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ECONOMIC DEVELOPMENT THEN AND NOW

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I. Introduction

What insights can the study of the consequences of the Industrial Revolution yield for contemporary development policy in developed and developing countries? In the nineteenth century, the industrialization of Western Europe, especially Great Britain, caused a dramatic expansion in international trade, capital movements, and international migration and severely upset the previous balance of economic and political power. Different countries adapted quite differently to the changed international environment and to the new technological and trade opportunities it provided. Some adapted very successfully, others did not. Some developed, others experienced growth without development, and still others stagnated. The consequences for the working poor also varied very significantly across countries and over time.

Can a long-run model of nineteenth century growth be specified which will explain this variety of country experiences? To what extent would such a model be relevant to today's developing countries? In the present paper, we attempt to specify and estimate a stylized long-run model of nineteenth century development and compare it with a post-World War II model. The historical model is based on the data and hypotheses derived from the most recent book of Morris and Adelman (1988) describing the patterns of economic development of 23 countries from 1850 to 1914. The post-World War II model examined the validity of the nineteenth century model by reestimating it with the contemporary data for developing countries during 1950-1964 derived in Adelman and Morris (1967).

The historical model in this paper specifies a simultaneous equation regression model and uses latent variables to portray various economic institutions and facets of technological development. It posits a causal chain through which, on the average, exogenous initial conditions, political structures, and economic institutions affected patterns of long-run technological development, the structure of economic activity, economic growth and the diffusion of benefits from growth during the nineteenth and early twentieth centuries. The structure of the model is largely recursive, and the model is estimated using the technique of partial least squares with latent variables first proposed by H. Wold (1975 onward) and the computer program developed by Lohmöller (1981).

The next section summarizes the statistical technique. After a brief section describing the data, we specify our model of nineteenth century growth. We then examine the statistical results of the estimation of the average model for 1850-1914 in the light of historical and development theories, historical case studies, and the previous Morris and Adelman results. We then look at how well the average model fits the experience of developing countries between 1950-1964. We fit a model identical in structure to the average model of 1890-1914 to 1950-1964 and examine how the individual regression coefficients change between the two periods.

II. The Method

The general technique of modelling we apply to the historical data is Partial Least Squares (PLS). Linear regression equations are used to model the relations between the variables, which can be observed either directly (manifest variable, MVs) or indirectly (latent variables, LVs) by multiple indicators. The latent variables are estimated as weighted aggregates of their indicators. The weights for the aggregates and the regression coefficients are estimated in an iterative way by the PLS algorithm. The method is described in detail by H. Wold (1975 and onward). The computer program used is PLS 1.8 (Lohmöller 1981). What follows here is a short overview of the statistical model and of the estimation.

Regression: The basic elements of the PLS model are regression equations, which may include only latent, or latent and manifest, variables. We treat all variables as standardized to zero mean and unit variance and leave aside the problem of measurement errors. We write an equation for variables x_j:

$$x_j = \Sigma_i \, b_{ji} x_i + u_j, \tag{1}$$

where index j stands for the predictand, index i ranges over the predictors of x_j, and there are other, potential, predictors x_h in the model that are not included in the equation for a given x_j. We assume that the conditional expectation of x_j follows the linear expression:

$$E(x_j \mid \text{all } x_i) = \Sigma_i \, b_{ji} x_i. \tag{2}$$

For this specification as well as for the least squares estimates, it is implied that predictors x_i and residual u_j are uncorrelated,

$$\text{cov}(x_i, u_j) = 0 \qquad \text{for all predictors } x_i \text{ in equation j.} \tag{3}$$

The zero-covariance restriction does not necessarily hold for omitted variables, and if the covariance

$$\text{cov}(x_h, u_j) \qquad \text{for any variable } x_h \text{ omitted from equation j} \tag{4}$$

is different from zero, this may give hints for model modification.

Path model: In a path model, a set of variables is connected by a system of regression equations. All variables, which before were called predictands, predictors, and omitted variables [which are available but not included in equation (1)], are collected into one vector $x = [x_j]$. With vector x, vector $u = [u_j]$, and square matrix $B = [b_{ji}]$, we rewrite equation (1) in matrix notation:

$$x = B\,x + u. \tag{5}$$

Some of the regression coefficients b_{ij} are set to zero a priori. In particular, the diagonal elements of B are zero. If B is subdiagonal, the model is recursive. In the _i_th column of the matrix B, one finds the influences the variable x_i exercises on other variables in the model. The _j_th row of B gives the coefficients of the regression equation with x_j as a dependent variable and indicates the influences of the other variables on this specific predictand. If the _j_th row has all zero coefficients, then the corresponding variable x_j is exogenous and the corresponding u_j is not a residual but is identical to x_j. Matrix B is called the path matrix, and the coefficients b_{ji} the path coefficients; under the statistical specification we use in the present analysis, the path coefficients are identical to regresssion coefficients, but in general they need not be. A path diagram (as in Fig. 2) can be used to visualize the connections between the variables.

The pattern of zero and nonzero coefficients is recorded in the path design matrix $D_B = [d_{ji}]$, which contains a zero entry $d_{ji} = 0$ for each path coefficient restricted to zero, and a one, $d_{ji} = 1$, for each path coefficient that is free. Hence, the path matrix follows the restriction

$$b_{ji} = d_{ji} \cdot b_{ji} \quad \text{or } B = D_B * B, \tag{6}$$

wnere the star (*) denotes the Hadamard product. The specifiction of the model is done by specifying D_B. The conditional expectation is written as

$$E(x_j \mid \text{all } d_{ji} \cdot x_i) = \Sigma_i \, b_{ij} x_i \qquad \text{for all } x_j. \tag{7}$$

The conditional expectation in (7) implies that the residual variable u_j has mean zero and is uncorrelated with all the predictors which are selected by the expression $d_{ji} \cdot x_i$ but not necessarily with the other variables. Hence, the covariance matrix cov(u,x) has a pattern of zeros that is complementary to the pattern of D_B. Moreover, the conditional expectation (7) implies that least squares estimates are consistent (under mild additional assumptions, see H. Wold 1963); that the system (5) can be estimated by separate multiple regressions for each line; that the residual variance, var(u_j), is minimal for each equation; and that the sum of the residual variances is minimal. However, there is no guarantee that the residuals of different equations are uncorrelated. The covariance matrix

$$\text{Psi} = \text{cov}(u,u) \tag{8}$$

can be used to identify potential improvements of the predictive power of the model by changing the model specification D_B.

Latent variables: So far, we have taken for granted that the variables x are known, in the sense that either their covariance matrix $S = [s_{ji}] = [\text{cov}(x_j, x_i)]$ or their scores $X = [x_{jn}]$, where the index n ranges over the observational units, are known. This is not the case when some x_j are unobservable, and only indicators of the variables x_j are directly observable. In that case, the unobservable variable, known as a latent variable (LV), is established by its relation to its observable, manifest variables (MVs). The relationships between LVs and MVs are described by two equations, see (9) and (10) below. These two equations constitute the outer part of the model (or measurement model), while the path model (5) forms the inner part of the model. The two outer equations give the composition of one set of variables in terms of the other: equation (9) of the MVs in terms of the LVs and equation (10), the composition of the LVs in terms of the MVs.

If we denote the vector of observed variables by $y = [y_k]$ and the matrix of their values (scores) for observation n by $Y = [y_{kn}]$, then:

$$y_{kn} = p_{kj}x_{jn} + e_{kn} \qquad \text{or } Y = PX + E \qquad \text{or } y = Px + e \tag{9}$$

where $P = [p_{kj}]$ is a matrix of regression coefficients, so-called loading coefficients. The residuals $e = [e_k]$ or $E = [_{kn}]$ represent that part of the observation that is not predictable from the LV; in some contexts it is interpreted as measurement error. Notice that (9) does not involve a summation over j, the index of the LVs, because each indicator is attached to only one LV. We treat all variables, MVs and LVs, as standardized, hence the loadings will be correlations, $p_{kj} = \text{cor}(y_k, x_j)$. The loading coefficient p_{kj} shows the influence of the latent variable x_k on the manifest variable y_k. A zero loading coefficient indicates that the LV has no explanatory power at all for the MV in question. A high loading coefficient allows for inference about the nature and meaning of the LV.

The loadings in (9) would be easily estimated, were the LV known. But it is not. The LV is estimated by a function specified on the MVs. In PLS the LVs are estimated as linear aggregates of the MVs:

$$x_{jn} = \Sigma_k w_{kj}y_{kn} \qquad \text{or } S = W'Y \qquad \text{or } x = W'y. \tag{10}$$

The pragmatic assumption of linearity, which is in line with the usage of principal components as estimates of common factors, reduces the problem of estimating the latent variables to finding appropriate weights $W = [w_{kj}]$.

Once the weights are known, the LVs can be treated as known, and the loadings, path coefficients, and various residual covariances are easily estimated. The assembly of indicators belonging to one LV is called a block of MVs.

There are different ways to think about the tasks an LV must perform in a latent variables path (LVP) or regression model:

- One way is to think of the LV as the best predictor of its indicators in equation (9). Applied to LVP models, this means that one estimates the LVs separately within each block, without reference to the path model. This is, of course, easily done by extracting the principal component of the block of manifest variables.
- Another way is to think along the lines of the canonical correlation model where the only emphasis is on maximizing the correlations between two LVs. With this philosophy, the weights are estimated so as to produce the best predictand in the one block and the "most predictable criterion" (Hotelling 1936) in the other block of MVs. This concept can be extended to multi-block models, where, depending on its position in the path model, an LV is required to be one of the following: the best predictor, the best mediator, or the best predictand.
- And third, there is a compromise between the two approaches: the LV is supposed to do both--fit well into the path model while being a good predictor for its indicators.

Which view is adopted is up to the researcher. But since each view implies a different error minimization criterion, the choice among these approaches implies different computational procedures and must be specified in advance by the researcher. As indicated above, the first approach requires simply the extraction of the first principal component of the block. The second and third require somewhat more complicated computations. We describe the estimation method that is based on the second approach, the generalization of canonical correlation, first. We then turn to the third, compromise, approach.

PLS algorithm for the second approach: The core of the PLS algorithm is the iterative estimation of the weights w_{kj} and can be characterized in this way: Estimate the latent variable x_j so that it is a good neighbour in its neighbourhood. That is, estimate the LV so that is is well predicted by its predecessors in the path diagram and is a good predictor for its followers in the diagram. Only the variables which have a direct connection to the LV under question are considered to be neighbours in the PLS estimation process. As an estimate of the "ideal" neighbour in this neighbourhood a weighted aggregate of the neighbours is taken:

$$\tilde{x}_{jn} = \Sigma_i \, v_{ji} x_{in}, \tag{11}$$

where $\tilde{x}_j$ is an approximation to the LV (called the inside approximation), and the index i ranges over the neighbours of x_j. In (11) the weights v_{ji} (called the inner weights) are chosen to be

$$v_{ji} = \begin{cases} b_{ji} & \text{if } x_i \text{ is a predictor of } x_j \\ r_{ji} = \mathrm{cor}(x_j, x_i) & \text{if } x_i \text{ is a predictand of } x_j \\ 0 & \text{if } x_i \text{ is not neighbour of } x_j. \end{cases} \tag{12}$$

To make x_{ij}, the LV under question, the best approximation to the "ideal neighbour" $\tilde{x}_j$, one applies multiple regression to the equation:

$$\tilde{x}_j = \Sigma_k \tilde{w}_{kj} y_k + \text{residual} \tag{13}$$

to get the weights $\tilde{w}_{kj}$. These weights are, then, rescaled so that the weighted aggregate formed by equation (10) has unit variance

$$w_{kj} = \tilde{w}_{kj} \,/\, \sqrt{\operatorname{var}(\Sigma_k \tilde{w}_{kj} y_k)}\ . \tag{14}$$

The x_j that results from the sequence of (12), (11), (13), (14), and (10) will fit better into the path model than the neighbouring variables x_i that go into this algorithm, because the summation in (11) averages out the possible imperfect adjustment of the neighbours to the path model, and because the multiple regression in (13) minimizes the distorting influence of individual MVs, especially if one or more MVs do not belong in the model.

The PLS algorithm estimates the weights for each LV separately, presuming, in each iteration, that the adjacent LVs are known. The weights are estimated so as to make the weighted aggregate fit for its duties in the path model. After each LV is improved in this way, the PLS algorithm starts a new iteration cycle, where each LV is again improved so that it fits better into the path model by reference to its improved neighbours. The iteration is stopped when no weight changes by more than, say, the fifth decimal place. The term Partial Least Squares relates to the fact that the PLS algorithm treats one part of the model, that can directly be estimated by LS methods, at time, then proceeds to the next part, and, in general, treats all parts of the model successively and iteratively, until convergence is judged to have occurred. The algorithm is partial; the result, however, gives a systemwide solution (Bookstein 1982).

Weighting modes: The third approach to LV estimation mentioned above leads to an algorithm with essentially the same steps as described in equations (10) to (14). Only (13) takes a different form, in order to express a different definition of the duties of the LV. Under the third approach, the LV is required to be at the same time a good neighbour in the path model and a good predictor for its own indicators. In this case, the weights are estimated by a simple regression, with the inside approximation as predictor:

$$y_k = \tilde{w}_{kj}\tilde{x}_j + \text{residual}. \tag{15}$$

[This equation does not sum over j, because the MV (y_k) is regressed only on the LV (x_j) of its own block.] The weights according to equation (15) are called Mode A weights whereas the weights of (13) are called Mode B weights. [One can visualize the modes-of-weight computations in a path diagram: Mode A weight estimation is depicted by arrows pointing from the LV "outward" to the MVs, and Mode B weights are drawn as arrows pointing from the MVs "inward" to the LV. This sort of diagram does not show the generating model, but is a sort of PLS command diagram (Bookstein 1982) or visualization of the estimation modes.] The PLS technique allows for the choice of different weighting modes for the different blocks of the LVP model. As a result, two traditional multivariate methods are special cases of the PLS method: A model with two LVs and Mode B weight estimation is identical to the canonical correlation model; a model with one LV, $\tilde{x} = x$, and Mode A weights is identical to the principal components model.

Mode B weights share the fortunate property of multiple regression coefficients that they give best predictions and high R^2 and the unfortunate property that they are less stable across samples and varying model specifications. Another fortunate property that Mode B weights share with multiple regression coefficients is the "Occam's razor" property that helps purge superfluous predictors which turn out to have zero weights. This, then, leads to the following argument regarding the choice of weighting modes: If one is not sure about the meaning of the LV under question, or if one is not sure about the quality of the collection of indicators, then Mode B weight estimation will pick out those indicators that make their weighted aggregate the best LV in the path model; then, if one of the indicators turns out to have zero weight, the omission of this unnecessary variable will not change the model at all. On the other hand, if one is sure of having the correct sample of indicators for an LV, with no MV missing and no MV superfluous, one should choose Mode A weight estimation, as this will give each variable an equal chance to be represented in the LV. In the model that was estimated with our historical data we have used both weighting modes, depending on our knowledge of our manifest and latent variables.

The interpretation of the LVs utilizes both the weights and the loadings, and they contribute different information about the LVs.

- The weight coefficient w_{kj} is used to construct the estimate of the LV. It indicates the relative necessity of each MV for constructing the LV. If a weight coefficient of an MV is close to zero, then this MV is unnecessary for the rest of the model and could be omitted.
- The loading coefficient p_{kj} shows the influence of the LV x_k on the MV y_k. A zero loading coefficient indicates that the

LV has no explanatory power at all for the MV under question. A high loading coefficient allows for inference about the meaning of the LV.

- If the weight coefficient w_{kj} of a given indicator is close to zero and the loading coefficient p_{kj} is of considerable size, then this indicator does not add to the construction of the LV; but it does add to the meaning, interpretation, and validity of this LV and gives additional evidence of the explanatory power of the LV.

If a variable is directly observed, it appears twice in the model, as an MV and as an LV. In this case, the LV is identical to its single indicator; the weight coefficient, without any iteration, is equal to one; and there is no iterative adjustment of this LV to its duties with respect to the neighbourhood in the path model or the indicators. The flow of mutual adjustments between all LVs in the model is then barred by such single-indicator LVs. If there is, in a bigger model, one part that is bordered by single-indicator LVs, then the weights for this part of the model can be estimated separately. The model we present below can be separated in this way into statistically independent submodels for various subperiods.

III. The Historical Model

III.1. The Data

The data for the historical model are drawn from the recently completed study of Morris and Adelman (op. cit.) of the development experience of 23 countries between 1850 and 1914. The sample of countries includes all countries that experienced some aggregate growth in the nineteenth century for which at least moderately reliable historical information could be found. Some countries in the sample experienced per capita growth as well; others did not.

The data consist of classificatory variables describing the characteristics of each country in 1850, 1870, and 1890 and rates of change between 1850-1870, 1870-1890, and 1890-1914. In addition to portraying each country's economic structure and dynamics, the data incorporate technological information in both industry and agriculture, socioeconomic and political features of national development, and institutional characteristics relating to the functioning of factor markets, land systems, foreign economic dependence, the government's economic role, and the political power of landed elites. The data form a pooled time-series cross-section set in which each country enters the analysis three times for each variable, once for each facet in each of our three 20-year periods. It is thus suited to the "three mode" statistical analysis presented in the previous section. Short definitions of the included manifest variables are given in Appendix A to the present paper. Full descriptions of the manifest variables are given in Morris and Adelman (op. cit., Appendix) together with the classification and sources on which the classifications are based for each of our 23 countries, 35 indicators, and 3 time periods. The latent variables generated by the PLS's outer model are presented in Table B1 of Appendix B to the present paper and discussed in Appendix B.

The period covered by our study is one of dramatic change. The Industrial Revolution in Great Britain posed new challenges and created new opportunities worldwide. Country responses to these challenges and opportunities varied quite significantly. Some countries responded by industrializing, in an export-led or import-substitution mode; others shifted to specialized high-value agricultural exports or to staple exports; and still others adopted balanced-growth strategies. Success varied as well, both across and within each growth path. A new international order was created, in which some countries became economically dependent, others used free trade and flows of people and capital to engender a complementary development pattern in their colonies, and still others managed to benefit from international trade and factor flows while retaining significant domestic autonomy in setting economic policy.

Partially as a result of their different responses to the challenges of the Industrial Revolution in this period, some of the countries in our sample are currently developed: Australia, Belgium, Canada, Denmark, France, Germany, Great Britain, New Zealand, Norway, Sweden, Switzerland, The Netherlands, and the United States. Others have become developed quite recently: Italy, Japan, and Russia. One, Spain, is in an in-between state. And still others continue to be underdeveloped: Argentina, Brazil, Burma, China, Egypt, and India.

Understanding the diversity of responses to the British Industrial Revolution and the variability in their success in different countries and aspects was the major aim of the Morris and Adelman (1988) study of comparative patterns of economic development. In the present study, we seek to gain insights into the longer run interconnections among exogenous initial conditions, political forces, and institutional development in explaining differences among countries in economic development. We estimate these interconnections based on the nineteenth century experience.

III.2. The Model

In specifying the present model, we were guided by the previous empirical analyses of the economic history of the nineteenth century by Morris and Adelman (1988) as well as by the multiplicity of partial causal theories by economists and economic historians about the determinants of economic development. (For a review of these theories, see Morris and Adelman, op. cit., Chapters 1 and 2).

The previous historical work of Morris and Adelman used the method of disjoint principal components developed by Svante Wold (1976) to study patterns of development within groups of countries characterized by similar development processes. The study revealed the existence of significant differences among groups of countries in their within-group development patterns. The different aspects of development studied (market systems, industrialization, agricultural development, international dependence and poverty) evolved differently and interacted in different ways in each group of countries.

Here we do not focus on deriving common models of nineteenth century development within groups of countries. Instead, we focus on cross-country analyses of development patterns, and do not group the observations either by time period or by similarity of within-group process. We perform an average analysis for all 23 countries and three time periods over 1850-1914 as a whole. [In a previous paper (Adelman, Lohmöller, and Morris 1987), we also derived three simultaneously estimated analyses for each period covered by the Morris and Adelman data: 1850-1870, 1870-1890, and 1890-1914 and compared them with the average 1850-1914 model.]

In the Morris and Adelman (1988) study, we grouped together countries and time periods that were similar with respect to a particular process of change such as industrialization. We included in each country group the three time periods for each country because they shared the characteristics defining the group, in part because of country-specific influences. We then fitted components models to each group. These components represented the average correlates in each group of a particular process of change (say, industrialization) experienced by actual countries during a particular time period.

In the present study our purpose is different. Here, we do not stress primarily the actual course of change during 1850-1914. Rather, we obtain models of the average relationships among country characteristics. In essence, each country is assumed to be a multidimensional point along a spectrum from which it could potentially reach any other point on the spectrum, except insofar as size and resource abundance constrain it. The interpretation of the results of the present procedure thus applied to a much longer run than the actual 1850-1914 period.

The present study complements that of the Morris-Adelman study. Here, we locate an individual country with respect to the entire development spectrum represented in the sample and indicate what could be achieved with a sufficient length of time. The institutional and political conditions and changes depicted in the present results indicate what would be required, on the average, for the economic transformations described by the model to take place. This approach is ahistorical in that countries were often unable to change their institutions between 1850 and 1914 to achieve their long-run potential. In the Morris-Adelman study, the institutional and other constraints that historically limited individual countries from achieving their long-run potential during the 1850-1914 period were the defining characteristics of the groups of countries. They were thus part of the explanation for the actual variations in historical performance studied in the Adelman-Morris analysis.

There is another important philosophical difference between the previously fitted historical models of Morris and Adelman and the present study. The previous study was one of interdependence that did not impose statistically an a priori causal structure on the data. It served to reveal the patterns of interactions among facets of development and to generate hypotheses about the different processes of economic change and institutional interaction during the nineteenth century. Armed with the hypotheses derived from the earlier empirical analyses, we now feel emboldened to take a further step toward a more simplified long-run model of economic development. We specify a recursive structural model linking blocks of variables that reflect one or several facets of an institution, condition, or process. The model is only partially specified a priori, however, since the blocks of variables consisting of more than one indicator form latent variables in which the relative importance of each indicator is estimated statistically rather than specified in advance.

The task of formulating a PLS model involves two steps: the selection of variables to be included in the model and the specification of the "path" diagram indicating which variables affect which process. To select the variables for the model, we started by studying the importance of individual variables in accounting for between-group differences in growth patterns in the earlier five disjoint principal components (DPC) analyses of Morris and Adelman. We include in the present model all those variables which appeared in at least two out of five DPC analyses in the list of the top ten most important variables accounting for between-group variances.[1] These were:

two exogenous variables, population and agricultural resources; two political characteristics, the degree of foreign dependence and the socioeconomic characteristics of political leaderships; a basic indicator of economic structure--the percentage of labor force in agriculture; three institutional characteristics, the level of development of commodity and factor markets, the spread of market systems, and the nature of land tenure;[2] two indices of the development of physical and human infrastructure, inland transport and illiteracy; and three development indicators, the levels of industrial and agricultural technology and of per capita GNP. To these we added several outcome variables which we aim at explaining: the rate of growth of per capita GNP and two indicators of the extent of diffusion of the benefits of growth--the direction and strength of change of industrial and of agricultural wages. We also added one intervening variable about whose effect there is currently controversy--the extent of direct government participation in economic activity--and three variables stressed by contemporary theories of economic development: the extent to which growth is balanced (represented by the degree of imbalance in technological development between industry and agriculture), the extent of shift in export structure, and the rate of growth of exports. Table 1 lists the included variables together with their means and standard deviations.

The formulation of the PLS model requires specifying not only the list of manifest and latent variables but also the design matrix, indicating which variables enter into which equations. In a recursive model, this specification is equivalent to the positing of a causal chain. We do this by drawing on the theoretical literature on economic growth, economic history, and the role of institutional forces in development and on the hypotheses generated by our previous studies.

Table 1: Overview of manifest variables for PLS models

Latent Variable	Manifest Variable	Means Ttl	Means '50	Means '70	Means '90	Standard Dev. Ttl	Standard Dev. '50	Standard Dev. '70	Standard Dev. '90	Auto-correlation 1*2	Auto-correlation 2*3	Auto-correlation 1*3	
Populatn	Populatn	44	41	44	46	24	24	24	25	97	98	95	Total population
AgrResou	AgrResou	53	55	53	52	26	25	25	27	97	99	96	Relative abundance of agricultural resources
Immigrat	Immigrat	46	46	44	47	25	22	27	26	85	82	71	Net immigration
Dependcy	Dependcy	46	46	50	49	28	25	29	29	80	98	77	Degree of foreign economic dependence
PolElite	PolElite	40	31	39	51	24	17	23	28	31	69	89	Socioeconomic character of national political leadership
GovtEcon	GovtEcon	43	33	40	54	22	18	21	23	59	73	41	Extent of domestic economic role of government
AgrLabor	AgrLabor	62	71	61	55	21	16	20	23	91	96	85	Percent of labor force in agriculture
LndTenur	LndTenur	64	55	65	71	27	30	27	21	79	93	77	Predominant form of land tenure and holding
	LndConcn	53	51	54	53	23	23	24	23	75	100	76	Concentration of land holdings
	LndTechn	54	52	55	56	24	26	23	21	93	97	90	Favorableness of land institutions to improvements
Market	MktComd	48	34	47	62	24	20	22	21	87	87	75	Level of development of domestic commodity markets
	MktLand	49	36	47	63	24	18	25	20	93	78	65	Level of development of domestic land markets
	MktLabr	55	44	55	66	21	18	22	18	84	89	78	Level of development of domestic labor markets
	MktCptl	35	27	36	46	23	17	22	25	90	87	77	Level of development of domestic capital markets
MarketS	MktComdS	55	42	58	65	21	21	18	16	59	28	01	Rate of spread of domestic commodity markets
	MktLandS	51	51	51	53	24	25	21	25	-20	48	-24	Rate of spread of domestic land markets
	MktLabrS	47	40	46	55	22	25	18	19	67	54	37	Rate of spread of domestic labor markets
	MktCptlS	46	36	47	55	22	18	23	21	67	83	71	Rate of spread of domestic capital markets
Transprt	Transprt	38	22	35	56	30	25	30	25	91	87	79	Level of development of inland transportation
Illiterc	Illiterc	45	52	45	38	30	28	29	30	97	97	90	Extent of adult illiteracy
	Educatn	41	44	37	42	27	32	23	25	48	34	06	Rate of spread of primary education (lagged)
ExportSt	ExportSt	36	30	38	41	26	21	26	29	67	91	55	Degree of shift in structure of export sector
IndTechn	IndTechn	35	24	35	47	21	15	19	21	90	93	87	Level of development of techniques in industry
	IndTechC	52	44	53	58	20	23	17	16	90	58	64	Rate of improvements in techniques in industry
AgrTechn	AgrTechn	43	40	48	59	27	25	27	25	95	94	91	Level of development of techniques in agriculture
	AgrTechC	41	27	37	58	25	16	19	28	83	69	75	Rate of improvements in techniques in agriculture
Tech Dual	Tech Dual	-2	2	4	-13	30	28	23	34	85	61	70	= (IndTec+IndTecC) - (AgrTec+AgrTecC)
GNP	GNP	47	39	49	54	25	20	23	28	90	94	85	Level of per capita income
ExportC	ExportC	54	60	45	58	29	30	26	30	-15	08	-11	Rate of growth of real exports
GNP_C	GNP_C	43	36	37	55	28	25	26	30	27	34	27	Rate of change in per capita income
IndWageC	IndWageC	55	49	53	61	26	27	27	21	13	30	42	Direction of change in average real wages in industry
AgrWageC	AgrWageC	43	46	43	59	27	25	29	23	40	57	32	Direction of change in average real wages in agriculture

Note: The correlation are multiplied by 100 and refer to Period 1 with 2, Period 1 with 3, and Period 2 with 3, respectively

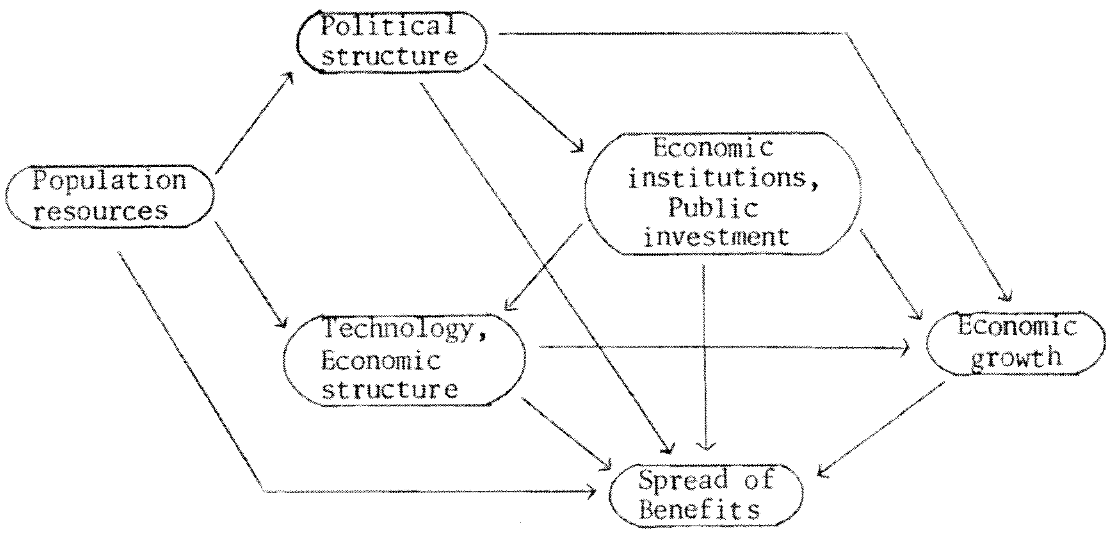
See Appendix A for variable definition and scoring method.

The model gives pride of place to the structure of political power and to institutional development. In this we were guided by the hypotheses and empirical findings stemming from the Morris and Adelman study of nineteenth century economic development. In four out of five of their disjoint principal components models, foreign dependence was the first or second most important variable in explaining between-group variances. And the overall findings of their study accorded institutional influences major importance in determining the path of development and the distribution of benefits from it.

In formulating the model we also tried to: (1) be parsimonious, doing with as few direct influences as we could; (2) give preference to the shortest causal chain, indicating the most direct influences, where a priori theorizing and previous work afforded a choice; and (3) avoid simultaneity--where theory permitted--so that ordinary least squares would remain statistically unbiased and efficient.

The overall logical structure of the model (see Figure 1) goes from exogenous initial conditions to a partial explanation of political structure. From political power structure, it goes to institutional development and government investment and trade policies. From institutions and public investment, it goes to the indicators of technological development level and per capita GNP. From here on the logical structure becomes more complex. The next elements in the causal chain describe the economy's dynamism and the diffusion of benefits from growth. These are more deeply embedded in the model, and do not have simple locations in the causal chain. While the rate of growth of GNP is influenced by the indicators of technological development, it is also directly influenced by institutional development and export growth. And the rates of change of exports and the distribution of benefits

Figure 1: The path model in overview



from growth are influenced directly (as well as indirectly) by political power structures, institutional structure, investment policies, technology, development patterns, and by GNP growth.

The path diagram depicted in Figure 2 summarizes our model specification in more detail, as does the structure of zero and nonzero entries in Table 2. We discuss the specification only briefly here, leaving aside the theoretical and historical justification of the specification to the section on estimation results. We do so to avoid repetitiveness. Also, the estimation indicates the directions of association and therefore allows for more pointed references to the literature.

We start from population and agricultural resources that are taken as exogenous initial conditions. The abundance of agricultural resources is assumed to attract immigration into land-abundant countries and cause emigration from land-poor countries. Immigration in turn is assumed to induce a dependent development pattern in the migration-receiving countries.[3]

Without prejudging the issue of whether foreign dependence has positive or negative effects, we posit that the effects of dependence on development are pervasive. Dependence is assumed to affect directly how agricultural the growth pattern is; the predominant land tenure system; how market institutions function and evolve; the socioeconomic character of political elites; transport and education investment policies; and the rate of growth and structure of exports as well as the rates of growth of industrial and agricultural wages.

Whether the political system reflects primarily the interests of landed and foreign elites or whether it reflects also the interests of rising domestic entrepreneurial groups is assumed in our model to depend both on the extent of foreign dependence and on how agricultural the country is. In turn,

Figure 2: The path model for 1850-1914

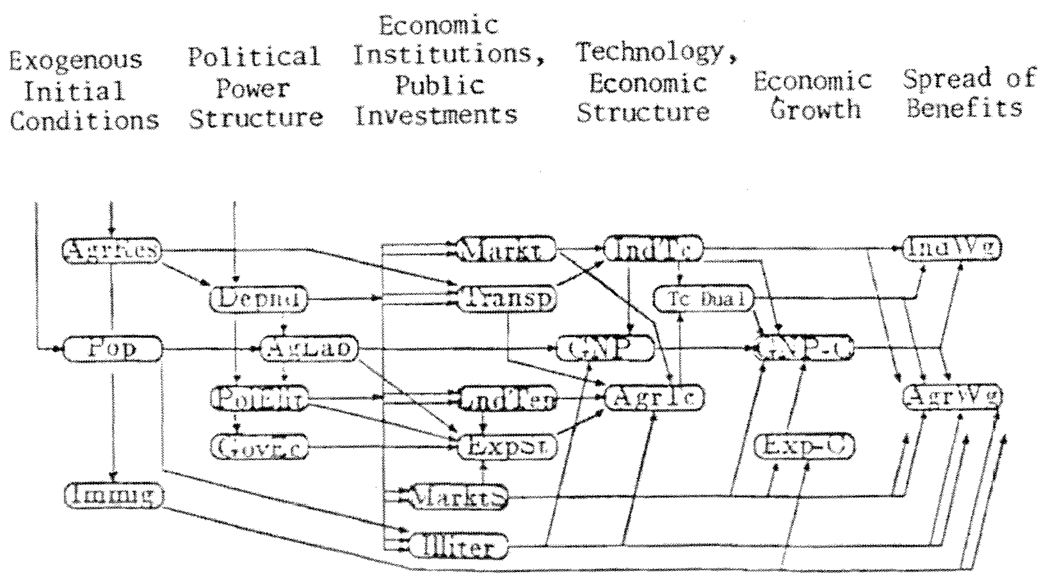


Table 2: Path coefficients for average model, 1850-1914

	Population	Agricultural resource	Immigration	Dependency	Political elite	Government economic	Land tenure	Market institutions	Market spread	Transportation	Illiteracy	Agricultural labor	Export structure	Industrial technology	Agricultural technology	Technological dualism	GNP per capita	Export change	GNP per capita change	R2
Population	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agricultural resource	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Immigration	0	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
Dependency	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
Political elite	0	0	0	-32	0	0	0	0	0	0	0	-60	0	0	0	0	0	0	0	65
Government economic role	0	0	0	0	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Land tenure	0	0	0	-48	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
Market institutions	0	0	0	-38	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72
Market spread	0	0	0	-29	41	37	0	0	0	0	0	0	0	0	0	0	0	0	0	66
Transportation	0	-34	0	-19	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61
Illiteracy	33	0	0	36	-46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73
Agricultural labor	40	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
Export structure	0	0	0	-17	0	10	30	0	50	0	0	27	0	0	0	0	0	0	0	62
Industrial technology	0	0	0	0	0	0	0	78	0	15	0	0	0	0	0	0	0	0	0	84
Agricultural technology	0	15	0	0	0	0	15	32	0	28	-26	0	14	0	0	0	0	0	0	88
Technological dualism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GNP per capita	0	0	0	0	0	0	0	0	0	0	-34	-44	0	22	0	0	0	0	0	76
Export change	0	12	29	5	0	7	0	0	23	0	0	0	25	0	0	0	0	0	0	27
GNP per capita change	0	0	0	0	0	0	0	0	46	0	0	0	0	29	0	-22	-39	24	0	50
Industrial wage per capita change	0	0	-15	-15	0	0	0	0	13	0	-28	0	0	- 4	0	- 8	0	0	15	39
Agricultural wage per capita change	0	0	-31	- 4	0	0	11	0	-26	0	-22	-27	0	-17	0	-26	0	0	33	50

Note: All coefficients are multiplied by 100.

the socioeconomic structure of political leadership is assumed to influence some of the same institutional features and investment policies as does foreign dependence: land tenure patterns, the development and spread of market institutions, and investment policies in transport and education.

The socioeconomic character of the leadership elite is assumed to also influence the extent of direct government participation in economic activity. Where governments take a more active economic role, they are presumed to affect how fast market institutions spread and to influence changes in the structure and growth of exports.

The politically determined institutional and investment policies described above, in turn, affect industrial and agricultural development and the structure of exports in our model. Industrial technology is assumed to be influenced directly by the spread of market institutions and by reductions in illiteracy. Agricultural technology is assumed to be influenced by land tenure, market development, transport, education, and shifts in export structure as well as by the abundance of agricultural resources. Finally, the level of per capita GNP is assumed to depend directly on the structure of production, industrial technology, and education.

The dynamism of the economy is reflected in our model by the rates of growth of GNP per capita and of exports. The rate of growth of exports is assumed to depend on the structure of exports, the spread of market institutions, government trade policies, foreign dependence, immigration and agricultural resource abundance. Export growth is, in turn, assumed to affect GNP growth. In addition, GNP growth is assumed to depend on industrial and agricultural technology, on the extent of technological imbalance between agriculture and industry, and on the spread of market systems.

Finally, the diffusion of benefits from growth is assumed to be affected directly not only by the rate of growth of overall per capita GNP but also by a host of institutional, political, and technological choices: immigration rates, dependence levels, the spread of markets, education, the level of industrial technology, and the extent of technological dualism between agriculture and industry. In addition, the growth of agricultural wages is also affected by land tenure patterns and by the percentage of the labor force in agriculture.

III.3. The Average Model, 1850-1914

The rows of Table 2 on page 24 summarize the path coefficients for the average model over all countries and over the whole period. Each row indicates the sign and degree of association of each manifest or latent variable with the dependent variable whose name is in the first column of the row. Each column indicates the sign and degree of association of the variable whose name is abbreviated in the first column of the row as an explanatory variable in the simultaneous equation model. In interpreting the results, we shall sometimes slip into causal or dynamic language, though like in all covariance-based statistical studies, only associations are summarized by the model. It is particularly important to emphasize that, in the average model, we are dealing with a combined cross section of time series. No single nineteenth-century country actually traversed the entire path represented by our estimated model during the period. What our model represents are the systematic correlates, on the average, of a hypothetical transformation of an average nineteenth-century country moving from the lowest level of development represented in our sample to the highest level of development represented in the sample between 1850 and 1914. The institutional features of the model portray the transformations that would have to take place for a country to move from the low to the high end of the spectrum.

We first note that the estimation results of the stylized, long-run path model are quite good. All the coefficients have signs that accord with a priori expectations and, with only a few exceptions, the R-squares are high.

The first two variables, population and natural resources, are exogenous. Only their correlates are specified by the model. Looking down the population column (column 1, Table 2), we find that countries with larger populations tended to be more agricultural and more illiterate. Looking down the agricultural resource abundance column (column 2, Table 2), we find that greater relative resource abundance tended to be associated with: more immigration (no point in migrating to a resource-poor country); greater economic dependence on foreign countries (no point in colonizing a resource-poor country); to have transport networks that only linked the hinterland to ports (to be able to take advantage of export opportunities for their resources); to have somewhat higher agricultural productivity (relying on plantation agricultures producing export staples with good land-intensive technology), and to have slightly higher rates of growth of exports.

The immigration row (3 of Table 2) explains the large migration flows characterizing the nineteenth century through an association with resource abundance: people tended to emigrate from resource poor countries to resource rich overseas territories. But this economic explanation of international migration accounted for only 26 percent of the variance over the whole period. The immigration column (3 of Table 2) links international migration flows with more rapid change in exports, a phenomenon discussed by Thomas (1973), and slower improvements in industrial and agricultural wages as each new wave of immigration competed with existing workers in urban areas and induced increased internal migration from the coasts into the agricultural hinterland of the land abundant countries.

Foreign dependence (rows and columns 4 of Table 2) was also associated with greater relative resource abundance that permitted the creation of structures of domestic production heavily linked with export expansion to land scarce metropolitan nations. In turn, greater foreign economic dependence had pervasive impacts on domestic institutions, political structures, investment and growth patterns, and on the diffusion of growth benefits. The predominance of negative signs in column 4 of Table 2 lends support to the claim of dependency theorists that, on the average, greater economic dependence had mostly negative effects on development patterns when one looks across countries. The only positive association of greater foreign dependence was with faster export growth but, on the average, this effect was relatively small. Going down column 4, we find that, as Baran (1957) claimed for currently developing countries, historically, foreign dependence tended to encourage a pattern of political development in which the structure of political power was dominated by expatriates and by large primary producers. As a result of the immigration, financial, tariff, and transport policies, these political elites supported dependent countries, tended to, on the average, stay more agricultural; the development of small-scale farms tended to be retarded by land legislation and land policies that promoted concentration of land holdings; and the development of domestic, as contrasted with export and import-serving, markets tended to be delayed by legal arrangement limiting the operation of factor markets, particularly land and labor. The more dependent the country was, the more limited the development of national domestic commodity markets tended to be: Transport policies tended, on the average, to stress railways linking the interior to ports rather than transport networks promoting internal trade; tariff policies tended to favor imports over indigenous manufacturing; and financial policies tended to serve exclusively export markets. Finally, our results indicated that, on the average, dependence tended to foster a development pattern characterized by a slower spread of benefits to industrial workers and small farmers due to a complex of policies: encouraging and subsidizing immigration, even during periods of depression; limiting investment in education; and promoting tenurial and trade policies fostering staple exports.

The picture of the effects of foreign dependence that emerges from our present model is somewhat more negative than that painted by the Morris and Adelman results or within-group processes. There, only the completely dependent countries got no benefits at all from foreign dependence. In other less dependent countries, the effects of greater dependence were to increase rates of growth of exports, immigration, and sometimes GNP while retarding the development of political institutions giving power to local nonlanded elites, the evolution of tenurial systems favoring medium-sized family farms, and the spread of benefits to workers in rural and urban areas. The weaker positive effects of foreign dependence in our present results are due to the difference between combined cross-section and within-group models. The present, combined, model averages over the totally negative effects for the wholly dependent countries and the more mixed results of foreign dependence for the more modestly dependent countries.

Political structures in which modernizing local elites were weak (row 5 in Table 2), in which power was concentrated in the hands of expatriates and the classes with which they were allied--the large primary-export producers, were more prevalent in economically more dependent countries in which the primary sector was larger. In turn, the signs of the path coefficients in column 5 of

Table 2 indicate that modernizing local elites could counteract the pattern of negative effects of foreign dependence, either partially or wholly, to the extent that they could gain political power. Greater political influence by indigenous manufacturers, wage earners, or small farmers in setting domestic policies tended to result in land, tariff, financial, and investment policies more favorable to domestic economic development. More specifically, going down column 5 we see from the pattern of positive association of greater power of modernizing elites that, where they were more influential, on the average: governments tended to adopt a more active role in promoting policies fostering the development of local manufactures; the destruction of communal land arrangements and land concentration in large estates tended to proceed more slowly; domestic markets for local manufactures, rural banking institutions, and roads for marketing agricultural wage goods tended to develop and spread more rapidly; and the public investments undertaken where nontraditional groups were politically influential stressed the development of feeder roads linking rural communities to cities and rural public-education facilities. This pattern of beneficial effects associated with the rise in power of domestic nonlanded elites is entirely consistent with the Morris and Adelman results. It is also consistent with the staple export theories of economic history that, by stressing how institutional features of linkages limit the spread of benefits from staple export expansion (Hirschman 1977), point to the obverse of the positive effects captured here.

Economic historians agree on the importance of an active role of governments in the economic arena during the 19th Century. Row 6 of Table 2 relates the extent to which governments took an active stance in the promotion of development to the socioeconomic structure of their political elites. The more influential modernizing elites were, the more active governments tended to be in encouraging domestic economic development. Some of the effects of governments were already summarized by the path coefficients of the two previous political structure variables: foreign dependence and the class-structure of political power. The sixth column of Table 2 focuses only on the direct dynamic effects of the government's role in the economy. The estimated coefficients suggest a pattern that associates, on the average, a more active developmental role of governments with the more rapid spread of market institutions and with greater shifts out of staple exports into specialized high-value agricultural exports and/or processed and manufacturing exports. Historians writing on the period stress the role of government-promoted legal reforms fostering the commercialization of land and the spread of credit institutions and of tariff policies in nineteenth century development and the varied effects these institutional and policy changes had in countries with different dependency status and resource endowments.

The next three latent variables in the model portray important aspects of key economic institutions: land tenure and the development and spread of market institutions throughout commodity and factor markets. The explanations for systematic intercountry and intertemporal differences in these institutions offered in rows 8-10 of Table 2 consist of differences in the structures of political power among countries and periods. On the average, our estimates suggest that greater economic dependence tended to retard the evolution of institutions favorable to widespread domestic development and to favor institutions that tended to encourage the growth of export-related activities. By contrast, greater political influence of indigenous commercial and industrial groups (including workers) tended to favor the evolution and spread of institutions favorable to widespread domestic development. Together, these two political variables explain 37 percent of intercountry and intertemporal differences in the evolution of forms of tenure favorable to the widespread adoption of agricultural improvement and 72 percent and 66 percent of the evolution and spread of national commodity and factor market institutions.

The effects of these economic institutions on the structure of nineteenth century economies indicated by our estimates are presented in columns 7-9 of Table 2. Land institutions more favorable to agricultural improvements (column 7) tended to be associated with: a greater shift in export structure away from staple exports; higher levels of and more rapid improvements in agricultural productivity; and greater improvement in the wages and living levels of the agricultural poor. Higher levels of development of market institutions (column 8) were associated with higher levels and improvements in both industrial and agricultural technology. More rapid diffusion of market institutions (column 9) was associated with greater shifts in export structure away from staples and more rapid growth in exports, GNP, and in industrial but not agricultural wages and living levels. In the agricultural sector, the spread of factor markets led to land alienation and land engrossment which tended to promote land concentration and proletarianization, and the spread of commodity markets tended to destroy cottage industry that was so important to the incomes of rural subsistence workers.

The next two variables describe the structure of public investment: investment in transport networks and in education. The development of internal transport networks linking towns throughout the country with each other and with rural communities (row 10 of Table 2) by railways, all weather roads, and waterways suitable for the mass shipment of bulky goods tended to be retarded where resource abundance and foreign dependence tended to focus policy mostly on the development of transport networks linking export producers with export centers. By contrast, the development of transport links among the major urban centers and feeder roads, railways, and canals serving the agricultural sector tended to be encouraged where staple-export oriented large landowners were less influential politically. In turn, denser transport networks tended to favor the adoption and more rapid spread of more advanced techniques in both industry and agriculture (column 10 of Table 2).

Investment in education reflected public policy choices (row 11 of Table 2) and was therefore influenced by the structure of political power. Where governments were less economically dependent and modernizing elites gained political influence, they invested in rural public education facilities. Illiteracy also tended to be less prevalent in small countries. In turn, greater literacy was associated with (column 11 of Table 2) higher levels of agricultural technology and greater adoption-rates of improvement in agricultural techniques and improvements in urban and rural wages.

The next five variables describe important structural aspects of the economy: its structure of production and exports, its technological development, and its per capita GNP. Row 12 ascribes intercountry and intertemporal variations in the shares of the labor force employed in agriculture to intercountry differences in foreign dependence and to population size: larger countries tended, on the average, to be more agricultural, and more dependent countries tended to remain more agricultural.

Our results confirm that the shift in export structure out of staple exports in more agricultural countries (row 13 of Table 2) tended to be strongly affected by government policy. It tended to be retarded where tariff and investment policies were dominated by external interests and accelerated where domestic governments reflected the interests of domestic manufacturers and of farmers producing food for the domestic market in setting trade policy. On the average, the shift out of staple exports was accelerated where land tenure was conducive to the generation of an agricultural surplus that was widely distributed. It also occurred more rapidly where market institutions spread more quickly. These results are consistent with the earlier work of Morris and Adelman and with the writings of Senghass and Mentzel (1978) on the historical conditions in which primary export expansion led to successful development.

More substantial shifts out of staple exports (column 13 of Table 2) were associated with better technology in agriculture and with higher rates of growth of exports. The first association reflects the fact that our measure of shifts out of staple exports includes shifts within agriculture, to more specialized high-value crops, as well as shifts out of agricultural exports into food processing and manufactures. The second association is due to the fact that specialized agricultural exports and manufactures fetched better prices than staples and had more rapidly expanding markets.

Our path model provides a very parsimonious model of the influences conducive to the development of industrial technology and its spread, on the average, during the 19th Century. The direct effects (row 14 of Table 2) are only two: the level of development of market institutions and the development of inland transport. Taken by themselves, these two account for over 80 percent of the variance in 19th Century development in industrial technology among countries! The significance of these two variables is consistent with the writings of institutional economic historians. North and Thomas (1970) stress the importance of legal and institutional changes reducing market transactions costs while Polanyi (1944) underlines the drastic social changes that were implicit in the establishment of functioning market systems. Anderson (1974) emphasizes the importance to the industrialization of 19th Century Europe of the revival of Roman law that provided for fixity of contract and for predictable economic transactions between individuals. The earlier work of Morris and Adelman on industrialization in the 19th Century also emphasized the importance of markets and transport. But, in addition, it related industrialization to the major influences on the development of markets and transport as well as to the major consequences flowing from industrialization.

Improved industrial technology, in turn, was associated with (column 14 of Table 2) more rapid growth in per capita GNP but slower growth in both rural and urban wages. Improved technology was capital intensive so that, other things being equal, it was associated with less industrial employment (and, hence, lower wages in manufacturing) and required more resource diversion out of agriculture (and, hence, was associated with lower wages in agriculture).

Patterns of agricultural development are more complex than patterns of industrialization and, hence, subject to more influences. This is evident in the specification of influences on agricultural technology adopted in row 15 of Table 2. Our results indicate that agricultural technology tended to be more developed in countries with abundant agricultural resources and that forms of tenure in which medium size, owner-operated farms predominated tended to be more conducive to the use and adoption of high-yield technologies. The transformation of conditional landownership into absolute private property and reductions in the prevalence of sharecropping, parcelized holdings, estate or plantation systems, or communal production all tended to promote to agricultural progress. By the same token, both exremes in land concentration tended to constrain technological advance: excessive concentration limited the demand for consumption goods while excessive parcelization limited the agricultural surplus and the ability to save and invest. In addition, the adoption of agricultural improvements tended to be faster where market institutions were more developed and where canals, feeder roads, and railroads linking agricultural producers and consumers with urban and export markets encouraged commercial agricultural production and nonstaple exports. Finally, agricultural productivity tended to be higher where farmers were more literate.

Since the correlation between the two latent variables representing technological development and dynamism in industry and agriculture was quite high (R-square of .72), we found that we could not use both variables in the same equation. To infer the influence of the agricultural technological variable, we therefore defined the "technological dualism" variable which consists of the difference between our industrial and agricultural technology variables. We can infer the influence of agricultural technology from this variable (column 15 of Table 2); a negative sign for the technological dualism variable implies a positive effect of agricultural technology. We find the effects of better agricultural technology and a more dynamic agricultural sector to be highly positive: on the average, they tended to be associated with higher rates of growth of per capita GNP and with higher real wages in both manufacturing (since they increased the supply of wage goods) and in the rural sector (since improved agricultural technology was labor intensive during the period and, hence, led to a higher demand for agricultural workers). These positive impacts of agricultural development on growth and distribution are consistent with the Morris-Adelman study, which underlined the extremely important roles of agriculture and its institutions to the initiation of economic growth and its subsequent diffusion.

The level of per capita GNP (line 17 of Table 2) varied directly with the structure of production: It was higher where a smaller percentage of the labor force was agricultural, reflecting both demand and supply factors, as stressed in the work of Kuznets (1968) and Chenery and coauthors (1975 and 1986). It was also higher where technology in industry was more developed and where illiteracy was less. The level of per capita GNP is regarded primarily as an outcome-variable. The only role the level of per capita GNP plays in the model (column 17 of Table 2) is to affect the rate of growth of per capita GNP. On the average, rich countries tended to grow more slowly than countries just starting growth from low levels.

The dynamism of the economy, reflected in lines 18 and 19 of Table 2, is described by the determinants of export growth and of the growth of GNP per capita. Over the period as a whole, growth was export-led, as indicated by the positive association of export growth with GNP growth (column 18 of Table 2). Despite a multiplicity of explanatory variables (row 18 of Table 2), we do least well in explaining the rates of growth of exports in the 19th Century, due primarily to differences in trade policy among subperiods (see Adelman, Lohmöller, and Morris 1987). More agricultural resources, more immigrant expatriates linking domestic development policies to export markets, better trade policies by governments promoting exports, greater shifts in export structure toward manufacturing exports, and more rapid growth of market systems all tended to lead to more rapid export growth. But, when all is said and done, we only explain 27 percent of the total variance in export performance for the whole period. And an examination of the residual correlations for this variable with the omitted variables indicates that there are no other variables in the model that could increase the explanatory power of the export equation.

The estimated equation for the growth of GNP per capita yields a very classical stylized picture of long run economic growth in the 19th Century (row 19 of Table 2). It confirms the neoclassical thesis that, in the 19th Century, export-led growth raised the rate of growth of per capita GNP. It emphasizes the dynamic role of the diffusion of the industrial revolution technology in raising rates of economic growth. It also places the changes in economic, social, and legal conditions involved in promoting the effective functioning of commodity and factor markets at the core of an explanation of capitalist development. In turn, faster GNP growth improved the economic lot of the urban and rural poor (column 19 of Table 2).

The technological picture of 19th Century growth in row 19 is consistent with the writings of Marshall (1920), Landes (1969), and Kuznets (1968). In their view, the dynamic forces for change in the 19th Century were the revolution in textile and steel technology and the transport revolution embodied in the introduction of the steamship and the railroads. The emphasis on market institutions in row 19 lends support to the neoclassical institutionalists, North and Thomas (1970) and Hicks (1969) as well as to Polanyi (1944), all of whom view the spread of market systems as the central process for modern economic growth. We also find that a more balanced emphasis on both industrial and agricultural technology tended to improve the performance of the economy wherever it occurred. Failure to expand agricultural productivity in line with industrial productivity tended to lead to bottlenecks in foreign-exchange earnings, domestic savings, and domestic demand as agricultural export-earnings became insufficient to pay for the imports of food and intermediates required to support growing immigrant populations and industrialization. These findngs lend support to the balanced-growth theorists, Rosenstein-Rodan (1943) and Nurske (1953), over the long perspective. The estimated equation also indicated that, averaging over the second half of the 19th and earlier 20th Centuries, economies with higher levels of per capital GNP tended, on the average, to grow more slowly.

When we come to the diffusion of benefits from growth (lines 20 and 21 of Table 2), the stylized picture is no longer either classical or neoclassical. Over the whole period, there tended to be, on the average, some, relatively weak, positive effect of change in GNP on industrial wages and a stronger positive effect on agricultural wages. In individual countries and periods, however, the net positive effect of growth on agricultural and industrial wages could be more than counterbalanced by other negative influences. In dependent colonial countries, the encouragement of immigration tended to reduce the rate of increase of both agricultural and industrial wages. And dependency per se worked to depress the growth of wages mostly in industry but also in agriculture. The spread of market systems tended to affect industrial workers differently from the way it tended to affect agricultural labor. On the average, the effects of market penetration on industrial wages were strongly positive while its effects on rural wages were strongly negative. This average picture of the effects of market penetration is dominated by the nondependent countries. Education, especially reductions in illiteracy, had strong positive effects on wages in both sectors. But increases in industrial technology had a small negative effect on the rate of growth of industrial wages, serving mostly to raise profits, and a more significant negative effect on agricultural wages, serving mostly to increase returns to landowners. The negative effects of industrial growth could be more than counterbalanced, however, by adopting a more balanced growth strategy. Raising agricultural productivity pari pasu with industrial productivity could ameliorate rates of growth of real wages in both sectors. This last effect lends support to those who argue for the adoption of wage goods (de Janvry, 1984) and agricultural (Mellor, 1976; Adelman, 1984; and Singer, 1984) strategies as improving both growth and distribution and indicates a further benefit of balanced growth.

The rate of improvement in agricultural wages was also, not surprisingly, affected by some purely agricultural phenomena. There tended to be less improvement in rural wages in economies that remained strongly agrarian and more improvement when tenurial conditions favored family farms of moderate size. The overall picture of influences on agricultural and industrial wages revealed by the analysis is thus complex, leaving room for policy and institutional choices in how growth affects the working class and the poor and in the incidence of the distribution of benefits of growth between urban and agricultural workers. The complexity of the analysis of spread effects from growth is entirely in line with previous analyses of influences on poverty and growth of wages by Adelman and Morris (1973, 1974), Morris and Adelman (op. cit.), and the policy writings of Adelman (1984-1986).

III.4. The 1950-1964 Developing Country Model

We now turn to the question of contemporary relevance of the historical analysis. The differences between the context of economic growth in the nineteenth century and the post-World War II era are clearly vast. Today's more rapid population growth and greater rural-urban migration make it tougher to absorb increases in the urban labor force into nonagricultural employment while the exhaustion of good unsettled land cannot offer relief from population pressures. Today's technology in advanced countries is much less suitable to the resources of developing countries. Today's populations in developing countries place greater demands on their governments to deliver gains from development, generating unprecedentedly severe political and ideological pressures on governments with weaker capacities for satisfying them. Offsetting these new handicaps are the enormously greater and more rapidly expanding markets for consumer goods in advanced nations. As a result, the rates of growth of exports from developing countries, their speed of economic growth, and the rates of transformation of their structures of production, exports, and consumption have been much more rapid in today's developing countries than in the nineteenth century. Notwithstanding these important differences, a nonquantitative comparison of development patterns, prime movers in development, and sources of growth suggest that similarities between the nineteenth century and post-World War II growth are substantial (Adelman 1987) and that the insights concerning interactions between institutions, development, and development policy derived from an examination of nineteenth century experience have some current relevance (Morris and Adelman 1988).

In the present section, we take a formal approach to the issue of contemporary relevance of the nineteenth century experience. We fit the same model specification as we used in the 1850-1914 analysis to data for 74 developing countries during 1956-1962. The data are mostly drawn from the 1967 book of Adelman and Morris, Society, Politics, and Economic Development. But seven new variables, not included in that study, had to be developed to enable parallel economic and institutional specification of the contemporary model with the nineteenth century model used in the previous section. Short definitions of the variables used for the contemporary study are given in Appendix C of this paper; longer definitions, together with individual classifications, are presented in Adelman-Morris (1967, Chapter 2). For the variables not included in that book, the classification scheme and data are available from the authors.

Table 3 summarizes the results of the estimation of the 1850-1914 model specification with contemporary data. In interpreting the results, one should bear in mind that: the Table 3 estimates relate only to developing countries; that the period they cover is only 15 years rather than the 65 years of the nineteenth century experience; and that the 1950-1964 period had some special characteristics. More specifically, during this period, virtually all developing countries were pursuing programs of import-substitution industrialization; were using capital-intensive technology in industry and infrastructure; were neglecting investment in agriculture, except for export-agriculture; and were deriving their dynamic from capital accumulation and foreign capital inflows.

In fitting the contemporary model, we made some very minor adaptations to conform with the period and with differences in data availability. Thus, we omitted international migration as a variable from the contemporary model since this was not an important factor in the 1950-1964 period. We also omitted the rate of spread of market institutions because it was difficult to develop an appropriate indicator for so short a period. In addition, we focused the contemporary model more squarely on dynamics by omitting the level of per capita GNP as an "explanatory" variable; this could be done since the

Table 3: Path coefficient matrix, 1950-1964

	Popu-lation	Agricul-tural resource	Depen-dency	Polit-ical elite	Govern-ment economic	Land tenure	Market	Trans-porta-tion	Lit-eracy	Agricul-tural labor	Export struc-ture	Indus-trial tech-nology	Agricul-tural tech-nology	Change in Exports	Change in GNP per capita	R2
Population	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agricultural resource	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dependency	0	- 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Political elite	0	0	- 5	0	0	0	0	0	0	21	0	0	0	0	0	3
Government economic role	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	25
Land tenure	0	0	-45	29	0	0	0	0	0	0	0	0	0	0	0	30
Market	0	0	-78	13	- 1	0	0	0	0	0	0	0	0	0	0	64
Transportation	0	30	-56	21	0	0	0	0	0	0	0	0	0	0	0	47
Literacy	-16	0	-65	20	0	0	0	0	0	0	0	0	0	0	0	44
Agricultural labor	19	0	64	0	0	0	0	0	0	0	0	0	0	0	0	36
Export structure	0	0	-27	0	16	28	-15	0	0	-35	0	0	0	0	0	57
Industrial technology	0	0	0	0	0	0	11	79	0	0	0	0	0	0	0	74
Agricultural technology	0	-21	0	0	0	58	- 8	-36	40	0	18	0	0	0	0	43
Export change	0	-34	0	0	- 7	0	0	0	0	0	35	0	0	0	0	11
GNP per capita change	0	0	0	0	0	0	- 6	0	0	0	0	44	31	14	0	50
Urban poor income per capita change	0	0	0	0	0	0	46	0	- 2	0	0	- 6	- 5	0	12	24
Agricultural poor income per capita change	0	0	7	0	0	9	38	0	34	49	0	- 1	8	0	14	22

period was so short and intercountry differences covered a more limited range in per capita GNP. We also omitted the "technological dualism" variable that we were forced to introduce into the historical analysis because of strong multicollinearity between industrial and agricultural change during the nineteenth century since the contemporary data display much smaller correlation between the two (.62 as compared with .79 for the historical data). The contemporary model is therefore slightly more parsimonious and cleaner. But we did not change the essential specification or introduce new variables to reflect new processes (such as internal migration) or better data availability (such as investment rates). As a result, the model of Table 3 is not intended as a model of development in contemporary developing countries. Rather, it is intended to serve a more restricted function: to help explore which features of nineteenth century experience carry over into the twentieth and which do not.

An examination of Table 3 reveals striking similarities with the nineteenth century. The structure of political power (columns 3 and 4 of Table 3) is still very important in determining institutional development and government investment policies. As in the nineteenth century, greater political dependence tends to retard the development of institutions and investment patterns designed to promote widespread domestic development, and more influence by nontraditional elites tends to encourage them. Tenurial forms characterized by a predominance of owner-operated farms of viable size (column 6 of Table 3) still encourage greater shifts in export structure away from agricultural exports and have a significant impact on improvements in agricultural technology. Shifts in export structure away from staple exports (column 11) still tend to encourage more rapid growth in exports. More advanced technology in industry (column 12 of Table 3) is still associated with more rapid growth of GNP and with downward pressure on industrial and agricultural wages. More rapid growth in exports (column 14 or Table 3) still imparts an impetus to GNP growth, despite the general import-substitution tenor of industrialization during the period. And GNP growth (column 15 of Table 3) is still, on the average, over all developing countries, positively, though weakly, associated with improvements in living levels of the poorest urban and rural 20 percent.

There are also some differences: Agricultural resource abundance (column 2 of Table 3) now appears to play a different role from its role in the nineteenth century when it was a major influence on colonization and international migration. But the differences between the historical results and the contemporary ones may be overstated, due to differences in measurement. The historical measure is based on the relative abundance of agricultural and pastoral resources only, while the contemporary measure includes fuel and mineral resources. Historically, differences in land abundance were greater than they are now, when the existence of unsettled territories suitable to agriculture has been largely exhausted. It now has a negligible influence on foreign dependence; indeed, the overall degree of explanation of foreign dependence (row 3 or Table 3) becomes negligible, suggesting a historical explanation for the persistence of this phenomenon. Agricultural resource abundance now has a positive (rather than negative effect) on the development of inland transport networks and a retarding (rather than accelerating) effect on improvements in agricultural technology, reflecting the greater tendency to stress export agriculture over food agriculture in technology improvements in the 1950-1964 period. Finally, more abundant agricultural resources are associated with slower rather than more rapid export expansion, reflecting the impact of declining terms of trade for primary commodities during this period.

Governments very active in influencing the development process (column 5) had a different influence on exports during the 1950-1964 period. They encouraged import substitution rather than export expansion; the sign of the government-influence variable in the export-change equation is now negative rather than positive, like in the nineteenth century.

The development-of-market-institutions variable (column 7 of Table 3) now stands for both the latent variables representing the level of development of market institutions and their rates of spread. Some of the influences of development of market institutions remain the same as they were in the nineteenth century, and some become different. Due to the import-substitution thrust of policy in the 1950-1964 period, better developed domestic commodity and financial markets tend to retard rather than accelerate shifts in export structure away from staple exports as governments relied on staple exports to finance infrastructure investment and the import of machinery for import-substitute industrialization. They also tend to slow rather than accelerate the expansion of exports. As in the nineteenth century, the development of market institutions tends to accelerate the adoption of more modern technology in industry. But by contrast to the nineteenth century, the spread of market institutions tends to slow the adoption of more modern technology in agriculture. As farmers shift to production for markets, marketing boards and government-imposed terms-of-trade policies keep agricultural prices low in order to shift resources away from agriculture into industrial investments in a Lewis-type agriculturally financed industrialization process. As in the nineteenth century, greater penetration of markets into the economy raises the rate of growth of real income of the urban poor. But unlike in the nineteenth century, where more rapid spread of market institutions had a negative influence on the rural poor, the current analysis suggests that, averaging over all countries, higher levels of development of market institutions were associated with improved living standards of the rural poor. This association may reflect the fact that the market-institution-development indicator developed for the contemporary period lays heavy stress on the existence of institutions providing rural credit as an indication of the level of development of factor markets. (This was also an element in the historical classification but was tempered by the inclusion of other features of factor market development, especially land markets.) It may also reflect the contrast between the influence of higher levels of development of market institutions and their more rapid spread.

Denser transport networks (column 8) continue to have a positive impact on industrial technology, but they now have a negative effect on agricultural technology perhaps because they now encourage more rapid rural-urban outmigration.

Greater education (column 9) now has a negligible impact on the incomes of the poorest 20 percent in the urban sector--the variable that we used in the contemporary study--and a stronger positive impact than it did historically on improvement in agricultural productivity and on the incomes of the poorest 20 percent in rural areas. The apparent difference in the influence of education on the urban poor is most probably due to the fact that our contemporary poverty measure cuts at a different point in the continuum than the historical one. The historical measure relates to the wages of urban factory workers whereas the contemporary measure relates to the poorest 20 percent in urban areas, wherever and, indeed, whether or not they are employed. The poorest 20 percent in the urban sector of developing countries are most likely in the urban informal sector or casual workers, and there is no reason to believe that education will improve their lot as long as they remain in that employment status. The strong impact of education on agricultural technology and on the rural poor is due to the change in the nature of technology in agriculture. Historically, agricultural technology benefited from education only in specialized activities such as dairying; this is no longer true currently where the diffusion of good-practice agricultural technology requires communicating with extension agents, cooperatives, and credit institutions, and improved agricultural technology is dramatically more labor-intensive than traditional agricultural technology.

It is difficult to compare the influence of agricultural technology (column 3) directly with its historical influence, where the impact was measured only indirectly, through the technological imbalance variable. But, if one takes a negative coefficient on technological imbalance as indicative of a positive effect of improvements in agricultural productivity, then the only difference in results is a very slight negative (rather than positive) effect of improvements in agricultural technology on the real incomes of the urban poor in the 1957-1962 results. During this period, improvements in agricultural technology were mostly limited to export crops; they thus diverted resources away from food agriculture, explaining the negative effect of improvements in agricultural technology on the real incomes of the urban poor.

On the whole, the estimation of the same model as in 1850-1914 with contemporary data suggests very strong carry over. Despite very substantial difference in the technological, political, and international environments, the detailed comparison of the estimates suggests that the structure of political power and economic institutions continue to affect contemporary growth in much the same way as they did historically. The differences we find are due mostly to differences in the major thrust of policy, differences in the measurement of indicators, and to differences in the nature of technology between the two periods.

IV. Conclusion

Our attempt to model long-run development patterns with the aid of a PLS model has been quite successful. The results of the model yield interesting insights into historical long-run development patterns, and the model carries over remarkably well into the 1950-1964 period.

The historical model confirms the previous analysis of Morris and Adelman (1988) and is complementary to it. It is also consistent with a great number of historical and development theories and with many country studies. We confirm the following hypotheses for both the nineteenth century and contemporary developing countries:

(1) Political and economic institutions matter a great deal in determining development patterns.

(2) Political and economic institutions play a very significant role in determining the diffusion of benefits of growth to the poorer members of society.

(3) Our model of economic growth stresses the importance to growth of exports, technology, and market institutions.

(4) Our model of diffusion of benefits from growth stresses land tenure, education, the nature and autonomy of domestic political elites, and the development strategy chosen.

(5) In the long haul, balanced growth, in which improvements in agricultural technology keep pace with industrial innovations, succeeds in increasing both GNP and the diffusion of benefits to the poor.

APPENDIX A:

Short Definition of Variables in 1850-1914 Model

All variables are constructed as classifications of 69 observations. The observations are the 23 countries treated as separate observations for each time period. Each variable constitutes a classification and groups the observations into one out of several classes. The classes are rank ordered with category (1) ranking highest. The rank values are transformed into (mostly) equidistant scale values which vary from 0 to 100 with high scores referring to high ranks. Means and standard deviations of these scales are reported in Table 1. Depending on the amount of information available, the classification scheme comprises 4 to 12 classes. For some of the variables, several different measures were assembled and combined into a single classification. Although numeric estimates like census data are available for some variables for some countries, we preferred to use groupings which appeared relatively insensitive to errors in the data.

The following paragraphs on the classification schemes utilized in the analyses are designed to give a general idea of their character. Only leading traits of the schemes are indicated. The classification schemes are presented in detail with the sources on which they are based in Morris and Adelman, Appendix (in press).

Total population: The 69 observations are grouped into seven classes by the size of their total population ranging from (1) more than 100 million to (7) less than one million.

Relative abundance of agricultural resources: Four classes ranging from (1) great abundance of agricultural and pastoral resources relative to the population without major institutional barriers to access to (4) scarcity of agricultural resources with or without major barriers to access.

Net immigration: Five classes ranging from (1) major net immigration probably equivalent to at least one-third of the population increase to (5) major net emigration probably more than one-third of the sum of the population increase plus net emigration.

Degree of foreign economic dependence: Seven dimensions of economic dependence were considered in constructing this variable: Extent of foreign ownership and control of (1) factory industry and (2) foreign trade, export channels and financial services; extent of local dependence on (3) foreign technical and administrative skills, (4) foreign loans, (5) foreign capital inflows, and (6) primary exports for domestic economic growth; and extent of (7) expatriate dominance of national governmental economic initiatives.

Countries were then grouped into seven categories ranging from countries that were (1) heavily dependent of all seven dimensions to (7) advanced countries that had no significant dependent features.

Socioeconomic character of national political leadership: Four principal categories ranging from (1) countries in which rising economic classes, including workers, had direct and controlling share in the political life of the nation to (4) countries where the propertied national or colonial elites were in full control and little influence by indigenous commercial or industrial groups.

Extent of domestic economic role of government: Five categories according to the importance of direct economic actions of government ranging from (1) countries in which the regional and national governments financed the greater part of investment in transportation, as well as in industrial and agricultural expansion, to (4) and (5) countries where the governments' investments were extremely small either in transportation or in the agricultural and industrial expansion.

Percent of labor force in agriculture: Seven categories based on census data of varying quality and other rough estimates having a less-certain basis.

Predominant form of land tenure and holding: Seven categories ranging from (1) countries in which most lands were farmed by cultivators with rights of ownership, with the remaining land farmed by tenants with considerable de facto security of tenure, to the last three categories of countries (5)-(7) with, respectively, "independent" peasants with significant communal controls over types and methods of cultivation; cultivation on large estates by hired laborers or by short-term tenants or sharecroppers; and finally, cultivation on large estates by serfs or other forms of servile labor.

Concentration of landholdings: Six categories ranging from (1) countries with extreme concentration of landholdings with the top 10 percent of landholders probably holding over 75 percent of the cultivated land to (6) countries where small holdings with extreme parcelization and fragmentation prevailed.

Favorableness of land institutions to improvements: This classification scheme is a composite of the predominant form of land tenure and the extent of concentration of landholdings. Countries are grouped into nine categories which are ranked by a priori reasoning about the favorableness of farm size and predominant conditions of tenure to the adoption of agricultural improvements. At the top of the spectrum are independent cultivators with middle-sized or large farms without, however, extreme concentration of landholdings.

Level of development of commodity markets: Seven categories ranging from countries with (1) national markets for most commodities, widespread commercialization, extensive interregional trade, good marketing facilities, and no premodern legal restrictions to (7) overwhelming importance of local self-sufficiency, major transport barriers and premodern legal restrictions (e.g., guilds), and domestic trade limited to luxuries and a few necessities (e.g., salt). Also included in (7) are newly settled countries heavily dependent on imported consumer goods.

Level of development of land markets: Four categories ranging from countries with (1) widely commercialized land markets; individualized landownership; no major premodern restrictions on sale, mortgaging, bestowal and use of land; and some specialized institutions for land transactions to (4) land not widely commercialized and individualized.

Level of development of domestic labor markets: Five categories ranging from countries with (1) widespread wage labor, significant interregional flows and no effective legal barriers to labor mobility, similar wage changes throughout the country, and no persistent regional or sectoral labor surpluses to (5) slave labor, de facto servitude, or widespread compulsory labor.

Level of development of domestic capital markets: Six categories ranging from countries with (1) substantial stock exchanges, significant long-term financing by banks, and no major legal impediments to limited liability enterprises to (6) limited short-term credit through financial institutions, predominance of moneylenders, significant impediments to limited liability, and no securities markets.

Rate of spread of domestic commodity markets: Four categories ranging from countries with (1) major expansion of commodity markets, through either widespread decrease in subsistence or barter, or significant spread of retail and wholesale marketing institutions to (4) very limited spread of relatively insignificant markets including countries in which narrowly based export expansion occurred around a few port cities.

Rate of spread of domestic land markets: Four categories ranging from countries with (1) substantial, rapid commercialization or geographic spread of land markets accompanied by diffusion of institutions favorable to land markets (e.g., building societies or land banks) to (4) little spread of or improvement in conditions for land markets.

Rate of spread of domestic labor markets: Four categories ranging from countries with (1) rapid, widespread increase in the proportion of wage labor accompanied by reduction in split agriculture-industry employment and major increases in sectoral and geographic labor movements to (4) insignificant spread of wage labor.

Rate of spread of domestic capital markets: Four categories ranging from countries with (1) widespread increase in formal institutions and institutional lending for investment financing to (4) very little spread of domestic capital-market institutions, with investment financing either by foreign dominated institutions or by domestic noninstitutional moneylenders.

Level of development of inland transport: Five categories ranging from countries with railways, all weather roads, and waterways suitable for the mass shipment of goods (1) serving towns throughout the country and the agricultural sector well to (5) not serving the overwhelming part of the population, with long distance transport only by natural waterways and dirt tracks.

Extent of adult illiteracy: Ten categories ranging from countries with (1) adult illiteracy exceeding 90 percent to (10) adult illiteracy less than 10 percent.

Rate of spread of primary education (lagged): Five categories ranging from countries where the percent of children aged 6 to 14 increased (1) by at least 15 percent to (5) negligibly, with no legislation extending school attendance.

Rate of growth of real exports: Four categories ranging from countries with rates of growth of real exports (1) exceeding 4 percent from a large base to (4) less than 2 percent from a small base.

Level of development of techniques in industry: Six categories ranging from countries where (1) both the spinning and weaving of cotton were predominantly mechanized, most consumer-goods employment was in factories, and interchangeable parts were quite common in the machinery industry to where (6) there were at most very few factories using low horsepower.

Rate of improvement of techniques in industry: Seven categories ranging from countries with (1) significant across the board industrialization from a substantial base to (7) insignificant growth of industry.

Level of development of techniques in agriculture: Seven categories ranging from countries with (1) most grain production using animal-drawn, cast-iron or steel plows and animal-drawn harvesting machinery, enclosures and stockbreeding for livestock, and improved crop rotation to (7) no significant use of these technologies and poor agricultural resources.

Rate of spread of techniques in agriculture: Six categories ranging from countries with (1) significant improvements in agricultural technology through spread of laborsaving machinery, major increase in fertilizer, or fencing and stockbreeding to (6) countries with moderate improvements in agricultural technology limited to at most one region or crop or very small more widespread improvements.

Level of per capita income: Six categories ranging from countries in which the level of per capita income was (1) over 80 percent to (6) under 20 percent of that of the United Kingdom in 1890.

Degree of shift in export structure: Four categories ranging from countries shifting away from primary exports toward processed primary and manufactured exports (1) very strongly to (4) negligibly.

Rate of change in per capita income: Five categories ranging from countries with the rate of change of per capita income (1) exceeding 2 percent to (5) declining, not necessarily markedly.

Direction of change in average real wages in industry: Five categories ranging from countries in which real wages in industry showed a (1) strong upward movement to (5) a downward movement.

Direction of change in average real wages of the employed agricultural poor: Five categories ranging from countries in which average incomes of the employed agricultural poor showed a (1) strong upward movement to (5) a downward movement. Where the employed agricultural poor consist overwhelmingly of small peasants, including tenants, rather than wage earners, their position rather than just the position of wage earners has been taken into account. Where different groups, such as wage earners and small peasants, experienced different trends, these were weighted according to the relative importance in the population.

APPENDIX B:

The Latent Variables 1850-1914: The Outer Model

Table B1 presents the estimated weights and loading for the historical model. Six of the 21 variables of the path models have more than one indicator; five are estimated by PLS.

Technology: For two blocks, Industrial Technology (IndTech) and Agricultural Technology (AgrTech), we chose Mode A weights because we wanted both indicators of each block, the level of development and the rate of improvement, to be represented in each LV. The weights, which range from 0.48 to 0.59, indicate that this intention is supported by the data.

Imbalance between industrial and agricultural technological development: This LV is formed by a priori weights:

Imbalance = (IndusTechn + IndustTechnChng) - (AgricTechn + AgricTechnChng)

Education: For the block of educational variables, Mode B weight estimation was adopted. The two indicators, extent of adult illiteracy and rate of spread of primary education, cut the continuum of education at different levels, and it remains to be seen which cutting point has higher predictive power. The weights in Table B1 indicate that the LV is formed entirely by the illiteracy variable, and the loadings display a perfect correlation between the LV and the MV illiteracy. The loading of the MV education changes with time in exactly the same way the correlations between the two MVs, illiteracy and education, change with time: The correlation drops from 0.89 in 1850 to 0.60 in 1870 down to 0.46 in 1890.

Table B1: The outer model

Variables		Weights				Loadings			
Latent	Manifest	Total	'50	'70	'90	Total	'50	'70	'90
LndTenur	LndTenur	43	47	39	40	93	97	92	88
	LndConcn	-20	-17	-27	-19	-55	-46	-67	-59
	LndTechn	55	51	53	59	90	91	87	90
Market	MktComd	47	64	46	44	96	95	97	95
	MktLand	7	12	24	2	86	84	90	75
	MktLabr	12	20	11	6	87	76	85	88
	MktCptl	41	16	25	53	96	90	96	97
MarketSp	MktComdS	4	-10	24	-5	72	85	74	51
	MktLandS	-9	34	-32	7	26	85	8	2
	MktLabrS	32	34	17	51	84	88	67	91
	MktCptlS	75	52	82	60	97	94	91	93
Illiterc	Illiterc	109	109	101	105	99	100	100	100
	EducatCL	14	10	2	10	-59	-89	-60	-46
IndTech	IndTech	56	48	55	59	95	97	96	94
	IndTechC	50	54	50	49	94	98	95	91
AgrTech	AgrTech	55	51	57	57	94	97	93	94
	AgrTechC	51	52	51	51	93	97	92	92

Note: All coefficients are multiplied by 100

Markets: Two latent variables are created to capture the level and the spread of markets. Both have four indicators each, related to the markets of commodities, land, labor, and capital. Because the land market was very thin, we considered omitting the level and spread of land markets from the analysis. Instead, we chose Mode B weight estimation which leaves this decision to the predictands and predictors of market LVs in the model. The loadings show that the power of the land market variable changes over time. In the first period both MVs, level and spread of land market, have high loadings (0.84, 0.85), which implies that variations in these variables have an impact on development. In the second and third period, the loadings of the spread of the land market (0.08, 0.02) is actually zero, which implies that the spread of the land market has reached such a level that variations around this level have no further impact.

Land tenure: This LV is a composite of three indicators which portray the characteristics of landownership that are relevant for development. The three indicators are: the predominant form of land tenure and holding; the concentration of landholdings; and the favorableness of land institutions to improvements. The sign of the weight of the concentration variable is negative for all time points, meaning that this variable enters the linear aggregate not as concentration but as spread. The loadings of the MV concentration are lower, in absolute terms, than the loadings of the other two indicators, indicating that concentration is not the strongest indicator of the land tenure LV which fits best into the path diagram.

APPENDIX C

Short Definition of Variables in the 1950-1964 Study

All variables are constructed as classifications of 74 observations. The observations are all developing countries existing in 1950 with populations over 1 million. Each variable constitutes a classification that groups observations into one of several classes. Depending on the amount of information available, four to six classes are identified. The classes are rank ordered, with category (1) ranking highest. The rank values are then transformed into (mostly) equidistant scale values which vary from 1 to 100, with high scores referring to high ranks.

The following paragraphs on the classification schemes utilized in the analysis are designed to give a general idea of their character. The variables relating to levels are either as of about 1960 or average over 1957-1962. The variables relating to rates of change generally apply from 1950-51 to 1963-64. The classification schemes and data come mostly from Society, Politics, and Economic Development (Adelman and Morris 1967). However, the names given to the variables in this Appendix correspond to the analogous historical variable. The name by which the variables were identified in Adelman and Morris (1967) are listed in parenthesis. The variables which were added for the present study are identified with an asterisk.

Total Population:* The 74 observations are grouped into six categories by the size of their total populations as of 1960 ranging from (1) over 100 million to (6) less than 5 million.

Abundance of Natural Resources: Four classes ranging from (1) countries with a great abundance and wide variety of known resources, having more than three acres of agricultural land per capita and important fuel, nonfuel, and mineral resources, to (4) countries with either less than an acre of arable land per capita or without significant nonagricultural resources.

Degree of Human Resource Dependence:* Four categories ranging from (1) countries in which, as of 1960, expatriates completely dominated entrepreneurial, commercial, administrative, and technical groups to (4) countries in which, as of 1960, they played a negligible economic role and at least 20 percent of the active male population was in commerce, technical, professional, managerial, administrative, or clerical employment.

Degree of Financial Dependence:* A composite variable taking account of the following aspects: the ratio of foreign capital inflow to domestic investment, the ratio of foreign capital inflow to the government budget, and the degree of autonomy in setting monetary and exchange rate policies. Four categories ranging from (1) countries which were in the French-franc currency zone and had no autonomy in setting domestic monetary or exchange rate policies to (4) countries in which foreign capital inflows were less than 15 percent of investment or less than 20 percent of the government budget in 1960.

Degree of Trade Dependence:* A composite variable taking account of the following aspects: the share of trade in GNP; the country concentration of exports as indicated by the share in 1960 of its exports to its most important trading partner; the commodity concentration of exports as indicated by the share of exports in 1960 of its three major commodities; and the degree of export receipt instability between 1960 and 1970. Six categories ranging from (1) exports plus imports exceeding 80 percent of GNP to (6) exports plus imports less than 15 percent of GNP. Within categories, pluses and minuses were assigned according to whether commodity and country export concentration and/or export instability were high, moderate, or low.

Socioeconomic Character of National Political Elite (Political Strength of Traditional Elite): Three categories ranging from (1) countries in which tradition-oriented elites had little or no political power during most of 1957-1962 to (3) countries in which traditional landowning elites and/or other traditional elites were politically dominant during most of 1957-1962.

Extent of Leadership Commitment to Economic Development: Three categories ranging from (1) countries in which government and other semiofficial agencies made concerted efforts to promote economic growth and purposive attempts to alter institutional arrangements unfavorable to growth to (3) countries in which no efforts to promote economic growth were made and in which there were no development plans and government planning groups as of 1957-1962.

Government Enterprise Ownership:* This classification groups countries into four categories by the share of government-owned enterprise in the manufacturing sector. It ranges from (1) over 25 percent of manufacturing output produced by government-owned enterprises to (4) less than 5 percent.

Predominant Form of Land Tenure (Character of Agricultural Organization): Four categories ranging from (1) countries characterized by a predominance of commercial owner-operated farms sufficiently large to be economically viable to (4) countries characterized by the predominance of communally owned agricultural lands and/or small subsistence tenant-operated farms.

Level of Development of Commodity and Factor Markets:* Composite variable consisting of: the extent of development of commodity markets and the degree of development of financial institutions. No countries had legal impediments to labor mobility during this period, and land markets were only of incidental importance. Four categories ranging from (1) countries with subsistence sectors involving less than 25 percent of the population, with financial institutions that are at least moderately effective in attracting private savings and which provide fairly adequate supply of medium and long-term credit to both industry and agriculture and with internal transport systems serving all parts of the country, to (4) countries in which over 80 percent of the population was in the subsistence sector, in which the marketing of crops was of minor importance, and financial institutions attracted a negligible amount of private savings and provided a negligible amount of investment-finance.

Level of Development of Inland Transport (Level of Development of Physical Overhead Capital): Four categories ranging from (1) countries in which internal transportation systems and power networks were reasonably effective in meeting current requirements for rapid economic development. Feeder roads to agriculture were adequate for marketing agricultural products and intercity connections were fully established to (4) countries in which transportation and power systems were pervasively inadequate and constituted major bottlenecks to development. Many of these countries had less than 200 miles of paved roads.

Extent of Adult Literacy (Extent of Literacy): Four categories ranging from (1) countries in which at least 65 percent of the population was literate as of 1958 to (4) countries in which less than 16 percent of the adult population was literate.

Rate of Spread of Primary Education (Rate of Improvement in Human Resources): Four categories ranging from (1) countries that showed significant rates of increase in the stock of their human resources as indicated by a Harbison composite index exceeding 40 to (4) countries that were making relatively few improvements in their stock of human resources as indicated by a Harbison index of less than 6.0.

Percent of Labor Force in Agriculture (Size of the Traditional Agricultural Sector): Four categories ranging from (1) countries with 80 percent or more in traditional subsistence agriculture to (4) countries with less than 25 percent of their populations in traditional subsistence agriculture.

Degree of Shift in Export Structure (Structure of Foreign Trade): Five categories ranging from (1) countries in which over 20 percent of exports were manufactured exports to (5) countries in which manufactured commodities accounted for less than 10 percent of total exports and two leading primary exports accounted for over 75 percent of total exports.

Level of Development of Techniques in Industry (Level of Modernization of Industry): Four categories ranging from (1) countries with industrial sectors that, as of about 1961, were producing a wide variety of domestic consumer and/or export goods and at least some intermediate goods to (4) countries in which industrial development as of about 1960 was very slight.

Rate of Improvement of Techniques in Industry (Change in Degree of Industrialization): Three categories ranging from (1) countries with an increase in real industrial output of 7.5 percent per year between 1950-1963 to (3) countries with no change or decline in real industrial output.

Level of Development of Techniques in Agriculture (Level of Modernization of Techniques in Agriculture): Four categories ranging from (1) countries in which the agricultural sector was characterized by the moderate use of mechanical power, fertilizer, and other modern techniques that were not, however, applied to a single crop to (4) countries that were almost exclusively characterized by the use of traditional agricultural methods.

Rate of Spread of Techniques in Agriculture (Degree of Improvement in Agricultural Productivity): Four categories ranging from (1) countries with marked increase in the use of fertilizer or mechanical power, important modern irrigation systems, or marked extensions in the use of other modern agricultural techniques to (4) countries in which agricultural output had remained static or declined between 1950 and 1963.

Rate of Change in Per Capita Income (Rate of Growth of Per Capita GNP): Six categories ranging from (1) countries with rates of growth of real per capita GNP exceeding 3 percent annually between 1950 and 1964.

Rate of Growth of Real Exports:* Five categories ranging from (1) rate of growth of real exports between 1960-1965 exceeding 4 percent per year to (5) negative rate of growth exports.

Change in Real Per Capita Income of the Poorest 20 Percent Outside Agriculture* (replaces the historical variable "Direction of Change in Average Real Wage in Industry"): Six categories ranging from (1) countries in which the average real per capita incomes of the poorest 20 percent of the population employed outside agriculture rose by more than 2.5 percent per year between 1960-1970 to (6) countries in which the average real per capita incomes of the poorest 20 percent employed outside agriculture fell between 1960-1970. The data source is a study by Adelman (1985).

Change in Real Per Capita Income of the Poorest 20 Percent in Agriculture* (replaces the historical variable "Direction of Change in Average Real Wage of the Employed Agricultural Poor"): Six categories ranging from (1) countries in which the average real per capita income of the poorest 20 percent of the population employed in agriculture rose by more than 2.5 percent per year between 1960-1970 to (6) countries in which the average real per capita income of the poorest 20 percent employed in agriculture fell between 1960-1970. The data source is a study by Adelman (1985).

APPENDIX D

The Latent Variables 1950-1964: The Outer Model

Table D1 presents the weights and loadings for the latent variables for the 1950-1964 model. There are five latent variables in the model. Three (literacy and the two technology variables) are analogous to the historical ones; two (dependency and government economic role) that were manifest variables in the historical analysis are latent variables in the contemporary study.

Dependency: Three aspects of economic dependence on foreigners were combined into a single latent variable: dependence on foreigners for manning economic activity (human resource dependence); dependence on foreign capital inflows for investment and for the government budget (financial dependence); and dependence on foreign trade (trade dependence). The latent variable was estimated by outward weights because we wanted all aspects of dependence to be represented. The estimation indicates that for 1950-1964 human resource dependence was the most important aspect of dependence, with financial dependence being the next most important and trade dependence being the least important. These relative weights are consistent with how developing country nationals feel about their dependence but not with the relative emphasis in the dependence literature. The literature emphasizes trade dependence most and the role that this dependence has on the structure of the leadership elite. (To see whether a change in estimation mode would change the relative weights of the different aspects, we also estimated the model with Mode A weights. These estimates emphasized human resource dependence even more relative to the other aspects of dependence and gave trade dependence a negligible weight.)

Table D1: The Outer PLS Model 1950-1964

Variable: Latent	Variable: Manifest	Weights	Loadings
Dependency*	Dependency human resource	73	91
	Dependency financial	38	70
	Dependency trade	16	40
Government economic role	Government development commitment	88	95
	Government enterprise ownership	31	51
Literacy	Literacy	73	95
	Education	31	86
Industrial technology*	Industrial technology level	43	68
	Industrial technology change	77	91
Agricultural technology*	Agricultural technology level	49	85
	Agricultural technology change	64	91

Note: All coefficients are multiplied by 100. The Latent Variables that are estimated by Mode A weights are indicated by an asterisk.

Government Economic Role: Two variables were combined by inward weights in this variable: leadership commitment to economic development and the share of government ownership of manufacturing enterprise. Of the two, leadership commitment to development, as indicated by government actions to generate institutions favorable to development, to remove critical development bottlenecks, and to engage in economic planning of development strategies, was the most important (a weight of 88 as compared with 31). But the signs of the loadings indicate that, at least during this period, on the average a greater share of public enterprise was positively associated with a greater role of the government in the economy. The model of Table 3 in the text, in turn, indicates that, on the average, a greater economic role of the government has a positive impact on structural change.

Literacy: This variable is analogous to the corresponding historical one, except that it measures literacy rather than illiteracy. This is not just a sign reversal since there are people who are neither functionally literate nor illiterate. The contemporary estimates give higher relative weight to education than the historical ones of Table B1, where the weight of education in the latent variable was negligible. Now, the weight of education in the composite is almost a third, and the latent variable is almost as closely associated with education as with literacy. The difference captures the greater contemporary importance of education in being functional in the contemporary world and in the application and absorption of modern technology.

Industrial Technology and Agricultural Technology: These two variables are also analogous to the corresponding historical ones and estimated in the same fashion. The estimates indicate that the dynamic elements of technology are now more important than the static ones. Historically, the two variables had almost the same weight and loadings, while the contemporary estimates accord higher weight to extensions of modern industry and to improvements in agricultural methods than to levels of modern industry and levels of agricultural productivity. The same tendency is also reflected in the patterns of loadings.

Footnotes

[1]Colonialism, which appeared in the top ten list in three analyses, was excluded because the correlation matrix among the full list of potentially available manifest variables indicated that colonialism is dominated everywhere by the broader measure of extent of foreign dependence. A latent variable formed including colonialism would either have given colonialism negligible weight under Mode B weights or lowered the correlation of the latent variable with other variables under Mode A weights. In neither case would its inclusion have added to the analysis.

[2]The land tenure indicators appeared in the top ten list only once, in the study of agricultural development. We, nevertheless, included this indicator because it was pervasively important in the analysis of agricultural growth.

[3]For a discussion of the importance of immigration in the evolution of mutally integrated patterns of Commonwealth development in the 19th Century, see Thomas (1973). A less sanguine view of the effects of dependency on development is provided by Baran (1957), and the dependency school. The varying effects of dependency on within-group growth are studied empirically by Morris and Adelman (op. cit.) in chapter 6.

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