanization in the western districts. In an explicit, though partial, rehabilitation of arguments based on caste stereotypes, Stokes explained the apparent lack of entrepreneurial spirit in the eastern districts as a reflection of the reluctance of dominant castes either to embrace the role of farmer or to diversify into non-agricultural activities.

While the majority of agricultural holdings in the western districts were owner-cultivated, tenant cultivation predominated in the east. Although, by the turn of the century, the landlord castes were far too numerous for individual families to preserve their traditional aloofness from the soil, they chafed at the prospect of relinquishing their status and clung to lordly pretensions through reliance on subtenants and hired labor, supplementing their income with usurious credit transactions with subordinate cultivators. Farmers in the western districts, meanwhile, took full advantage of the opportunities presented by the canals. Stokes left implicit the conclusion that the combination of greater agricultural income and willingness to enter into agricultural processing and other nonfarm industries and services was responsible for the higher degree of urbanization and economic dynamism in the west.

Significantly, Stokes buttressed his argument based on differential attitudes toward entrepreneurship with an appeal to differential ecology as the ultimate source of property

institutions and corresponding behavior types. He referred the reader to earlier essays in the same volume in which he developed the contention

> that not only the major tenurial distinctions between the ryotwar [cultivator] and non-ryotwar forms of village, but also caste differentiation and social distance erected upon them, can be largely explained in their origin by the distinction between regions of secure and insecure agriculture and their corresponding contrasts in population density. (p. 7)

The essence of Stokes's ecological argument is that, where soil fertility and rainfall were adequate to support a large population, an incentive existed for individuals or groups to seize proprietary control over land and extract a rent from its cultivators. In regions of insecure agriculture -- that is, where the land on an average yielded a bare subsistence to a hard-working farm family -- population remained low relative to the arable area; cultivators had neither a surplus to attract potential landlords nor any incentive to take land on lease. Moreover, the exactions of overlords, such as the Mughals or the British, tended to absorb any surplus that might otherwise have supported a landlord class, unless the land was both particularly fertile and scarce. "In the eastern districts of what is now Uttar Pradesh . . . population pressed on resources, and the fertile soil was excellent for producing landlord-type villages" (p. 58).

Overall, Stokes argument from ecology to economic performance retains the form devised by Darling fifty years before. The tone of moralistic condescension prominent in Darling's writing is muted by Stokes's interposing the structure of landholdings between the character of the land and the character of its inhabitants. Moreover, institutional constraints explain, where Darling's theory could not, how scarcity of land as a result of population growth encourages rent-seeking behavior and economic stagnation, rather than an entrepreneurial response. Nonetheless, Stokes was careful to attribute economic behavior not to the direct compulsions of nature and society but to the personal traits of diligence and entrepreneurship or indolence and nostalgia which ecology and institutions conspired to inculcate.

Emphasis on character types appears to be related to the way both Darling and Stokes viewed the impact of British intervention on economic behavior. As noted above, Stokes acknowledged

the contribution of the canals in western U. P. only to subordinate their role to the quality of the farmers' response. Darling (1978), for his part, attributed the progress of canal areas primarily to the strong character of the cultivators. He stressed, in fact, that to the extent that the combination of canals, improved access to markets, and higher grain prices had produced a windfall prosperity, it produced "a demoralizing effect, and he (the Jat) often spends his substance upon wine, women and strife" (p. 48). As regards less direct interventions by the British, Darling (pp. 171-172) recited the now largely discredited view that the introduction of civil courts had strengthened the moneylender and accelerated the peasants' loss of land through default. Stokes (1978, p. 89) credited British land revenue demands with contributing to the durability of the owner-cultivator system in western U. P. by adding an additional element of adversity to the cultivators' life. What these examples suggest is that government intervention was helpful only when the existing institutions and personalities were already conducive to economic progress, or else by accidently reinforcing the strictures of nature. Is the role of government genuinely so limited, or can it play a positive role in transforming institutions and individuals who have not been adequately blessed by adversity?

If adversity is the chief engine of economic progress, the phenomenon of sustained advance remains unexplained. Indeed, Darling (1978, p. 260) observed that increases in productivity and output inevitably would be overwhelmed by subsequent population growth. Similarly, Stokes (1978, p. 239) acknowledged that when land became relatively scarce in parts of western U. P. the Jats did not "wholly escape landlordism and preserve the pristine character of their bhaiachara [coparcenary] tenures unimpaired." Unable to account fully for economic dynamism with his theory of adversity-driven growth -- necessarily self-limiting -- Stokes nonetheless pointed to a possible solution. Having noted the increasingly complex nature of tenurial institutions in western U. P., Stokes (p. 240) wrote

> Ownership was also intimately linked with the system of cash-crop production, marketing, and the provision of credit, in a skein so complex and variegated that commissions of inquiry never succeeded in disentangling it. How far this complex

> structure, along with greater urbanisation and a more substantial agriculture-based industry, supplied one of the keys to Meerut's superior economic drive must remain an important but unanswered question.

This passage is as close as Stokes came to describing the flow of economic activity in the western districts. Stokes was able to complete the syllogism of stagnation for the eastern districts: rent-generating soil gives rise to a rent-seeking society. Dynamism in the west, however, presents the difficult task of identifying the precise mechanisms through which entrepreneurial attitudes produce not only income but incentives to pursue further improvements. A better explanation is wanted than prosperity "either strengthens or weakens." How is it that the canals, in transforming a relatively insecure environment into a secure one, caused a strengthening of entrepreneurial institutions, attitudes and behaviors, instead of their conversion into the rent-based alternates native to a secure agriculture?

This "important but unanswered question" is the focus of a thorough study by one of Stokes's former students, Ian Stone. In the concluding chapter of his analysis of the impact of the canals in western U. P., Stone (1984) reviews favorably Stokes's explanation for stagnation in the eastern districts of the province. "The picture in the west needs to be filled out a little, however, to take account of the fact that the *bhaiachara* tenurial form was not the only one in the Upper Doab[4], and that dynamism was not confined within the boundaries of the *bhaiachara* villages" (p. 304).

The central point in Stone's explanation for relative dynamism in the western districts is the qualitatively different impact on agricultural practice and productivity of canal irrigation versus well irrigation. The latter was important in the east; so much so that, around the turn of the century, a greater average proportion of net cropped area was irrigated (from all sources) in the eastern districts of Jaunpur and Azamgarh (56%) than in the western districts of Muzaffarnagar, Meerut, Bulandshahr, and Aligarh (45%) (p. 292). And this was despite the lower and more

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[4] The thirteen districts situated on the plain (doab) between the Ganges and Jumna rivers are known collectively as "The Doab," while the subset of the five northernmost of these districts, including Meerut, are commonly referred to as "The Upper Doab."

variable rainfall in the west. The east's advantage in terms of water supply did not translate into a more dynamic and prosperous economy, because irrigation from wells was labor intensive. By contrast, canal irrigation, even when involving one or more lift operations to bring water to the fields, required considerably less labor per irrigated acre. Estimates of labor requirements in the Doab indicate that canal irrigation with a single lift required only a third of the labor input of a common well to water a given area of land (p. 93). This comparison from within the Doab may overstate the contrast between east and west, since generally higher watertables in the east undoubtedly reduced the labor requirement on wells there. On the other hand, flow irrigation, often available in many canal areas (depending on distance from the headworks and the supply of water in the canal), could provide water with less than five percent of the labor input of a typical well (p. 96). Regardless of the fact that canals would have conferred a smaller net benefit in the east, the important point is that their impact in the west was dramatic.

The savings of labor, as well as draught animal resources, allowed farm families receiving canal water to redirect these inputs to make fuller use of their land through multi-cropping and increased cultivation of cash crops. The result of more intensive land use was that the total labor input in agriculture was greater in canal villages than in well villages in the west (p. 119), and in western districts than in eastern districts (p. 300). High labor demand, in turn, gave rise to labor-saving technical innovations: improved cane presses, plows, and carts. By raising the profitability of cash-crops, such innovations, together with associated improvements in farm techniques, seeds, and marketing arrangements, served to extend cultivation and send labor demand higher still. Inevitably, the rural economy became more specialized. Employment opportunities expanded in related non-farm activities, including the manufacture and repair of farm implements such as carts and cane presses, transport services, and bullock raising and trading.

> The continuous improvement in productivity through the application of technical inputs and innovations (both technical and institutional), lowered costs and relieved constraints and thus created new opportunities for growth. It is this dynamic process which brought about the contrasting pattern of prosperity which separates the west from other areas, especially the eastern districts (p. 289).

While Stokes's (1978) explanation of stagnation in the east is based on ecology, Stone attributes the prosperity of western districts to a major government intervention. It appears, then, as if the phenomena of dynamism and enervation in U. P. were independent of each other. One might conclude that both favorable institutions and attitudes *and* appropriate government intervention are necessary ingredients for long-term economic success. Expressed in such vague terms, the conclusion is probably impossible to contradict. Nevertheless, institutions change over time, as do government policies and their "appropriateness" to the changing circumstances. The hope of those who seek social reform is that institutions may be changed so as to call forth the necessary government actions. But even in the absence of deliberate reform, governments exercise power, occasionally, in ways that alter institutions and attitudes. Such a process is revealed when the theories of Stokes and Stone are integrated in a model of dynamism and enervation.

4. Agriculture: Traditional and modern

The starting point for the model is Stokes's (1978) concept of "security." As described in the previous section, Stokes distinguished between regions of secure agriculture in which a favorable ecology supports a large population and insecure regions in which cultivators face more adversity than bounty. Let L represent a measure of the security offered in a particular ecological setting. Then, output per worker in agriculture is

$$T = Lu , \qquad (1)$$

where u indicates the labor effort of each worker. Taking unity as the maximum value of labor effort per worker, and assuming that total labor is supplied inelastically, per capita output in this "traditional" agriculture is simply L. A region of more secure agriculture would, presumably, attract and sustain a higher population than a less secure region, but such population dynamics are not included in the model. Similarly, in either region, output per worker is not altered as population changes. Output per worker may be maintained by bringing additional land of equal

quality under cultivation and through minor innovations and small-scale investments in land-improvement, implements, etc. Thus, the constant productivity parameter, L, represents the susceptibility of the regional ecology to a slow accumulation of knowledge and investments that allows labor productivity to remain stable from one generation to the next.

To represent the possibility of rising living standards in agriculture, an alternate mode of production is assumed possible in any region. This so-called "modern" agriculture is based on accumulation of fixed inputs. The qualitative importance of modern production is in its ability to participate in dynamic technical advance. Inputs such as improved seeds, equipment, machinery, and knowledge permit farm incomes to rise. Modern agriculture takes the form

$$M = Ak^{\beta}(hv)^{1-\beta}, \qquad (2)$$

where M is output, A is the productivity of modern agriculture, k is physical capital, h represents technical knowledge and technology-based inputs (each in per capita terms), and v is the proportion of labor time allocated to modern production. Examples of physical capital[5] are grain held as seed or as a wages fund, farm-raised draught animals, and land improvements such as leveling and digging of wells. Investments in physical capital are financed from total output produced by either traditional or modern means.

Technical advance is a result of research and/or educational efforts:

$$\dot{h} = \delta h s - h\lambda, \qquad (3)$$

where the $\dot{}$ over a variable indicates a time derivative, δ is the productivity of the technology sector, s is the proportion of labor time allocated to the sector, and λ is the exogenously determined population growth rate. The equation says that technology contributes to its own improvement in such a way as to avoid diminishing returns. Farmers engaged in modern production are able to benefit from advances in science and technology occurring in the broader

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5 To simplify the analysis, without affecting the results, depreciation is assumed to be zero.

economy. It is this feature that makes possible continuous growth of output per capita in agriculture.

The distinction between physical capital and the technology input needs to be stressed. Accumulation of the former is entirely dependent on the size of farm output and the farmer's willingness to save. A particular piece of physical capital, a bullock, perhaps, may be used either implicitly to maintain the productivity of labor in traditional agriculture or to raise labor productivity in modern agriculture. Application of improved technology, also, involves saving, but more important is the farmer's investment of time to learn of and learn to use improved agricultural practices and inputs. Learning takes place in traditional agriculture, as well, but serves only to permit absorption of a growing population at a constant marginal product of labor. The technology sector represents the combined efforts of farmers willing to experiment and learn and of input producers engaged in research and development.

In this model, the key determinant of whether a region's rural economy is stagnant or dynamic is the allocation of farmers' time between the traditional and modern modes of production. This, of course, depends on the returns to labor effort in each activity. Specifically, eqs. (1) and (2) imply that the proportion of labor time in modern agriculture, *v*, must be such at each point in time as to satisfy

$$L = (1 - \beta) A k^{\beta} h^{1-\beta} v^{-\beta}. \qquad (4)$$

This first-order-condition for optimal labor allocation says, not surprisingly, that involvement in modern agriculture increases with increases in the productivity parameter, the quantity of physical capital, and the level of technical inputs. Neglect of modern agriculture is encouraged by a high value of productivity in traditional agriculture.

Eq. (4) sheds light on Darling's (1978) observation that adverse conditions produce robust farmers. The descriptions offered by Darling and his European contemporaries in India often took the form of contrasting the unceasing effort expended by good farmers with the indolence of others. Since total labor effort is not a variable in the present model, such a comparison is not

captured. Beyond this, however, the caricature of the good farmer reflected a belief that those who faced a demanding environment, such as the Jat of the Punjab plains, engaged in a superior quality of cultivation. Darling (p. 62) describes the Jat as "intelligent," as well as "industrious" and "prosperous." These qualities, as has been noted, were attributed by European consensus to the "insecurity" of the environment, while the residents of the fertile river valleys "take not the slightest pride or interest in any agricultural pursuit; their fields are cultivated in the most slovenly manner." In the context of the model, this contrast is due, in large part, to investments (principally in wells) and innovations by plains farmers to compensate for a less than generous environment. That is, those whom the Jat typifies achieved a high standard within the confines of a traditional agriculture, while those in the valleys enjoyed a relatively high value of L without much effort or attention. It is clear that, except in those parts of the Punjab served by canals, Darling does not see the sturdy Jat farmers participating in the kind of dynamism described by Stone (1984) in U. P. The prosperity of the Jat on the dry plain is only relative. Of greater significance than good farming in reducing the hardships of an insecure environment is "enterprise," pursuit of nonfarm occupations. Only with "the beneficence of a wise Government" (p. 132) in providing the canals did the potential returns to modern agriculture make it a viable option.

Darling's portrayal of the dry Punjab plains suggests that the productivity parameters in the model, A and L, are likely to vary together from one environment to another. The very adversity that produced admirable qualities in the Jat made it unlikely that even such an industrious and intelligent cultivator could, by himself, make a success of a dynamic modern agriculture with continually rising productivity and income. A coincidence of high parameter values is to be expected, as well. Fertile tracts with adequate moisture and temperature are certainly not to be avoided by those wishing to engage in modern agriculture. Divergence of these values is possible, however. Darling's (1978, pp. 61, 62) scathing characterization of the Punjab valley dwellers reflects a failure to recognize that investments to improve the land are irrational in an agriculture

based on periodic flooding. Darling (p. 65) was mistaken, also, in suggesting that this peculiar combination of high L and low A is characteristic of India as a whole. For the most part, the secure tracts cited by Stokes (1978) as the nurturing ground of landlord-tenant institutions are equally suited, as far as ecology goes, for either traditional or modern agriculture.

Stokes's explanation of the link between ecology and institutions, translated into the language of the model, is that regions with a high L generate a surplus over subsistence needs that, if demand for land is sufficiently high, can be seized by those who enjoy enforceable property rights over the land. Insecure regions, those with a low L, neither produce much surplus nor attract sufficient population to support a landlord class. Landlords may prove an obstacle to a switch to modern agriculture, because the property rights on which rents are based do not extend automatically to the new inputs that are responsible for productivity growth in modern agriculture. At the least, a landlord is less likely to choose modernization for himself, since the ability to benefit from the work of numerous tenants on a land area beyond his capacity to cultivate directly causes the landlord to reap a greater benefit from traditional agriculture than would owner-cultivators. On the other hand, since the persistence, as well as the emergence, of tenurial institutions is indicative of a high value of L, there is no reason to presume that the abolition of landlords, or more sweeping egalitarian reforms, would in itself cause cultivators to adopt modern agriculture. The point is a familiar one and need not be stressed. However, the implications of the model regarding the requirements for dynamic growth suggest that a policy focus on social reform and equity may itself obstruct the transition to modern agriculture.

Eq. (4) is a static condition. It does not indicate how the agricultural economy might evolve over time. The dynamic behavior of the model is determined by optimizing a welfare function using eqs. (1) through (3) as constraints. The details are presented in an appendix. The principal implications of the model may be stated briefly.

The model generates two stable equilibria. In one, production is focused on traditional agriculture; inputs in modern agriculture are negligible. In the other, traditional agriculture has

been abandoned. Labor is allocated between modern agriculture and the technology sector; continual technical advance causes per capita income to rise at a constant, permanent rate. Between these equilibria is an unstable transitional state in which some labor is allocated to both traditional and modern agriculture. The share of labor in the technology sector is proportional to the labor allocation in modern agriculture; the technical advance on which long-run growth depends cannot occur unless a critical minimum of labor effort is committed to modern agriculture.

Assuming all other parameters remain constant, movement of an economy from the stagnant equilibrium to the growth equilibrium can occur only if the marginal product of labor in modern agriculture is raised sufficiently relative to that in traditional agriculture. As is clear from eq. (4), an exogenous increase in A (and/or fall in L) could have that effect. Alternatively, an exogenous increase in A, even if matched by an equal increase in L, might permit a transfer into modern production of physical capital that had been accumulated to maintain the value of L. Any increase in the amount of physical capital available for modern agriculture will raise the marginal product of labor there. This possibility is of greater interest, because it conforms so closely with the manner in which dynamic growth was effected in western districts of U. P. in the second half of the nineteenth century.

The bringing of canal water was, of course, a significant event exogenous to the farmers' discretion. The resulting dynamism, however, seems not to have been determined solely by the productivity differential between traditional and modern agriculture. In fact, the most rapid and substantial response to the canals occurred in villages where a high watertable made traditional agriculture relatively secure.

As noted above, a prominent means of maintaining labor productivity in traditional agriculture is irrigation from wells; where soil conditions, terrain, and depth of the watertable are favorable to wells, farmers enjoy a natural bounty not dissimilar from that in regions of greater rainfall. Wells serve to promote traditional, rather than modern, agriculture, because they have only a small

impact on labor productivity, being themselves labor intensive. Their primary purpose is to raise the productivity of the land: to raise the value of L.

Canals, providing an alternate source of irrigation, increased land productivity, also. "Precarious" villages with little or no irrigation from wells showed the greatest improvement in per acre yields when provided with canal irrigation (Stone, 1984, p. 77). However, utilization of canal water was limited in such villages, since they lacked the labor supply and stocks of other complementary inputs, especially bullocks, that were associated with traditional well irrigation. Had villages in western U. P. been predominately without substantial well irrigation, or had the canals served only such villages, the ultimate impact of the canals would likely have been very different from the dynamism in fact observed. It is easy to imagine a scenario in which cultivation is extended only as fast as population growth permits. The greater yield on irrigated land would allow rents to rise, reducing tenant cultivators' ability to invest and biasing landlord interests in favor of maintaining the rental share of output rather than increasing total farm output. This appears, indeed, to have been the case in some parts of the Doab, where "To prevent the accrual of occupancy rights, tenants were made to take different fields each year, rendering all effort at improving or maintaining soil fertility pointless" (Stone, 1984, p. 311). Tenants, for their part, would in some cases choose to forgo the option of canal irrigation for fear that landlords would "enhance their rents and deprive them of *maurusi* [occupancy] rights" (p. 312). In short, even as dramatic an intervention as canal irrigation was susceptible to absorption within the structure of traditional agriculture. The canals, by themselves, were unable to force the rural economy to a growth equilibrium based on modern agriculture, because the canals' effect on productivity was felt in traditional agriculture, as well; with both A and L rising together, the balance of incentives between traditional and modern activities was hardly altered.

That tenurial institutions were not necessarily an immovable obstacle to modernization is made clear by the significant presence of landlords in the most dynamic regions of the Upper Doab. Muzaffarnagar and Meerut districts had together around one-third of the cultivated area

under unprotected tenancies (Stone, 1984, p. 312). In Khatauli *pargana* (in Muzaffarnagar district), a predominance of landlords did not prevent the canals from creating a widespread prosperity. Landlord villages in Khatauli were slightly in advance of owner-cultivated villages in terms of area under cash crops and the extent of double cropping (p. 304). The key to such dynamism, irrespective of tenurial conditions, was the supply of complementary inputs of labor, bullocks, and manure that Khatauli's former reliance on wells had put in place. Quoting from a British Settlement Report of 1882, Stone (p. 97) observes that

> the bullock power released from the treadmill of water-raising on nearly 7,000 acres was 'sufficient for all the work connected with the increased cane cultivation [including processing] and for the ploughing of 10,000 acres besides.'

In contrast to previously dry villages, well villages along the canals were presented with more than a higher productivity of agriculture, whether traditional or modern. The switch from well to canal irrigation liberated the services of considerable capital. In addition to bullocks, family labor became available for redeployment, as described in the previous section. In fact, the redeployment of labor was in some cases greater than indicated above. When canal water had to be lifted from the channel to the fields, it was necessary for most families to hire workers during the brief irrigation periods (Stone, 1984, p. 93). Thus, part of the relatively small labor input in irrigation would be met from the family's wages fund, a form of capital, leaving more of the fixed supply of family labor to be used in other operations. In addition, the knowledge and experience gained in producing the few acres of cash crops feasible under well irrigation was available to enhance the productivity of the now available supplies of labor and capital. Well villages, therefore, experienced not only an increase in the potential productivity of modern agriculture, which likely was matched by a corresponding increase in the productivity of traditional agriculture, but, also, a need to redeploy inputs no longer needed in traditional activities. While the direct productivity effect of the canal raised both sides of eq. (4) by similar amounts, the redeployment effect impacted solely on the right-hand side of the equation, tipping the balance of incentives in favor of modern agriculture.

The profitability of modern agriculture brought about by canal irrigation in villages previously irrigating from wells affected the behavior of landlords, as well as owner-cultivators. According to the evidence reviewed by Stone (1984, pp. 304-310), landlords, as a group, did not actively participate in the process of modernization and reaped a rather small share of the benefits. Rather, Stone is struck by the evidence that landlords in much of the Upper Doab were able neither to interfere with tenants' investment and production decisions nor to raise rents by anything approaching the rise in income from the land. The primary reason, Stone concludes, is that legally secure occupancy rights at low rental rates, established long before the canals were built, were next to impossible to wrest from tenants enjoying the financial strength now being provided by the canals. Tenants in some villages succumbed to harassment by landlords, ceding their occupancy rights and paying much inflated rents as tenants-at-will. However, the majority of cultivators in this region were well able to resist challenges to their occupancy status and low rent levels, matching, if necessary, their landlords' expenditures in court. Over time, the area under secure tenancy increased -- by, for example, 35,000 acres in Muzaffarnagar between 1892 and 1920 (p. 308) -- as farmers used a portion of their increased income to pay as much as 23 years' rent to the landlord for occupancy status.

Ironically, though not surprisingly, the success of prospering cultivators, both occupancy tenants and owners, helped to undermine the position of less secure cultivators. Farmers maximized the area under valuable cash crops on their original holdings by moving their production of subsistence food crops and fodder to unirrigated land in neighboring villages for which they were willing to pay higher rents than could be afforded by tenants growing only these lower-value crops (Stone, 1984, pp. 312, 313).

Ultimately, population growth on the limited land area reachable by the canals would have brought an end to the process of rising incomes but for the involvement of the final element in Stone's account, and in the model: the technology sector. As indicated in the previous section, the effect of reducing labor demand for irrigation by replacing well water with canal water was a

rise in the quantity and quality of cultivation that drove the demand for labor higher than it had been previously. Widespread involvement in modern agriculture represented a laboratory in which production bottlenecks were discovered and remedied. This interaction between farmers and specialized nonfarm activities on which they increasingly depend is the defining characteristic of modern agriculture and, indeed, of a modern economy. The crucial point is that in western U. P., as in the model, the establishment of modern agriculture had to precede and call forth the technology sector. Dynamism begins with the recognition of a technical challenge and continues so long as each new input or technique causes output to expand and create new constraints, a demand for yet newer inputs.

5. Government policy: Traditional and modern

The model reviewed in the previous section offers one way to think about the causes of a persistent gap between current practices and technical possibilities in agriculture. The model suggests that such a technology gap may not reflect "inefficiency" in the usual sense of the term. Rather, farmers prefer traditional agriculture because it works; the net benefits to be had in modern agriculture are not sufficiently greater than those arising from the present system to justify a switch. This rationality may apply even to downtrodden, insecure tenants, so long as the inputs associated with modern agriculture remain prohibitively expensive.

In theory, social reform and cooperation could allow the mass of cultivators to organize the investments and distribute the benefits associated with modern agriculture. However, even champions of reform such as Dantwala (1986) see little reason to hope that the poor can be mobilized effectively to remake their economic possibilities. The primary reason is that the necessary support both for grassroots organizing efforts and substantial reforms in response to popular demands is unlikely to come from a government controlled by the rich. In apparent despair, Dantwala (1986, p. 477) concedes that "Those who believe in the revolutionary overthrow of the present order as the only option should be free to adopt that line of action." The

irony is that even revolution could prove to be a marginal change as regards growth by failing to alter the strong incentives to maintain production through continual increases in labor intensity.

The model of dynamism and enervation implies that both a significant improvement in modern agriculture's productivity *and* a considerable shift of resources into modern production in response are needed to establish modern agriculture, as well as the technology sector from which it draws its dynamism. Fortunately, the technical knowledge exists in the wake of the "green revolution" to achieve far higher productivity than is presently observed in most of India's east region. Massive investments on the land to improve irrigation and drainage are among the prerequisites to apply this knowledge.

Unlike canal irrigation, modern biochemical technology is not labor-saving. Rather, its direct impact on yields and profitability has the potential to expand output greatly, thus producing a dramatic rise in labor demand in cultivation, agro-processing, marketing, etc. A dynamic agriculture may result from attempts to respond to rising labor costs, so long as the response is to improve labor productivity and maintain the expansion of output. Again, unlike the experience of western U. P. in the later decades of the nineteenth century, the necessary shift of resources into modern production in the late twentieth century requires more than the response of the relatively wealthy cultivators. In the east region states of Bihar, Orissa, and West Bengal, operational holdings of under 2 hectares (4.9 acres) comprise 41.6, 37.9, and 60.4 percent, respectively, of operational area (as of 1980-81), while the proportion of land in holdings of over 10 hectares is 10.5, 7.4, and 3.7 percent, respectively (Bandyopadhyay, 1986, p, A-54).[6] Because biochemical technology is technically scale neutral, its fullest exploitation can occur only when a majority of the regions' "small" and "marginal" farms have devoted their land, labor, and capital resources to

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[6] By contrast, as late as 1961, the area of holdings under 2 hectares in western U. P. was less than 30 percent of the total operational area; holdings of more than 10 hectares made up just under 11 percent (Sharma and Poleman, 1993, p. 59).

modernization. This, of course, must await the regions' equivalent of the canals: water control investments, as well as reliable and affordable supplies of HYV seeds and fertilizers.

While reform movements and even revolution may be inadequate to effect the necessary policies and investments, the model suggests a scenario in which the government might find it politically expedient to bring the "green revolution" to the east.

In the previous section, canal irrigation was interpreted as an element exogenous to farmers' discretion that altered the productivity parameters influencing their behavior. Government, obviously, faces different sets of constraints and possibilities. From the perspective of a policymaker with revenue-gathering and public-expenditure-allocating powers, an investment in canals is a deliberate act of capital accumulation. The productivity parameters, L and A, describing potential output in the traditional and modern sectors, respectively, determine the possible return on various policies or investments on the policymaker's menu of choices.

To the rulers of colonial India, the security afforded to the population by a high productivity in traditional agriculture meant a relatively rich source of land revenue, as well as a supply of valuable export commodities. Such was the case in the fertile, high-moisture tracts predominant in the eastern half of British India. To the west, and on the Deccan plateau comprising much of peninsular India, the ecology left agriculture insecure. Here revenue possibilities were more limited and unstable. Investment to improve production served not only to enhance revenue but to reduce government expenditures on famine relief, as well. Thus, as predicted by the model, the government directed its agricultural improvement investments so as to achieve the maximum return; beginning in the desert-like Punjab and heading east through the inadequately watered western districts of U. P. to the increasingly secure lands of the east, one observes a declining density of publicly-funded irrigation infrastructure.

Return on government projects depends on the suitability of the land for an improved, modern agriculture, as well as on the natural productivity of traditional agriculture. The rational inverse relationship between L and public investment is matched by a positive relationship between the

latter and *A*.. The relatively even terrain and access to perennial rivers in the Punjab and western U. P. allowed canals to be constructed and maintained with much less expense than was incurred on the less extensive projects on the Deccan. The geomorphology in Bengal Province is relatively ill-suited to large water-control systems. The drainage and waterlogging problems encountered in western U. P. were an increasingly serious threat the further east one looked.

Finally, to the extent that human interventions to correct perceived deficiencies in the natural environment generate opportunities and incentives to continue the process of raising productivity and output, we should expect to see insecure, originally poor regions develop faster than and eventually exceed the living standards found in secure, formerly more prosperous regions. Unfortunately for the interests of those in the originally secure region, so long as dynamic growth continues, incentives remain biased in favor of continued investment in the now prospering region. It comes as no surprise, then, to see "history repeating itself" (Sharma and Poleman, 1993, p. 35) with the government of Independent India deliberately targeting the northwest region to launch the "green revolution" while offering little more than rhetoric and what Dantwala (1986, p. 11) calls "countervailing measures" of poverty relief in neglected regions. In fact, the host of programs designed to provide alternate income from "tiny sector" activities like poultry raising and small-engine repair are the public sector counterpart to the small investments and innovations through which individuals rationally resist declines in labor productivity in traditional activities.

Presumably there is a limit to the size of population that can be supported in India's east region, beyond which conditions become so intolerable as to accomplish what countless would-be revolutionaries have not. Before such a watershed is reached, it is a reasonable possibility, at least, that government leaders will find their calculations of the "security" of the east altered by considerable numbers of voters who are no longer willing to accept the curse of a favorable ecology, especially since they know that substantial improvement is technically feasible.

An early, meaningful, and sustained response to farmers' demands for the necessary government policies and investments would almost certainly begin with a focus on output, rather

than equity. As has been the case for more than a century in the northwest region, relatively better-off farmers are in the most favorable position to benefit from a modernization effort, as well as being the most politically influential. The combination of economic and political leverage and interest in higher farm income among these "middle peasants" is, perhaps, the best chance of ending the effective neglect of India's east region. There is no conceivable way, short of revolutionary expropriation, to prevent such people from sharing disproportionately in the process. At the same time, since a dynamic agriculture is inconceivable without public investments that reach a majority of cultivators, a genuine commitment to improved productivity and higher output in the region overall cannot but benefit the poor along with the rich.

Appendix

A Model of Endogenous Dynamism and Enervation

A homogeneous agricultural product may be made using either "traditional" or "modern" methods. The traditional mode is characterized by constant labor productivity:[7]

$$T = Lu, \tag{A1}$$

while the marginal product of labor is variable under modern production:

$$M = Ak^{\beta}(hv)^{1-\beta}, \tag{A2}$$

Technical knowledge and inputs arise in a separate technology sector:

$$\dot{h} = \delta h s - h\lambda, \tag{A3}$$

The representative, infinitely-lived family is assumed to maximize the value of its utility stream according to

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[7] For definitions of variables, see section 4 of the main text.

$$W = \int_{t=0}^{\infty} e^{-(\rho-\lambda)t} \ln(c)\,dt, \tag{A4}$$

where ρ is a subjective discount rate and *c* is per capita consumption.

The Lagrangian functional implied by eqs. (1) through (4) is

$$L(t) = \ln[c(t)] + \theta_1(t)\{Lu(t) + Ak(t)^{\beta}[h(t)v(t)]^{1-\beta} - k(t)\lambda - c(t)\}$$
$$+ \theta_2(t)[\delta h(t)s(t) - h(t)\lambda] + \gamma(t)[1 - u(t) - v(t) - s(t)]. \tag{A5}$$

where the θ_i are costate variables and γ is a Lagrange multiplier.

The first-order-conditions governing the choice (control) variables of consumption and labor allocation require the following relationships to hold:

$$\theta_1 = \frac{1}{c} \tag{A6}$$

$$\theta_1 L = \theta_2 \delta h \tag{A7}$$

$$L = (1-\beta)Ak^{\beta}h^{1-\beta}v^{-\beta}. \tag{A8}$$

The equations of motion for the costate variables, after some minor algebra and substitution from eqs. (A7) and (A8), imply

$$\frac{\dot{\theta}_1}{\theta_1} = \rho - \beta Ak^{\beta-1}(hv)^{1-\beta} \tag{A9}$$

$$\frac{\dot{\theta}_2}{\theta_2} = \rho - \delta v - \delta s. \tag{A10}$$

Let the proportional growth rate of per capita consumption, $\frac{\dot{c}}{c}$, be represented by ϕ. Then, eq. (A6) implies

$$\phi = -\frac{\dot{\theta}_1}{\theta_1}. \tag{A11}$$

Differentiation of eq. (A7) with respect to time yields

$$\frac{\dot{\theta}_2}{\theta_2} = \frac{\dot{\theta}_1}{\theta_1} - \frac{\dot{h}}{h}. \tag{A12}$$

Substitution among eqs. (A3), (A10), (A11), and (A12) implies

$$\phi = \delta v + \lambda - \rho. \tag{A13}$$

Time differentiation of eqs. (A8) and (A9) yield, respectively,

$$\beta \frac{\dot{v}}{v} = \beta \frac{\dot{k}}{k} + (1 - \beta) \frac{\dot{h}}{h} \tag{A14}$$

$$\beta \frac{\dot{v}}{v} = (\beta - 1) \frac{\dot{k}}{k} + (1 - \beta) \frac{\dot{h}}{h} + \frac{\dot{v}}{v} \frac{\lambda}{(\delta v + \lambda)}. \tag{A15}$$

Combining eqs. (A14) and (A15) implies

$$\frac{\dot{k}}{k} = \frac{\dot{v}}{v} \frac{\lambda}{(\delta v + \lambda)}, \tag{A16}$$

$$\frac{\dot{h}}{h} = \frac{\dot{v}}{v} \frac{\beta}{(1 - \beta)} \frac{\delta v}{(\delta v + \lambda)}. \tag{A17}$$

Eqs. (A16) and (A17) indicate that, when ϕ is greater than (less than) zero, v is rising (falling). Therefore, by eq. (A13), ϕ is rising (falling). This behavior is depicted in Figure A1.

In the long run, the upper bound on ϕ is determined by the abandonment of traditional agriculture that occurs when rising levels of k and h have caused the RHS of eq. (A8) to become strictly greater than L. It is readily confirmed that the growth rate of consumption per capita, ϕ_τ, is then

$$\phi_\tau = \delta - \rho. \tag{A18}$$

The lower bound on ϕ is set by the approach of v toward zero as k and h become negligible. Here, again, eq. (A8) ceases to hold; modern agriculture is abandoned, and per capita output and consumption have the constant value L.

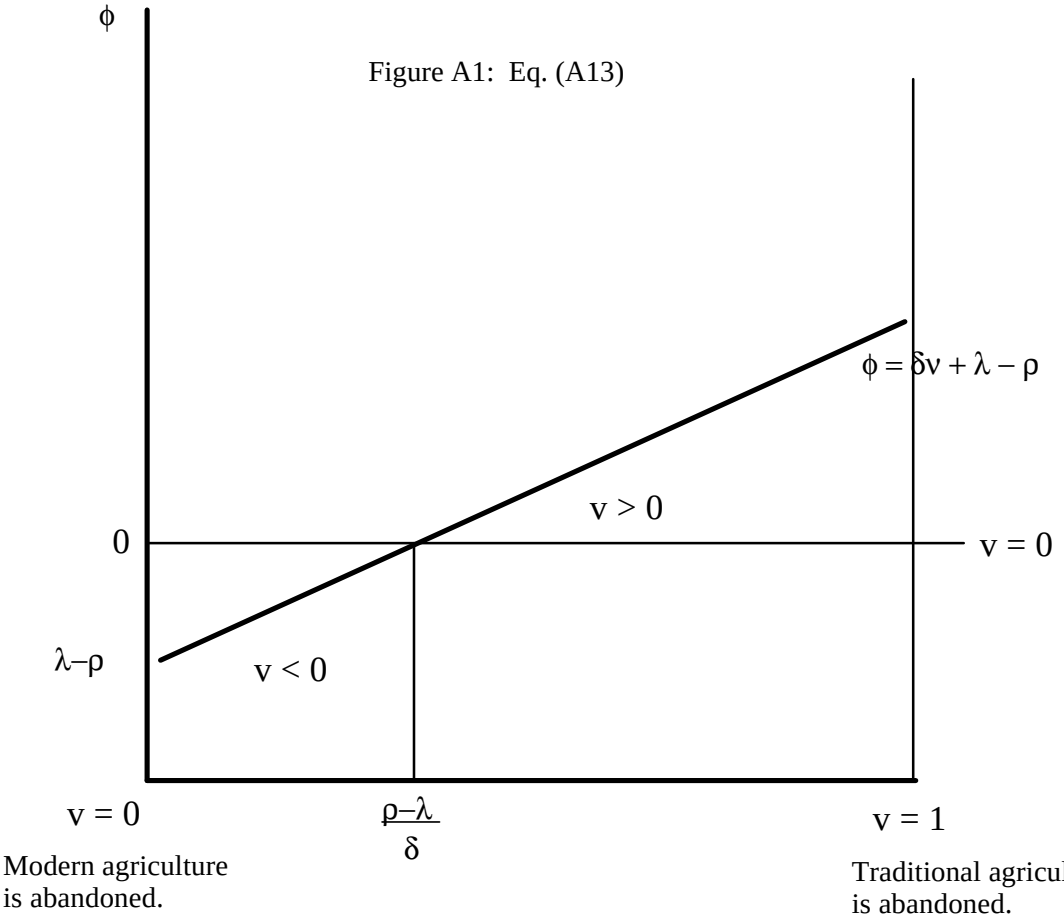
In a long-run growth equilibrium, eq. (A18) obtains. Since h must be growing at the same rate, we have from eq. (A3) and the fact that all labor time is divided between modern agriculture and the technology sector,

$$v_\tau = \frac{\rho - \lambda}{\delta}. \tag{A19}$$

Thus, the share of labor that will be used in modern agriculture in a growth equilibrium, v_τ, corresponds, from eq. (A13), to the threshold between dynamism and enervation. To initiate the

transition from traditional to modern agriculture, labor allocation in the latter must be held *above* its long-run level until the traditional sector is abandoned.

Figure A1: Eq. (A13)



References

Anstey, Vera. 1957. *The economic development of India*. Longmans, Green and Co., London, U. K.

Bandyopadhyay, D. 1986. Land reforms in India: An analysis. *Economic and Political Weekly*, XXI, (June 21-28), A-50 - A-56.

Dantwala, M. L. 1973. From stagnation to growth: Relative roles of technology, economic policy and agrarian institutions. In R. T. Shand, Editor. *Technical change in Asian agriculture*. Australian National University Press, Canberra, 259-281.

_____ *et al*. 1986. *Indian agricultural development since Independence*. Oxford and IBH Publishing Co., New Delhi, India.

Darling, Sir Malcolm. 1978. *The Punjab peasant in prosperity and debt*. South Asia Books, Columbia, MO.

Mann, Harold H. 1967. *The social framework of agriculture*. Augustus M. Kelley, New York, NY.

Report of the Royal Commission on Agriculture in India. 1928. HMSO, London, U. K.

Schultz, T. W. 1993. *Origins of increasing returns.* Basil Blackwell, Cambridge, MA.

Sharma, Rita and Thomas T. Poleman. 1993. *The new economics of India's green revolution: Income and employment diffusion in Uttar Pradesh*. Cornell University Press, Ithaca, NY.

Stokes, Eric. 1978. *The peasant and the raj: Studies in agrarian society and peasant rebellion in colonial India*. Cambridge University Press, Cambridge, U. K.

Stone, Ian. 1984. *Canal irrigation in British India: Perspectives on technological change in a peasant economy*. Cambridge University Press, Cambridge, U. K.