Technoeconomic Heritage, Patterns of Development, and the Advantage of Backwardness*

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Abstract

Analysis of industrializing agrarian societies of the Third World reveals notable differences in demographic rates, levels and patterns of development, income distributions, and patterns of trade dependency that are linked to the length of time since the population of these societies made the shift from horticulture to agriculture. Furthermore, the fact that societies that made the shift more recently enjoy higher GNPs/capita supports the hypothesis that there can be certain developmental advantages to limited *backwardness.*

From time to time during the last seventy years, students of societal development have proposed some version of what has come to be known as the "advantage of backwardness" hypothesis (e.g., Service; Spencer; Trotsky; Veblen). Reduced to barest essentials, this hypothesis asserts that less developed societies sometimes enjoy advantages that allow them to overtake more developed societies at a later date. Proponents of this hypothesis have noted that societies that pioneer in the development of new technoeconomic systems have to pay the sometimes heavy costs of innovation (i.e., the costs of "research and development"). More important still, they become committed by heavy capital investments to early forms of the new technology that may soon be surpassed. In contrast, their more backward competitors avoid the costs of research and development and are freer to adopt later and more advanced forms of the technology when they appear. Various instances of this have been cited. Thorstein Veblen

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pointed to the success of Germany and the United States in overtaking Britain in the late nineteenth and early twentieth centuries, and Leon Trotsky predicted that the Soviet Union would benefit similarly from the advantages of what he called the "law of uneven and combined development." More recently, we have witnessed the rapid rise of Japan relative to the United States and western Europe and the growth of the American "sunbelt" relative to the so-called "snowbelt" or "rustbelt."

Although most discussions of the "advantage of backwardness" hypothesis have focused on the industrial era and on the leading competitors in the world system, the hypothesis clearly has much wider applicability (e.g., Service). The historical record is replete with instances of societies that were once at the forefront of development but were later overtaken and surpassed by others that previously were less developed (e.g., Childe,a,b). One need only recall the fate of Sumer, Babylonia, Assyria, Egypt, Persia, Athens, or Rome to appreciate how impermanent the status of the most advanced societies can be. And it is not only the most advanced societies whose positions are impermanent and insecure. Further back in the pack, too, positions change and societies are often overtaken and surpassed by previously less advanced competitors.

Thus, the "advantage of backwardness" hypothesis raises one of the most interesting and important questions in the whole field of societal development: how is it possible for less developed societies to overcome this handicap and move ahead of competitors who previously were more developed and, therefore, presumably in a better position to develop further? The "advantage of backwardness" hypothesis challenges the conventional wisdom that advantages (and disadvantages) cumulate, and it forces us to consider the circumstances and the processes that enable some societies to overcome their seeming disadvantage.

This paper reports the results of a test of the "advantage of backwardness" hypothesis as applied to industrializing agrarian societies of the Third World. This is a set of societies that has one foot in the modern industrial era and one foot in the older agrarian era. These societies combine in various ways elements of a modern industrial technology and economy with elements of traditional agrarian technology and economy.

Although industrializing agrarian societies have much in common with one another, they differ greatly in the length of time since they made the transition from horticulture to agriculture. Horticulture is a more primitive method of farming than agriculture and it employs the hoe and/or digging stick as the basic tool or tools in cultivation. These tools are much less effective than the plow—the basic tool of the agriculturalists—in combatting weeds and in maintaining the fertility of the soil. As a result, horticulturalists are forced to abandon their gardens every few years and clear new ones. Furthermore, the yields they obtain are considerably less than those of agriculturalists.

Following the invention of the plow, farmers were able to combat weeds and preserve the fertility of the land much more effectively than had previously been possible. One consequence of this was the replacement of temporary gardens (*horti cultura*, the cultivation of gardens) by fields kept permanently under cultivation (*agri cultura*, the cultivation of fields). With the adoption of the plow, farmers were also able to harness the energy of oxen and other large animals to the work of food production. As a result, the shift from horticulture to agriculture meant a substantial increase in productivity and in the potential size of the economic surplus, and these developments led, in turn, to increased occupational specialization, the growth of cities and towns, the growth of the state, and numerous other changes that are part of what we have come to associate with societal development.

Despite these overall similarities, agrarian societies differ in one important respect that would appear to have special relevance for the "advantage of backwardness" hypothesis: some of them adopted the plow and became agrarian societies a thousand years or more before the beginnings of industrialization, while others took this important step only in the last few centuries. Thus until recently, the former group of societies was substantially more developed than the latter. This was not an unmixed blessing, however, since adoption of the plow has enabled populations to increase in size and density. Many of the gains that have been achieved by agrarian technology (e.g., gains in productivity, and national income) have been lost over time through the gradual increase in population. To put the matter another way, societal development tends to be subverted in agrarian societies by growth in numbers. Thus, under the conditions that have prevailed in recent centuries, there may have been an advantage to backwardness: societies that were slow to make the shift from horticulture to agriculture may have brought less of a demographic burden into the industrial era and therefore have been in a better position to take advantage of the new opportunities that industrialization has provided. If so, this would be quite a new kind of evidence in support of the "advantage of backwardness" hypothesis.

The present paper tests important implications of these ideas with comparative data on a number of currently developing nations in the Third World. It extends earlier work on the continuing impact of preindustrial technoeconomic heritages on development (Lenski and Nolan) by subdividing societies that were practicing plow agriculture (agrarian technology) on the basis of the length of time they had relied on that technology prior to the industrial era. It has already been shown that societies with an agrarian heritage have a number of substantial advantages over societies with a horticultural heritage in adapting to industrial technology (Lenski and Nolan).

Our present concern is to determine if differences consistent with

the "advantage of backwardness" hypothesis exist *within* the set of industrializing agrarian societies.[1] Three basic questions will be addressed in the analysis that follows. First, are societies with longer reliance on plow agriculture slower or less able to accommodate industrial technology? Second, are there significant differences in the patterns of development associated with the length of agrarian heritage prior to the industrial era? And, third, are there important and continuing social-structural consequences of the difference in the timing of the shift from horticulture to agriculture?

In the Old World, the shift from horticulture to agriculture began in the Middle East approximately 5,000 years ago and the process was completed at least a thousand years ago, except in sub-Saharan Africa, in the Philippines, and in some of the hill country in Southeast Asia. In contrast, the process only began in the New World after its discovery and conquest by Europeans. Thus, the practice of agriculture has only been introduced in this part of the world in the last 500 years, and in many areas much more recently than that. To facilitate discussion, the first set of societies will be referred to as the "Old Agrarian" and the second as the "New Agrarian" societies.

These differences in the timing of the adoption of plow agriculture allow us to derive a number of specific hypotheses based on anticipated differences between the two sets of societies. First, because plow agriculture produces greater crop yields per unit of land than does horticulture (Boserup; Curwen and Hatt; Farmer) and because populations tend to increase as food supplies increase, we should expect Old Agrarian societies to have greater population densities than New Agrarian societies.[2]

Second, because of the anticipated difference in population density between the two sets of societies, we should expect differences in their modes of production and in their patterns of development. In the densely settled Old Agrarian societies, labor is cheap—even by Third World standards—while land is dear. Thus, there is a powerful incentive to adopt labor-intensive systems of production that maximize the productivity of land. In contrast, in the less densely settled New Agrarian societies there is a *relative* abundance of land and, therefore, greater incentive to maximize the productivity of the labor force. This difference should lead to higher levels of development in the New Agrarian societies when measured by the conventional measure of GNP (or energy consumption) per capita, but higher levels of development in the Old Agrarian societies when development is measured in terms of GNP (or energy consumption) per 1,000 square kilometers.

Third, the demographic differences between these two sets of societies should also have an impact on income distribution. Societies practicing labor-intensive agriculture should have more of their income going to the bottom portion of the income hierarchy than other societies simply because the minimal subsistence needs of these producers would require a

larger proportion of the total income. As a corollary of this, one might infer that the New Agrarian societies would have a relatively larger percent of their income going to the upper levels of their income hierarchy and a less egalitarian distribution of income overall.

Finally, because of the historical differences between our sets of societies, we would expect to find fundamental differences between the relative positions of these societies in the modern world economy. European conquest and colonization brought plow agriculture to the New World. Thus, all of these societies were politically and economically dependent societies at the time they began to shift from horticulture to agriculture. In contrast, several of the Old Agrarian societies never lost their political independence to the European powers (e.g., China, Thailand), and even those that did already had well-developed economies prior to their loss of independence. Thus, it seems not unreasonable to expect that the New Agrarian societies will have higher levels of trade dependency than the Old Agrarian societies, though, perhaps, lower levels of involvement in international trade and commerce.

Data and Methods

To test the hypotheses indicated above, we assembled data from several sources, specifically, Taylor and Hudson, the World Bank, Taylor and Jodice, the International Labor Office, Ahluwalia, and Paukert. The exact source of each of the variables is indicated in the notes appended to each of the tables, and the classification of societies on the basis of the length of their agrarian heritage is indicated in the Appendix. In the final "sample," 23 societies were classified as Old Agrarian, and 14 as New Agrarian.

In tests of our hypotheses, we compared these older and newer industrializing agrarian societies in terms of their respective demographic patterns, levels of economic development, income distributions, and trade patterns in recent decades. Category means of the measures are displayed in the tables as are the results of the statistical analyses. Analysis of variance was used to determine the amount of variance explained by the length of agrarian heritage dichotomy as well as to assess the statistical significance of the observed differences.[3] The number of cases on which mean values are based is presented in parentheses for each category mean.

Since our analysis of the demographic and economic development data suggested that the two sets of societies have, in fact, followed different paths of development, we combined Z-scores derived from measures of two different dimensions of development, and applied analysis of variance to measure the magnitude and significance of these developmental differences. And, to test the further hypothesis that population size and

density are responsible for these observed differences in development, we used dummy variable regression to see to what extent differences in them accounted for the differences in pattern of development.

Analysis and Discussion

As Table 1 makes clear, Old Agrarian societies are substantially larger and more densely populated than New Agrarian societies as we hypothesized. This is, of course, what one should expect given the long history of plow agriculture in these societies and its more recent introduction into the New Agrarian societies. Table 1 also provides support for the thesis that the greater density of population in the Old Agrarian societies has led to greater reliance on labor-intensive modes of production, at least in agriculture. This is indicated by the greater percent of the labor force employed in agriculture in these societies, the larger number of agricultural workers per unit of agricultural land, and perhaps also by the smaller percent of the population living in urban areas.

One interesting and important feature of Table 1 that we cannot claim to have anticipated is the lower rate of population growth in the Old Agrarian societies (which may well be at least partially a response to their higher densities). Because of the lower rate of growth in the Old Agrarian societies, one can hypothesize that the differences between these two sets of societies, insofar as they are based on differences in population density, will decline in the years ahead, since the *relative* difference in density is already declining. The absolute difference in density between these sets of societies increased (from 42.6 in 1950 to 77.2 in 1975), but the ratio of Old Agrarian to New Agrarian density declined from 3.2 in 1950 and 1965 to 2.8 in 1975.

Turning to Table 2, we find what appears to be only a modest measure of support for the second of our hypotheses. The Old Agrarian societies have achieved a higher level of land productivity, and the New Agrarian societies a higher measure of per capita productivity, but the R^2 values are small and most of the differences between the two sets of societies are not statistically significant.

One reason for this, however, is that the differences in Table 2 are in opposite directions. To get a valid test of the hypothesis that the two sets of societies have followed different paths of development, we need to compare *the difference of the differences between each of the indicators of the two dimensions of development for the two sets of societies*. Only in this way are we able to consider both dimensions simultaneously.

For this purpose, the measures of development were converted to Z scores (to express them in a common metric) and then the Z score of the *per capita* measure of productivity was *subtracted* from the Z score of the *per*

Table 1. DEMOGRAPHIC PATTERNS

Indicators	Old Agrarian Societies	New Agrarian Societies	Summary Statistics
Pop size in millions 1965[a]	73.0	15.1	R^2=.04ns
Mean 51.1	(23)	(14)	
Log pop size 1965[b]	4.3	3.8	R^2=.15**
Mean 4.1	(23)	(14)	
Pop/km^2 1950[c]	61.7	19.1	R^2=.16**
Mean 43.0	(18)	(14)	
Pop/km^2 1965[c]	94.7	30.0	R^2=.15**
Mean 70.3	(23)	(14)	
Pop/km^2 1975[d]	119.0	41.8	R^2=.12**
Mean 89.8	(23)	(14)	
Agricultural density 1960[e]	85.7	17.6	R^2=.25***
Mean 52.9	(15)	(14)	
% Urban 1977[f]	32.1	45.8	R^2=.16**
Mean 37.6	(21)	(14)	
% LF in agriculture 1977[g]	58.2	44.2	R^2=.22***
Mean 51.7	(16)	(14)	
Pop growth rate 1960-70[h]	2.5	2.9	R^2=.31†
Mean 2.7	(16)	(14)	
Pop growth rate 1970-77[h]	2.3	2.9	R^2=.27***
Mean 2.6	(16)	(14)	

*p<.10 **p<.05 ***p<.01 †p<.001 ns=not significant

See Appendix for the classification of societies. The number of cases on which mean values are based is indicated in parantheses beneath the values.

[a]Taylor and Hudson (V7).

[b]Taylor and Hudson (Log 10 of V7).

[c]Taylor and Hudson (V13, V16).

[d]Taylor and Jodice (Table 3.3).

[e](% labor force in agriculture 1960, World Bank, Series IV, Table 5/100) X (total labor force 1960, International Labor Office, Table 3) / agricultural land area (Taylor and Hudson, V17).

[f]World Bank (Series IV, Table 1).

[g]World Bank (Series IV, Table 5).

[h]World Bank (Series I, Economic Data Sheet 1).

Table 2. DEVELOPMENT

Measures of Development	Old Agrarian Societies	New Agrarian Societies	Summary Statistics
GNP/1,000km^{2}1965	$17.1	$7.9	R^2=.05ns[a]
Mean 13.6	(23)	(14)	
GNP/1,000km^{2}1978	$94.1	$33.1	R^2=.07ns
Mean 69.0	(20)	(14)	
Energy cons/1,000km^2 1965	33.6	9.0	R^2=.06ns
Mean 23.8	(21)	(14)	
Energy cons/1,000km^2 1975	64.8	15.9	R^2=.07ns
Mean 44.7	(20)	(14)	
GNP/capita 1965	$162.3	$290.9	R^2=.33†
Mean $211.0	(23)	(14)	
GNP/capita 1978	$636.2	$926.9	R^2=.10*
Mean $755.9	(20)	(14)	
Energy cons/capita 1965	228.9	429.6	R^2=.12**
Mean 309.2	(21)	(14)	
Energy cons/capita 1975	481.9	538.6	R^2=.00ns
Mean 505.3	(20)	(14)	

[a]When the measure is logged, R^2=.10*.

See Appendix for the classification of societies, and Table 1 for an explanation of symbols.

Variables and Sources--Taylor and Hudson: GNP/capita 1965 (V169); ENC/capita 1965 (V157); GNP/1,000km^2 1965 (U.S. million $ per 1,000km^2)=(V165/V12); Energy cons/1,000km^2 1965 (kilograms coal equivalent per 1,000km^2)=(V153/V12) X 1,000. Taylor and Jodice: GNP/capita 1978 computed from Tables 3.5 and 3.1; Energy cons/capita 1975 from Table 3.7; GNP/1,000km^2 (U.S. million $ per 1,000km^2) computed from Tables 3.5 and 3.3; Energy cons/1,000km^2 (kilogram coal equivalent per 1,000km^2) computed from Tables 3.7, 3.1, and 3.3.

area measure of productivity. A positive score, therefore, indicates a dominant pattern of "maximizing" per area productivity, and a negative score indicates a pattern of "maximizing" per capita productivity. If a society was high or low on *both* dimensions rather than having a dominant productive pattern in one direction or the other, Z scores for the two measures cancelled out each other and the combined measure was near zero.

As Table 3 clearly shows, when this combined measure is used, the second hypothesis is confirmed. The differences between the two sets of societies are quite strong, as indicated by the R^2 values, and all of the differences are statistically significant. It will be noted, however, that during the period covered by our measures, the differences between the two sets of societies appear to have declined. This is probably a reflection of the growing impact of industrial technology on the economies of both sets

Table 3. DOMINANT PRODUCTIVE PATTERN

Base Measure of Productivity	Old Agrarian Societies	New Agrarian Societies	Summary Statistics
GNP 1965	.60 (23)	-.99 (14)	R^2=.42†
Energy consumption 1965	.47 (21)	-.70 (14)	R^2=.28†
GNP 1978	.47 (23)	-.68 (14)	R^2=.25***
Energy consumption 1975	.26 (20)	-.38 (14)	R^2=.17**

GNP 1965 = $Z_{\text{GNP/1,000km}^2\ 1965} - Z_{\text{GNP/capita 1965}}$

Energy 1965 = $Z_{\text{Energy/1,000km}^2\ 1965} - Z_{\text{Energy/capita 1965}}$

GNP 1978 = $Z_{\text{GNP/1,000km}^2\ 1978} - Z_{\text{GNP/capita 1978}}$

Energy 1975 = $Z_{\text{Energy/1,000km}^2\ 1975} - Z_{\text{Energy/capita 1975}}$

Interpretation: Since the Z score of per capita productivity is subtracted from the Z score of per area productivity, a positive score indicates a dominant pattern of maximizing per area productivity, and a negative score indicates a dominant pattern of maximizing per capita productivity. If a society were high on both dimensions the measure would be near zero.

See Appendix for the classification of societies, Table 1 for an explanation of symbols, and Table 2 for sources of data.

of societies. Industrial technology gives rise to its own distinctive developmental pattern—one in which the productivities of *both* land and labor are maximized—and thus it seems to erode historic differences between societies that once manifested one pattern more than the other.

To a lesser degree, these differences are also being eroded because of the more rapid growth of population in the New Agrarian societies seen in Table 1. This has reduced the relative difference in population density between the two sets of societies and thus may have reduced the relative advantage likely to accrue from efforts to increase worker productivity relative to land productivity.

As a further test of the "divergent patterns" hypothesis, and as a method of determining whether differences in population density are associated with the developmental differences observed in Table 3, we conducted a dummy variable regression analysis of the relationship between length of agrarian heritage and the dominant productive pattern with controls for population size, log population size, and population density. In this analysis, the Old Agrarian societies were coded 1 and the New Agrarian societies 0.

As Table 4 shows, there are strong and significant relationships between the measures of dominant productive pattern and population density. The large coefficients for population density, and the effects of controlling for density, indicate that, as expected, population density is an important intervening variable in the relationship between length of Agrarian heritage and development pattern. In fact, the evidence suggests that it is only through population density that length of agrarian heritage continues to have an effect on dominant productive pattern in more recent years. For the later measures, controls for density reduce the standardized regression coefficients for the agrarian heritage dummy to nonsignificance, whereas for the earlier measures the partial standardized regression coefficients, though substantially smaller than the zero-order coefficients, were large and significant. The reduced but significant partial associations in the earlier period indicate that length of agrarian heritage affected the dominant productive pattern not only through its effects on density, but through its effects on other important intervening factors as well (see Figure 1). The nonsignificant partial associations in the later period indicate that the significant zero-order associations can be completely accounted for by differences in population density. However, one should not draw the inference from this that the length of agrarian heritage is no longer important, because to the extent that present differences in population density are a continuing consequence of variations in the timing of the adoption of plow agriculture, the influence of technoeconomic heritage continues to be felt in these societies.

To test our final hypotheses concerning the structural consequences of length of agrarian heritage, we examine, first, income distributions and, second, patterns of trade dependency. As noted earlier, in the case of income inequality, it seemed to us that there was a plausible link between variations in population density and the labor-intensive mode of agriculture characteristic of Old Agrarian societies. This led us to predict that Old Agrarian societies would have a greater share of total income going to the lowest segment of earners, and less income inequality overall. New Agrarian societies, on the other hand, were expected to have a greater share of income concentrated at the top of the income distribution and more income inequality overall.

Though cross-national measures of income distribution leave much to be desired, and the number of Third World societies for which data are available is much more limited than for other variables, evidence from several sources supports these hypotheses (see Table 5). In fact, the relationships are all quite strong, judging by the values of R^2, and they are all statistically significant. Whether the differences in Table 5 can be extrapolated to other agrarian societies for which data are currently lacking remains an open question, but the relationships are certainly strong enough and interesting enough to merit further study.

Table 4. ZERO-ORDER AND PARTIAL STANDARDIZED REGRESSION COEFFICIENTS OF DOMINANT PRODUCTIVE PATTERN MEASURES REGRESSED ON LENGTH OF AGRARIAN HERITAGE AND CONTROLS FOR POPULATION DENSITY[a]

Base Measure of Productivity	Zero-Order	Partials		
	Agrarian Heritage[b]	Agrarian Heritage[b]	Population Density	N
GNP 1965	.64†	.40†	.63†	37
Energy consumption 1965	.53†	.31†	.57†	35
GNP 1978	.50†	.24*	.66†	34
Energy consumption 1975	.42**	.16ns	.68†	34

[a]Controls for population size and log population size were not significant.

[b]Old Agrarian societies were coded 1, New Agrarian societies, 0.

See Appendix for the classification of societies, Table 1 for an explanation of symbols, and Tables 2 and 3 for sources of data and computation of measures.

Additional support for the income hypotheses and the line of reasoning on which they are based is provided by the fact that for measures from two of the three sources (Ahluwalia; World Bank) a control for population density greatly reduces the differences in income share going to the lowest 20 percent of the population. Density was not significantly related to the share going to upper income segments, however, suggesting that other forces, perhaps industrialization, were responsible for the relationship observed at this end of the income distribution.

The final set of comparisons we made involved patterns of international trade and, as Table 6 indicates, our expectations were confirmed. The New Agrarian societies have had more specialized patterns of international trade than the Old Agrarian societies. They have produced fewer products for export and they have been dependent on a smaller number of societal customers. At the same time, the Old Agrarian societies have been more heavily involved in international trade. When controls for population size and density are introduced, these relationships are strengthened because size and density are negatively related to exports as a share of GDP.

It is noteworthy, however, that trade differences between the two sets of societies seem to be declining as one would expect in a world in which the forces of industrialization are becoming increasingly dominant everywhere. Thus, it is not surprising that the two series of trends in Table 6 show weakening relationships, which by the latest date had ceased to be statistically significant at the 5 percent level (though with a control for population size they were diminished but still statistically significant).[4]

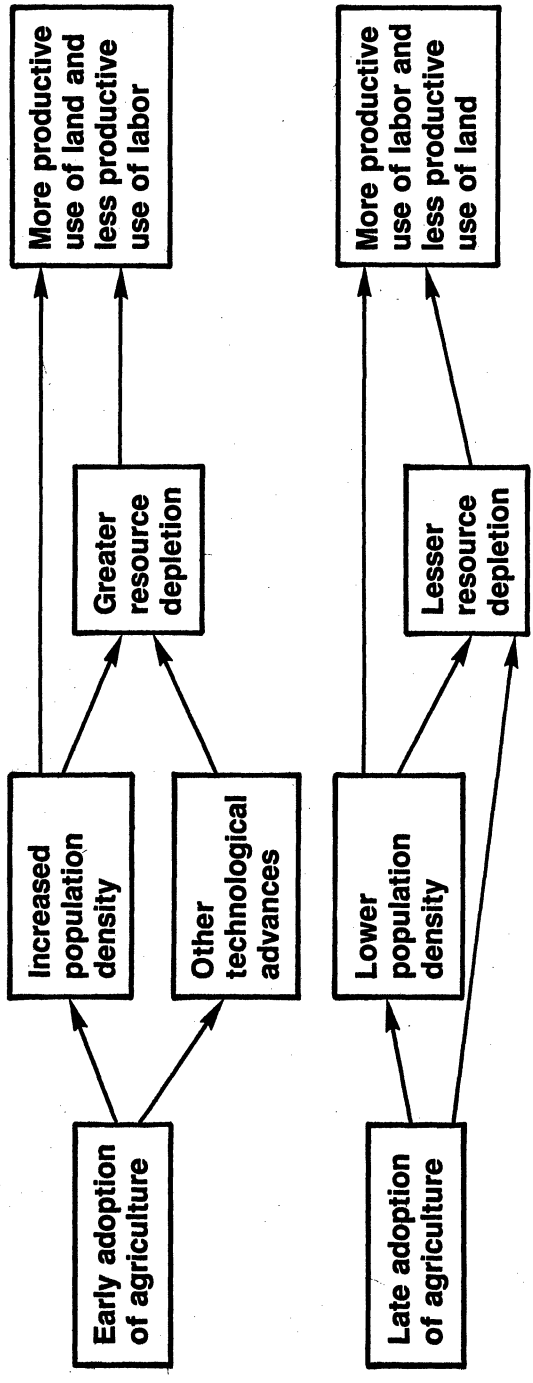

Figure 1. COMPARATIVE MODEL OF THE EFFECT OF TIMING OF THE SHIFT FROM HORTICULTURE TO AGRICULTURE ON THE DEVELOPMENTAL PROCESS OF THIRD WORLD SOCIETIES

Table 5. INCOME DISTRIBUTION AND INEQUALITY

Indicators	Old Agrarian Societies	New Agrarian Societies	Summary Statistics
	Data Circa 1965[a]		
Income Share			
Lowest 20%	6.6	4.7	R^2=.33**
Mean 5.3	(8)	(9)	
Top 5%	22.0	34.6	R^2=.48***
Mean 28.7	(8)	(9)	
GINI	.42	.52	R^2=.29**
Mean .47	(8)	(9)	
	Data Circa 1970[b]		
Income Share			
Lowest 20%	5.2	3.3	R^2=.33***
Mean 4.3	(11)	(10)	
Top 20%	51.6	60.6	R^2=.32***
Mean 55.9	(11)	(10)	
	Data Circa 1970[c]		
Income Share			
Lowest 20%	5.8	3.6	R^2=.37**
Mean 4.8	(9)	(7)	
Top 5%	24.0	31.6	R^2=.25**
Mean 27.3	(9)	(7)	

[a]Paukert.

[b]Ahluwalia.

[c]World Bank.

See Appendix for the classification of societies, and Table 1 for an explanation of symbols.

Summary and Conclusions

These data, like those we examined previously (Lenski and Nolan), strongly support the general hypothesis that the technoeconomic heritage of societies is an important influence on the course of their development in the second half of the twentieth century. A number of strong and statistically significant differences were observed between Old and New Agrarian societies—differences that appear logically to be the result of

Table 6. TRADE PATTERNS

Indicators	Old Agrarian Societies	New Agrarian Societies	Summary Statistics
	Concentration of Export Receiving Countries[a]		
1965	0.13	0.23	R^2=.46†
Mean .17	(17)	(12)	
	Concentration of Export Commodities[b]		
1961	51.2	69.0	R^2=.15**
Mean 59.5	(16)	(14)	
1970	44.8	56.9	R^2=.07ns
Mean 50.5	(16)	(14)	
1977	42.4	55.0	R^2=.08ns
Mean 48.3	(16)	(14)	
	Exports as a Percentage of GDP[c]		
1950-60	63.6	20.0	R^2=.28†
Mean 47.1	(23)	(14)	
1960-70	41.3	21.2	R^2=.08*
Mean 33.7	(23)	(14)	
1970-77	44.9	25.1	R^2=.08*
Mean 36.9	(23)	(14)	

[a]Taylor and Hudson (V183).

[b]World Bank (Series III, Table 8).

[c]World Bank (Series I, Economic Data Sheet 1).

See Appendix for the classification of societies, and Table 1 for an explanation of symbols.

differences in the length of time since the populations of these societies first began to practice plow agriculture and the impact of such differences on population density.

Some may conclude that the differences we have found are better explained by the fact that the Old Agrarian societies are all located in the Eastern Hemisphere while the New Agrarian societies are, with a single exception, located in the Western Hemisphere. This geographical distinction, however, *explains nothing by itself.* The question still remains: Why is the geographical distinction important and why are societal differences associated with it? We believe that we have shown how the historical differences in the timing of the shift from horticulture to agriculture may

have given rise to important demograhic, economic, and social differences today. For a graphic statement of our general theoretical model as it pertains to this issue, readers should consult Figure 2 in our previous paper (Lenski and Nolan) and the related discussion.

We are well aware that our two sets of societies differ in ways other than those we have focused on (e.g., religion, race, ethnicity, land tenure systems, etc.) and that some or all of these may be responsible for some or all of the differences we have identified. We believe, however, that it is not enough for critics or skeptics merely to invoke these uncontrolled (and, perhaps, uncontrollable) variables. It is incumbent on them to specify an alternative mechanism or set of mechanisms that could produce the specific differences we have identified—especially the contrasting patterns of development that are reflected in the two measures we used (i.e., GNP/capita versus GNP/1000 square kilometers).

The data we have examined also provide some support for the "advantage of backwardness" hypothesis. Despite the fact that the New Agrarian societies were much less developed than the Old Agrarian societies only a few hundred years ago, they are now, on average, well ahead when judged by the important per capita measures of development.

It is worth emphasizing, however, that our findings are consistent with the notion that any advantage that accrues to backward societies only accrues in cases of *limited* backwardness. Societies that entered the industrial era with a horticultural heritage have *not* been competitive developmentally with either the Old or the New Agrarian societies as a comparison of our present findings with our previous findings makes abundantly clear. We find considerable evidence of convergence between the Old and New Agrarian societies in recent decades at the same time that there has been a *growing divergence* between the industrializing agrarian societies collectively and the industrializing horticultural societies on many dimensions (Lenski and Nolan).

We also have found evidence to support the intriguing hypothesis that our two sets of societies have until recently, at least, manifested basically different patterns of development (see Figure 1). The Old Agrarian societies appear to have developed a pattern of labor-intensive agriculture that has maximized the yield of each acre of land and has taken advantage of the huge populations of these societies. The New Agrarian societies, in contrast, seem to have followed a path that has maximized the yields from labor and taken advantage of the relative abundance of land in these societies.

In addition, income distributions and trade patterns were shown to vary by length of agrarian experience. In part because of their larger, denser populations and labor-intensive agricultural systems, Old Agrarian societies have had larger shares of income concentrated in their lowest quintile of earners. In contrast, the more economically advanced New

Agrarian societies had larger shares of income concentrated in the highest quintile of earners; they also had greater overall inequality than the Old Agrarian societies. Old Agrarian societies were shown to be more involved in international trade but less dependent on trade in a few commodities than the New Agrarian societies. These structural characteristics of the two sets of societies are not only interesting and important in themselves, but are also important because of the feedback effects they are likely to have on future development.

While not wishing to claim that we have identified or explained all, or even most, of the important differences between Old and New Agrarian societies, we believe that we have made a beginning and that this beginning lends added support to the claim of ecological-evolutionary theory that change is a cumulative process and that characteristics of societies in the preindustrial past still exert an important influence on their life today. If our present findings, and those of our previous study, are any indication, this and the "advantage of backwardness" proposition merit considerably more attention than they have received thus far.

Notes

1. This feature of the research problem is also relevant to the recent work by Firebaugh. He tested for "scale entropy" and "scale economy" in a large sample of nations, and found a modest positive relationship between population size and economic growth in recent decades. But more interesting than his empirical results is the fact that in his conclusion he argued that further research should test for population effects *within technological levels*, because the effects of population size will vary according to its technological context. As a society approaches the carrying capacity of its technology, population growth may slow down economic growth, but if the increasing population and declining productivity results in the adoption of a new more productive technology, further population growth may actually increase economic growth until the society begins to approach the carrying capacity of the new technology. In this paper we explicitly hypothesize and test for just this kind of effect.
2. Although we view population and technology as mutually determining variables, the focus of the present study directs attention to only one aspect of the reciprocal relationship—the effects of technological change on population growth. This should not be seen as an indication that it cannot, or does not, act as an independent variable. In fact, a strong case has been made, by a number of people, that population growth and "population pressure" increase the probability of fundamental technological change (see Nolan).
3. One is tempted to ignore significance values in cross-national studies of this type, and if the only issue were the generalization of observed differences to some larger population this would be fully justified. Since one is dealing with a "universe" (for which data were available), observed differences could be treated as real and important. However, significance values can also be interpreted as indications of how reliable and believable observed differences are. The confidence placed in the reliability of observed differences between two groups of societies should be conditioned by the degree of variation within those groups. And this is exactly what a test of significance does—it compares between-category with within-category variation. Furthermore, one can interpret significance values as the probability that observed differences could have been produced by an *arbitrary* classification of observations from a uniform distribution (e.g., Blalock, 241–43).

If this probability is high, little confidence can be placed in them. Therefore, we report

significance values in our tables and use them as *guides* in making inferences from our data. But just as it would be wrong to reject or ignore significance values entirely, it would also be wrong to attribute undue importance to them in this type of analysis. They should be used prudently and flexibly, not blindly or rigidly.

4. The zero-order standardized regression coefficients for the heritage dummy variable and the partial standardized regression coefficients for the heritage dummy and the control variables are as follows:

	Zero Order	*Partials*			
	Agrarian Heritage[a]	Agrarian Heritage[a]	Population Density	Population Size (Log)	*N*
Exports as % of GDP 50–60	.53†	.75†	.28*	−.29**	37
Exports as % of GDP 60–70	.29*	.41**	NS	−.31*	37
Exports as % of GDP 70–77	.28*	.42**	NS	−.34*	37

[a]Dummy variable for length of agrarian experience: Old Agrarian = 1, New Agrarian = 0.
See Notes to Tables 1 and 6

Appendix. Classification of Nations by Length of Agrarian Experience Prior to the Modern Era[a]

Old Agrarian Societies ($N = 23$)[b]
Morocco, Tunisia, Turkey, Egypt, Syria, Lebanon, Afghanistan, China, Taiwan, N. Korea, S. Korea, India, Pakistan, Burma, Ceylon, Nepal, Thailand, Cambodia, Laos, N. Vietnam, S. Vietnam, Malaysia, Indonesia

New Agrarian Societies ($N = 14$)
Mexico, Guatemala, Honduras, El Salvador, Nicaragua, Panama, Colombia, Guyana, Ecuador, Peru, Brazil, Bolivia, Paraguay, Philippines

Notes
[a]Eight fewer cases are included here than in Lenski and Nolan. This is because these cases, though clearly agrarian in the premodern era, could not be definitively placed into one or the other of these more refined categories.
[b]Cases are ordered by Taylor and Hudson RSS codes and country names are those used by Taylor and Hudson (ca. 1965).

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