EVIDENCE ON GROWTH, INCREASING RETURNS, AND THE EXTENT OF THE MARKET*

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If economic growth relies upon the extent-of-the-market, then openness will decrease the connection between initial income and later growth. Alternatively, learning-by-doing models suggest that wealth will be more positively correlated with growth in open economies, because trade causes advanced economies to specialize in products with more opportunities for learning. We examine twentieth century less developed countries and nineteenth century U. S. states. In both data sets, there is a much stronger correlation between growth and initial wealth among closed economies. These findings support the importance of the extent-of-the-market, and aggregate demand in fostering growth.

I. INTRODUCTION

Following Allyn Young [1928], much of the recent theoretical work on economic growth builds on increasing returns to scale (e.g., Romer [1986], Lucas [1988], Murphy, Shleifer, and Vishny [1989], and Rebelo [1991]). In contrast to models based on diminishing returns production functions, some of this work implies that economies with more initial wealth experience faster economic growth. With increasing returns to scale, a cross section of economies may display divergence; i.e., initial income may be correlated with later income growth. This paper uses two sets of economies that display divergence to test between different models of endogenous growth.

One set of theories generating a positive connection between initial income and future growth emphasizes the importance of market size and the demand for industrialized products. These extent-of-the-market models suggest that initial wealth speeds growth because it increases market size. Larger market size induces investment in fixed cost (or other increasing returns) technologies [Rosenstein-Rodan 1943; Murphy, Shleifer, and Vishny 1989], and greater specialization [Smith 1976; Becker and Murphy 1992]. A second set of theories suggests that growth comes from specializing in the right products, particularly those products with learning-by-doing [Alwyn Young 1991; Stokey 1991;

* We are grateful to Alberto Alesina, Robert Barro, Olivier Blanchard, Fischer Black, Paul Romer, Sherwin Rosen, José Scheinkman, and Andrei Shleifer. Matthew Botein, Brady Gunderson, and Melissa McSherry provided excellent research assistance. We acknowledge financial support from the National Science Foundation and the Tozier/Clark Fund.

The Quarterly Journal of Economics, August 1999

Boldrin and Scheinkman 1988]. When these models assume that learning-by-doing is greater in producing more advanced products, they also predict that initial development will be correlated with faster growth.

The extent-of-the-market theories predict that access to foreign markets creates demand for domestic producers and makes home country demand and income less important. According to these theories, increases in openness should reduce the importance of domestic income in generating later growth.

In some learning-by-doing models, trade causes less advanced countries to specialize in basic products where there is little learning-by-doing. Trade causes more advanced countries to specialize in advanced products where more learning-by-doing takes place.[1] These models imply that openness increases the growth of rich economies and slows the growth of poor economies.

This paper tests between these models by examining whether the interaction between initial income and measures of openness is positive or negative in growth regressions. We use two data sets: poorer economies across the world since 1960 and U. S. states in the nineteenth century. In our cross-country sample we use income to measure growth and the share of GDP exchanged in trade to measure openness. We also instrument for the share of trade to GDP with physical characteristics of the country. Across U. S. states, we follow De Long and Shleifer [1993] and use urbanization and manufacturing to measure development.[2] For each state we measure openness by physical distance to major regional ports and regional railroad development outside the state. In both of our samples openness is a substitute for initial wealth. Our results support the importance of demand for growth.[3]

We explore further one particular theory which predicts that openness and initial wealth are substitutes: the division of labor. Using a measure of occupational specialization in the nineteenth century United States, we find that the division of labor is determined by the extent-of-the-market and is highly correlated

1. A primary assumption of these models is that there is more learning-by-doing among more advanced products.

2. Nineteenth century income data for U. S. states are neither reliable (despite heroic efforts by Easterlin and others) nor theoretically appropriate in economies with considerable amounts of intrastate migration.

3. Ben-David [1993] finds that an increase in openness leads to faster income convergence. His results imply a more positive correlation between initial wealth and later growth when borders are closed than when borders are open. The results of Sachs and Warner [1995] can also be interpreted as showing that initial development and openness are substitutes.

with later growth. However, the effects of initial wealth and openness are only partly caused by greater division of labor.

II. Empirical Framework: Are Openness and Initial Wealth Complements or Substitutes?

This framework attempts to capture a particular phase of early industrialization when firms introduce mass production techniques to save on production costs. In the model, firms pay a fixed cost to introduce industrial techniques for producing K units of a product at a unit cost of c. There is a continuum of products indexed between 0 and 1, and these goods are ordered so that the industrial techniques used in mass-producing product n must be in use before any industrial production of any good $n' > n$ is attempted. We use the notation $N(t)$ as the largest value for n for which a good has been introduced at time t, and $N(t)$ can be thought of as the level of development.

There is an identical supply of new monopolists in each period, each of which may potentially industrialize a new product. Each monopolist has a firm-specific cost of industrialization which is denoted $C(j)$, where j is an index variable with density $f(j)$. The monopolist gets only one chance to industrialize, and if he passes it up, a competitor will subsequently take his place. The index variable "j" orders the monopolists so that $C'(j) \geq 0$. We define $C(\dot{N}(t)) = C(j^*)$, where j^* is defined so that $\dot{N}(t) = \int_{j=-\infty}^{j^*} f(j)dj$, and $C'(\dot{N}(t)) \geq 0$ follows from $C'(j) \geq 0$.[4]

The firm has a one-period monopoly during which it sells it K units of product.[5] After that period, new entrants drive profits down to zero. During the period of monopoly, total domestic demand is denoted $D(Y(N), P)$, where $Y(N)$ captures per capita income, which, following Murphy, Shleifer, and Vishny [1989], is increasing in the level of development (N). Demand is declining in

4. Alternative specifications for the cost function are possible. For example $C(.)$ might be a function of the rate of growth ($\dot{N}(t)$) divided by the stock of remaining products ($1 - N(t)$) because costs might rise as the supply of potential monopolists shrinks. Our empirical work on urbanization uses a functional form based on this assumption. This assumption would not change the results of the model.

5. Somewhat inelegantly, we ignore discounting over the period where the industrializing firm has a monopoly. This assumption simplifies the model and does not change any of the results. The model assumes perfect capital markets; we will not investigate the possible role that openness plays in increasing the flow of capital (e.g., Levine and Zervos [1998]).

price, which is denoted P.[6] The monopolist has the ability to set prices only in the fraction $(1 - \theta)$ of the domestic economy that is closed to foreign competition.

In the rest of the economy and in the export sector, the monopolist is a price-taker and can sell as much as he wants at a price, denoted $P^W(N)$, which is determined by world supply. This international price may rise or fall with N to capture the idea that international competition may be more intense for more or less advanced products. If $\partial P^W/\partial N > 0$, then foreign competition is less intense for more advanced foreign products, and the country has a comparative advantage in producing more advanced goods.

Total monopolist profits after industrialization are

$$(1) \quad P(1 - \theta)\, D(Y(N),P) + P^W(N)\,(K - (1 - \theta)\, D(Y(N),P)) - cK.$$

This implies that the monopolist will set prices so that $P = P_w(\epsilon_p^D - 1)/\epsilon_p^D$, where ϵ_p^D refers to the absolute value of the demand elasticity of domestic demand.[7]

Monopolists industrialize until the point where profits from industrializing equal the cost of industrialization or $\Pi(N, \theta) = C(\dot{N})$, where $\Pi(N, \theta)$ denotes the profits of the monopolist of the Nth good. Differentiation of this equation shows that

$$(2) \quad \frac{\partial \dot{N}}{\partial N} = \frac{1}{C'(\dot{N})} \cdot \left[(P - P^W(N))(1 - \theta)\frac{\partial D(Y,P)}{Y}\frac{\partial Y}{\partial N} + (K - (1 - \theta)\, D(Y,P))\frac{\partial P^W}{\partial N}\right].$$

The first term within the brackets indicates the "big push" effect; the current level of industrialization raises the demand for new products and therefore raises the rate of industrialization. Following Murphy, Shleifer, and Vishny [1989], rising income may speed growth by increasing aggregate demand. The second term is the "learning-by-doing" style effect which implies that the current level of industrialization will raise the level of growth if the country's comparative advantage is in more advanced products.

We now assume that $C(\dot{N}) = C\dot{N}$ and differentiate equation

6. All prices and costs are in units of an unspecified agricultural numeraire commodity.

7. Throughout this paper we adopt the convention that $\epsilon_Y^X = Y\partial X/X\partial Y$ for any function X and any parameter Y.

(3) with respect to the openness parameter (θ):

$$(3) \qquad \frac{\partial^2 \dot{N}}{\partial N \partial \theta} = \frac{1}{C}\left[D(Y,P))\frac{\partial P^W}{\partial N} - (P - P^W(N))\frac{\partial D(Y,P)}{Y}\frac{\partial Y}{\partial N}\right],$$

which is positive if and only if $\epsilon_Y^D \epsilon_N^Y/(1 - \epsilon_P^D) > \epsilon_N^{PW}$. This equation describes the extent to which openness increases or decreases the positive connection between initial development and later growth. The first term in brackets in equation (3) will be positive as long as international comparative advantage promotes the connection between initial development and later growth. This term captures the effect that we associate with learning-by-doing models. The second term in the brackets is negative and captures the fact that in open economies, demand is not determined by domestic income.

Openness will increase the connection between the level of industrialization and later growth when (1) there is a strong connection between domestic income and demand, (2) there is a strong connection between industrialization and the level of income, (3) domestic demand is more inelastic, and (4) the world price is not rising too quickly with the level of industrialization. When the elasticities that make the big push important are large, then there will be a stronger connection between initial income and growth in closed economies. When the elasticity that drives the learning-by-doing-type effect is high, then we should expect to see that the connection between the level and growth of industrialization is greatest among open economies.

The next section discusses how this model will serve as the basis for our empirical work. We must emphasize that our work is only a test of the simple theories sketched here. Our model does not address learning-by-doing, nor does it qualify even as a gross simplification of Stokey [1991] and Young [1991].

Empirical Strategy

Both theories focus on countries in the process of early industrial transformation, not on fully developed, advanced economies.[8] Both theories also predict a positive relationship between initial income and later growth. Therefore, we examine economies where there is a positive, unconditional connection between initial income and later growth: poorer countries in the late twentieth century and U. S. states in the nineteenth century.

8. In the model, increasing returns cease when $N(t) = 1$.

Our primary test is whether there is a stronger positive effect of initial income for open or closed economies. We estimate

$$(4)\quad Growth = \alpha + \beta^{*}Initial\ Wealth + \gamma^{*}Openness + \delta^{*}Initial\ Wealth^{*}Openness + \epsilon.$$

When the interaction term (δ) is positive, then initial wealth is more important for open economies and the Stokey-Young theories are supported. Conversely, when this term is negative, initial wealth and openness are substitutes and the extent-of-the-market theories gain credence.

In the cross-country regressions we use per capita GDP as our measure of development. Across U. S. states, we use urbanization (and for later years, the level of manufacturing) as our measure of development. The model refers to the share of the products that are being made industrially, which makes the choice of urbanization natural. Urbanization captures the extent to which the economy has become industrialized.

Furthermore, the best data source on nineteenth century state income levels [Easterlin 1960] is available only at 40-year intervals, has large measurement error, and contains no correction for local price differences. Interstate mobility, especially within regions, should eliminate welfare differences across states. The income differences that do exist, should therefore represent a combination of unobserved heterogeneity and compensating differentials, such as the high incomes regularly received in remote, undeveloped, frontier states. In contrast, urbanization, which is the percentage of the population living in towns of more than 2500 persons, is available every ten years, simple and reliable, invariant with respect to local price levels, and reliably connected with economic development (see Bairoch [1988]).

The growth of urbanization can be measured by the change in the level of urbanization, but we instead normalize by dividing growth in urbanization by the share of the population that could, potentially, have moved from rural to urban states. Thus, our measure of urban growth is the change in percent urbanized divided by the initial share of the population that was not urbanized.[9]

9. Ades and Glaeser [1994] present a complete set of results using change in urbanization as the dependent variable. We are implicitly assuming that the changes in population occur through migration not differential fertility.

III. Evidence on Increasing Returns from World Data

Our cross-country data on population and real per capita GDP are from the Barro and Wolf [1989] data set. The trade data are from the World Bank's *World Tables* and consist of imports and exports of goods and nonfactor services. Data on educational enrollment and political variables are from Barro and Lee [1993]. The land area data come from the 1986 edition of the *FAO Production Yearbook.*

Regression (1) in Table I shows our first result on the positive connection between initial GDP and GDP growth for poorer economies. The relationship between initial levels and subsequent growth rates is well-known.[10] The coefficient of 0.019 indicates that an increase of US$ 100.00 in 1960 GDP increases the average growth rate by 0.19 percent per year. As discussed earlier, we restrict ourselves to the poorer economies where increasing returns seem to operate. We weight by country population. The cutoff point for being included in our 64-country sample was determined by regression (1) and is US$ 1650 or less in 1960.[11]

We measure openness by using the share of trade to GDP (i.e., exports plus imports divided by GDP) over the 1960 to 1985 period. Regression (2) shows our openness measure and the cross effect between openness and initial income, without any other control variables.[12] The pure effect of openness on growth is moderately positive. A one-standard deviation increase in the share of total trade to GDP increases the growth rate (at the average initial level of GDP per capita in 1960 of US$ 766) by 0.56 percentage points per year (0.29 standard deviations). The cross effect between GDP and openness is strong. For an open economy with a share of trade to GDP of 0.49 (which is slightly over the mean), there is no relationship between GDP and GDP growth. For a low trade, closed economy (with a trade share of 0.22, one

10. Our results do not differ from Barro and Sala-i-Martin [1992]. The positive unconditional connection between growth and initial income can be seen in Figure 2 of that paper.

11. The US$ 1650 cutoff was found by choosing the spline point to maximize the F-statistic, which is the standard technique for endogenous spline functions.

12. While we do later control for standard variables, there is a strong case for parsimony in controls. Continent dummies have been criticized as ad hoc variables that soak up useful variation. Education enrollment and investment variables are endogenous variables that reflect the same sort of development that we are attempting to measure with the dependent variable. Furthermore, the basis of convergence coefficients that is known to be created by measurement error is exacerbated when there are controls that are correlated with initial income.

TABLE I

Dependent variable	Average per capita GDP growth 1960–1985 (1)	(2)	(3)	(4)	(5)*	Specialization (6)	GDP growth (7)
Estimation method	OLS	OLS	OLS	OLS	TSLS	OLS	OLS
Intercept	0.0070	−0.0088	−0.0264	−0.0337	−0.0610	0.0144	−0.0088
	(.0031)	(.0074)	(.0075)	(.0092)	(.0157)	(.0675)	(0.0073)
Per capita GDP in 1960	0.0192	0.0333	0.0451	0.0422	0.0852	0.3393	0.0465
	(.0034)	(.0102)	(.0096)	(.0097)	(.0212)	(0.0918)	(.0122)
Per capita GDP in 1960* dummy for GDP > $1650	−0.0225						
	(.0041)						
Openness		0.0817	0.1504	0.1263	0.2491	1.2630	0.1292
		(0.0288)	(.0271)	(.0302)	(.0711)	(.2620)	(0.0112)
Per capita GDP in 1960* openness		−0.0723	−0.1481	−0.1337	−0.2875	−0.9839	−0.1084
		(.0360)	(.0298)	(.0307)	(.0758)	(.3272)	(.0385)
Specialization							−0.0368
							(0.0148)
Schooling enrollment controls**	No	No	Yes	Yes	Yes	No	No
Political variables***	No	No	No	Yes	Yes	No	No
Africa, East Asia, and Sub-Saharan Africa continent dummies	No	No	Yes	Yes	Yes	No	No
Number of observations	99	64	64	64	64	58	58
Adjusted R^2	0.2400	0.2302	0.7094	0.7282		0.4200	0.3100

Standard Errors are in parentheses. All regressions are weighted by country population.

* The instruments for this specification include country area, a dummy for landlocked status, an island dummy, a small island dummy, a small country dummy, and interactions of all five of these variables with initial income.

** Schooling enrollment controls include primary, secondary, and higher education enrollment in 1960.

*** Political variables include the Gastil index of political rights in 1960 and the number of revolutions and coups between 1960 and 1985.

standard deviation below the mean), a US$ 100.00 increase in the level of initial GDP raises the growth rate by about 0.17 percentage points per year. Figure I shows the relationship between growth and initial GDP in low trade, closed economies. Figure II shows that such a relationship does not hold for high trade open economies.

In regression (3) we introduce dummies for East Asia, Africa, and Latin America, and for primary, secondary, and higher

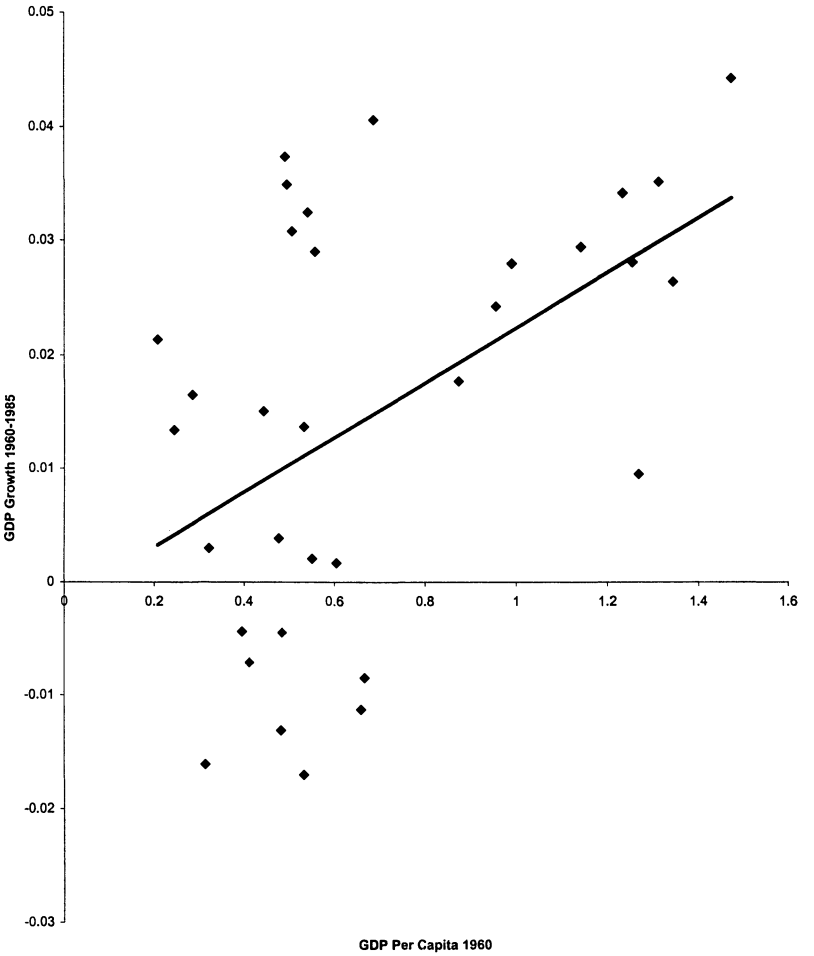

FIGURE I
GDP Growth versus Initial Income, Low Trade Sample

Per Capita GDP Growth 1960–1985 = .000 + .023 GDP 1960,
(.005) (.007)

$N = 33$, Adjusted $R^2 = 0.21$

schooling enrollment in 1960. The magnitude of the cross effect rises once these controls are included.[13] Regression (4) includes

13. We have also run these regressions with nonlinear specifications of GDP as an explanatory variable. The results remained essentially unchanged.

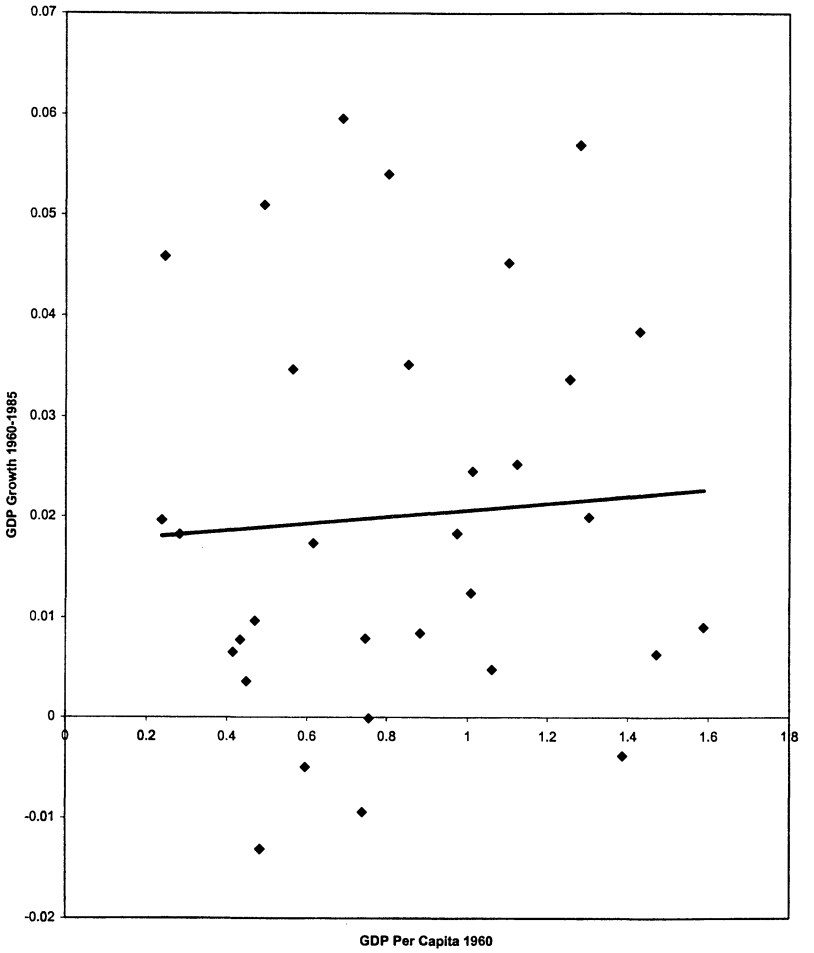

FIGURE II
GDP Growth versus Initial Income, High Trade Sample

Per Capita GDP Growth 1960–1985 = .016 + .004 GDP 1960,
(.008) (.009)

$N = 33$, Adjusted $R^2 = 0.21$

control variables for two political variables: the Gastil index of political rights in the country as of 1960, and the number of revolutions and coups over the 1960 to 1985 period (all data are from Barro and Lee [1993]). The principal interaction parameters strengthens these controls.

Regression (5) reproduces regression (3) using the instruments for trade based on physical attributes of the country used in Alesina, Spolaore, and Wacziarg [1998]: land area, a dummy for landlocked status, an island dummy, a small island dummy, and a small country dummy.[14] We interact these instruments with initial GDP to form instruments for the interaction between trade and GDP. In this regression the interaction between initial income and later growth becomes more negative. Of course, country land area may have a direct effect on growth by affecting the extent-of-the-market. However, if this instrument is biased due to that effect, it only creates further support for the importance of market size in generating growth.

In Appendix 4 we illustrate the robustness of our results. Our ordinary least squares results are robust to the elimination of population weighting. The interaction between openness and initial income is significant only at the 15 percent level in the instrumental variables specification without population weighting. Using the complete set of instruments suggested by Alesina, Spolaore, and Wacziarg [1998], the interaction is significant with and without population weighting. Although in other work we have found that the negative interaction appears to be robust to a large variety of other standard education and government control variables, our small sample size almost ensures that there will be some specifications under which the interaction coefficient fails to be significant.[15]

The Stokey [1991] and Young [1991] models suggest that the cost of openness for less developed countries is a reduction in the range of goods being produced. We test this implication using a measure of the range of goods being produced by each country. For 58 of the poor economies, we have a measure of diversity of exports (taken from the *United Nations Handbook of International Trade and Development Statistics*).[16] While this measure is far from ideal, we believe that it captures something of the range of products being produced. Countries with low values of this index tend to be producing only basic commodities; countries with a high value of the index produce a wide range of advanced products.

14. In Ades and Glaeser [1994] we check for robustness by using the share of the trade at the start of the period.

15. The Appendix also shows that including sufficient schooling variables eliminates this positive connection between initial income and growth.

16. This "Hirschman" index of diversity is given by $(\sqrt{\Sigma_{j=1}^{j=n} n(x_j/X)^2} - 1)/(\sqrt{n} - 1)$, where i is the country index, n is the number of commodities, x_j is the value of exports of commodity j, and X is the total value of exports.

In regression (6) we find support for the basic intuition of the Stokey-Young models. For countries with even a moderate amount of trade (openness greater than 0.4), income increases the range of products being exported. Openness increases specialization, but only for poorer economies. In richer economies openness actually increases the range of products being exported, just as the Stokey and Young models predict.

In regression (7) we confirm a second point of the Stokey-Young models: countries that produce a wider range of products tend to grow faster. However, this result is not robust to including a full range of continent dummies, schooling variables, and political controls. As such, this result should be seen as suggestive rather than conclusive. The learning-by-doing models appear to have some empirical support, even though, as we know from regression (2) the overall effect of the extent-of-the-market appears to be stronger than effects coming through the channels suggested by the learning-by-doing models.

IV. Evidence on Increasing Returns from U. S. Nineteenth Century Data

We take our data on U. S. state population, urbanization, and labor force from the *Historical Statistics of the United States* [1976]. The data on the labor force engaged in manufacturing in 1880 and 1890 come from several issues of the *Statistical Abstract of the United States.* For earlier years, we use the 1840 to 1870 censuses.[17]

In the nineteenth century U. S. data we use two measures of openness: the physical distance to a major port and the level of rail density in the states that are close to the state in question (excluding the state itself). The railroad data for 1860 to 1890, and the data on distance from the state's main city to the main

17. A problem with the U. S. census labor force and manufacturing data is that the population covered did not remain invariant during our sample period. Thus, while the 1840 and 1870 censuses covered the whole population, the 1850 census covered the free male labor force above fifteen years of age only, and the 1860 census included free females and extended the age limit to ten years or older. We dealt with this problem by obtaining census estimates of the slave population. To construct labor shares in manufacturing, we assumed that all slaves of fifteen years of age and older were in the labor force and that 15 percent of them were in manufacturing (we based this figure on Sokoloff [1988]). Before these corrections, Southern states displayed wild variations in their manufacturing shares. We also tried altering our assumptions about slave labor force participation rates and shares in manufacturing slightly, but none of our results seemed sensitive to these alterations.

TABLE II
DESCRIPTION OF THE U. S. DATA

State	Total population	Percentage urban 1840	Percentage urban 1890
	Five most urbanized U. S. states in 1840		
Rhode Island	109,000	44	85
Massachusetts	738,000	38	82
Louisiana	352,000	30	25
Maryland	470,000	24	47
New York	2,429,000	19	65
	Five least urbanized U. S. states in 1840		
Arkansas	98,000	0	6
Florida	54,000	0	20
Iowa	43,000	0	21
Vermont	292,000	0	15
Wisconsin	31,000	0	33

regional city, are from the *Statistical Abstract of the United States.* For each state, the relevant regional port was either New York, San Francisco, or New Orleans, depending on proximity. The railroad data for 1840 and 1850 come from Wicker [1960]. Literacy data are taken from the U. S. censuses.[18] Finally, we gathered data on over 300 occupations from the 1850 and 1870 censuses.

Our U. S data cover the decades 1840–1890. Data were not collected before 1840 because of availability problems. We stopped in 1890 because (1) massive immigration to eastern cities potentially biases our results, (2) rail development had become extremely comprehensive by 1890 so variation across regions in rail becomes less important after then, and (3) by 1890 the eastern states had relatively high levels of development after which increasing returns seem to fade in the cross-country data. Moreover, the period 1840–1890 is typically considered the era of America's industrialization.

Table II shows that in nineteenth century America the most and least urbanized states correspond reasonably well with areas that are commonly thought to have been the most and least well developed (see, e.g., Passell and Lee [1979]). This connection supports our contention that urbanization is a reasonable proxy for economic development. By comparing 1840 and 1890 urbaniza-

18. Before 1860 the census provides no information on literacy rates for the slave population.

TABLE III

Dependent variable	Growth in urbanization (1)	(2)	(3)	(4)	Manufacturing growth (5)	Division of labor (6)	Urbanization growth (7)
Initial urbanization/manufacturing	.3144 (.024)	.2888 (.0247)	.2343 (.0208)	.3452 (.061)	.0793 (.070)	5.9967 (.7299)	.2283 (.0670)
Distance dummy		−.0034 (.0163)	−.0047 (.0132)				
Distance * initial urbanization/manufacturing		.1013 (.0344)	.0866 (.0314)				
Initial regional railroads density				.0004 (.0003)	.001 (.0002)	.0158 (.0041)	.0003 (.0004)
Rail density * initial urbanization/manufacturing				−.0009 (.0005)	−.0033 (.001)	−.0256 (.106)	−.0012 (.0007)
South dummy			−.035 (.010)				
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	160	160	160	160	160	58	58
Adjusted R^2						.75	.72

Standard Errors are in parentheses. Railroad density refers to railroad density in neighboring states. Regressions (1)–(5) include observations on decadal growth for 1840–1850, 1850–1860, 1870–1880, and 1880–1890. Regressions (6) includes observations for 1850 and 1870 only, and Regression (7) includes observations for 1850–1860 and 1870–1880. All regressions have been corrected for correlation within states across decades.

tion levels, it can be seen that urbanization proceeded faster in the developed states.

Table III contains regressions for our U. S. states sample. This table shows results for a pooled sample of states over the period 1840–1890.[19] Our dependent variable is the decadal change in the share of urbanized population in the state divided by one minus the initial share of urbanized population in the state. The first regression in Table III documents the basic positive relationship between urbanization growth and initial levels of urbanization. The time dummies tell us that 1840–1850 and 1880–1890 were the periods of strongest urbanization growth. The coefficient on initial urbanization in regression (1) is positive and highly

19. The decade 1860–1870 has been eliminated due to the Civil War; our results become much stronger when that decade is included. Our regressions are run with state-specific random effects.

significant. It indicates that a 10 percent increase in the amount of initial urbanization, at low levels of urbanization, leads to an approximately 3.1 percent increase in the share of urbanized population relative to initial nonurbanized population over a ten-year period.

As general data on trade flows between U. S. states are not available, our first measure of openness is a distance dummy, which takes a value of 0 if a state was within 200 miles of a major regional port and a value of 1 otherwise.[20] Regression (2) finds that (by this measure) openness is negatively related to urbanization growth. A state that is far from major regional ports experiences a fall in the rate of urbanization of almost 2 percent per decade, holding initial urbanization constant at zero. However, as the rate of urbanization increases, this negative effect of distance disappears. By the time initial urbanization is at 15 percent, distance is irrelevant for growth. In other words, there is a strong positive cross effect between *lack* of openness and the initial level of urbanization. These results are consistent with our previous finding of a negative cross effect between openness and initial levels for world data.

Regression (3) includes a dummy variable for being a Southern state, i.e., a member of the Confederacy.[21] Given the remarkable series of events that affected the American South (shocks to cotton prices in the 1850s, the Civil War, Reconstruction, etc.), it seems reasonable to examine whether the results withstand the inclusion of this regional dummy. The cross effect is still significantly positive, but its coefficient drops slightly. In an experiment such as this one, we would expect the inclusion of regional dummies to reduce the distance-related coefficients (since both distance and regional dummies are geographic variables even if there had never been a Civil War).

Regression (4) looks at an alternative measure of openness: the extent of rail development in the states that belong to the same census region as a chosen state, while excluding the specific

20. Our decision to look at distance as a discrete rather than as a continuous variable is dictated by (1) our theoretical discussion that focused on a sharp difference between open and closed economies and (2) our lack of a clear theory of distance which gives us any preferable functional form (we found no papers that suggest a linear functional form relating openness to growth). Small changes in the specification of the functional form seem to make no difference in our results. The list of "open" and "closed" states according to this classification is in Appendix 1.

21. We have also run these regressions controlling for literacy for the decades 1850 and 1870 and found that the basic results on urbanization and distance remain unchanged.

state in question.[22] Neighbors with highly developed transportation systems constituted larger potential markets for the state in question. In addition, they facilitated access from the main production sites in the state to major regional ports. Here again, we see a very powerful negative cross effect between openness and growth. Initial urbanization only matters for states in regions with poorly developed railroad networks.

Regression (5) shows the effect on the share of the labor force employed in manufacturing and changes in the share of urbanized population living in the state's largest city. The manufacturing regressions only cover the 1870–1890 decades, as we do not have reliable manufacturing data for the earlier periods. Unlike urbanization, manufacturing shares mean revert.[23] Again for manufacturing we find a negative cross effect between openness and initial development. The results document a negative cross effect between initial levels of development (whether measured by income, rates of urbanization, or shares of the labor force in manufacturing) and openness.

The Division of Labor

Our results confirm the relevance of the extent-of-the-market, but we have not tried to better understand why the extent-of-the-market is so important. While a full examination of why market size matters is beyond the scope of this paper, we now test whether increasing returns in closed economies occur primarily because market size increases the division of labor which in turn increases growth.

Using hand-collected occupation data from the 1850 and 1870 U. S. censuses, we create a measure of the division of labor using a "Dixit-Stiglitz" variety index. Specifically, we define the division of labor index as

$$(5)\quad Dixit - Stiglitz\ Index_{i,t} = \left[\sum_j \left(\frac{employment_{ij,t}}{aggregate\ employment_{i,t}}\right)^{1/2}\right]^2,$$

where i is the state, and j is the occupation. This measure captures

22. There are nine census regions: Pacific, Mountain, West North Central, East North Central, Middle Atlantic, New England, South Atlantic, East South Central, and West South Central.

23. This is true primarily because of the more developed states in this later period. If this regression is run only for states with a low level of initial manufacturing, divergence is still found.

the extent of variety in occupations. While some of this measure might reflect industrial variety, our analysis suggests that it reflects the division of labor. In our data, variety of occupations comes from having people with occupations like butcher or barber, instead of having everyone classified as a journeyman worker or a farmer. We believe that this index reasonably captures Smith's notion of the division of labor because it strongly weighs the presence of relatively obscure professions.[24]

Regression (6) in Table III shows the connection between the division of labor and the extent-of-the-market. Urbanization is strongly correlated with the division of labor, as Smith [1976] argues. Regional rail density is also connected with a finer division of labor. As predicted by the extent-of-the-market theory, urbanization is less important in states that are more open.

Regression (7) in Table III shows that the division of labor is strongly connected to later growth in the level of urbanization for the state. Since we only have the division of labor variable for 1850 and 1870 (due to data availability), regression (8) reproduces our basic results using those years alone. Comparing regression (7) and regression (8) shows that the division of labor also tends to mitigate the importance of the extent-of-the-market variables. This finding can be interpreted to mean that the extent-of-the-market works, in part, through creating a finer division of labor. However, the extent-of-the-market variables still matter above and beyond the division of labor, so a finer division of labor appears to be only one means through which the extent-of-the-market generates economic growth.

V. Conclusion

Using two different and unconnected data sets, we find that openness and initial development are substitutes in generating growth. This finding suggests that growth may be a function of the size of the market, since openness and domestic developments are substitutes in providing a market for new goods. Our work does not support models that suggest that openness will be particularly harmful for the poorest countries. We find just the reverse.

24. Since occupational classifications changed over census years, we rescaled the indices of specialization obtained by subtracting from the corresponding value for each state-decade the decadal sample mean and dividing by the decadal standard deviation.

However, we do find that the level of specialization across the poorest countries declines with openness. Furthermore, we found that too much specialization (presumably in low growth products) is bad for growth. These findings do support an implication of the learning-by-doing models that we have just rejected. We reconcile these seemingly opposing results by acknowledging the importance of the effects pointed to by Young [1991], Stokey [1991], and others, but arguing that these effects are less important than the other, positive, effects of openness for poorer economies. Naturally, our findings cast doubt on some of the protectionist implications of this line of work.

We also find support from nineteenth century data for the idea that the division of labor is connected to urbanization and the extent-of-the-market and that the division of labor is important for development.

APPENDIX 1: U. S. SUMMARY STATISTICS

Variable	Obs	Mean	Std. dev	Minimum	Maximum
Population in 1870 (POP70)	29	1214	981	125	4382
Urbanization in 1870 (UR70)	29	0.23	0.18	0.024	0.74
Change in share of urbanized population 1870–1880 (URCH)	29	0.033	0.035	−0.025	0.107
Local railroads density in 1870 (RAIL70)	29	61.85	47.90	4.85	187.20
Regional railroads density (EXRL70)	29	47.60	30.52	2.50	115.34
Land area (LAREA)	29	36.43	20.59	1.058	69.322
Share of urbanized population in main city in 1870 (MCITSH70)	29	0.11	0.10	0.01	0.34
Change of the share of urbanized population in main city 1870–1880 (MCITCH)	29	0.006	0.021	−0.033	0.061
White literacy rate in 1870 (WLR70)	29	0.93	0.031	0.85	0.98
Occupational Dixit-Stiglitz index for 1870 (DS70)	29	0	1	−1.36	1.84
Share of the labor force in manufacturing (MAN70)	42	0.14	0.13	0.014	0.56
Change in the share of the labor force in manufacturing (1870–1880) (MANCH)	42	−0.007	0.030	−0.088	0.0623

APPENDIX 2: U. S. SIMPLE CORRELATIONS

	POP70	UR70	URCH	RAIL70	EXRL70	AREA	MCIT70	MCITCH	WLR70	DS70	MAN70	MANCH
Population 1870												
Urbanized % 1870	.237 (.215)											
Urbanized % change	.188 (.329)	.649 (.000)										
Railroads 1870	.168 (.384)	.770 (.000)	.849 (.000)									
Regional rail 1870	.344 (.067)	.480 (.008)	.590 (.000)	.477 (.009)								
Land area	.390 (.037)	−.527 (.003)	−.531 (.003)	−.704 (.000)	−.333 (.088)							
Main city population	.251 (.190)	.767 (.000)	.335 (.075)	.404 (.030)	.188 (.328)	−.367 (.050)						
Main city growth	.221 (.250)	.661 (.000)	.724 (.000)	.620 (.000)	.486 (.008)	−.416 (.024)	.494 (.007)					
White literacy	.212 (.270)	.373 (.047)	.488 (.007)	.378 (.043)	.593 (.000)	−.185 (.337)	.187 (.332)	.290 (.127)				
Division of labor	.373 (.046)	.870 (.000)	.799 (.000)	.832 (.000)	.653 (.000)	−.527 (.003)	.648 (.000)	.579 (.001)	.580 (.001)			
Manufacturing	.013 (.950)	.866 (.000)	.704 (.000)	.828 (.000)	.566 (.002)	−.705 (.000)	.527 (.004)	.637 (.000)	.434 (.021)	.825 (.000)		
Manufacturing change	.151 (.444)	.153 (.437)	.412 (.030)	.306 (.114)	.254 (.192)	−.242 (.215)	.068 (.729)	.323 (.093)	.054 (.785)	.286 (.140)	.019 (.924)	

The significance probability of the correlation under the null hypothesis that the statistic is zero is shown in parentheses.

APPENDIX 3: OPEN AND CLOSED STATES IN THE 29-STATE SAMPLE
(USING DISTANCE FROM MAJOR REGIONAL PORT)

Open states	*Closed States*	
Alabama	Arkansas	Mississippi
Connecticut	Florida	New Hampshire
Delaware	Georgia	North Carolina
Louisiana	Illinois	Ohio
Maryland	Indiana	South Carolina
Massachusetts	Iowa	Tennessee
New Jersey	Kentucky	Vermont
New York	Maine	Virginia
Pennsylvania	Michigan	Wisconsin
Rhode Island	Missouri	

APPENDIX 4

Dependent variable	Average per capita GDP growth 1960–1985						
	(1)	(2)*	(3)**	(4)**	(5)	(6)	(7)
Estimation method	OLS	TSLS	TSLS	TSLS	OLS	OLS	OLS
Intercept	−0.0085	−0.0133	−0.0524	−0.0173	0.0082	0.0021	0.0151
	(.0135)	(.0228)	(.0125)	(.0198)	(.0041)	(.0048)	(.0084)
Per capita GDP in 1960	0.0159	0.0223	0.0747	0.0266	0.0180	0.0145	0.0080
	(.0107)	(.0212)	(.0160)	(.0167)	(.0057)	(.0055)	(.0059)
Openness	0.0691	0.0763	0.2378	0.0844			
	(.0206)	(.0461)	(.0532)	(.0384)			
Per capita GDP in 1960 * openness	−0.0637	−0.0787	−0.2574	−0.0897			
	(.0215)	(.0514)	(.0560)	(.0407)			
Population weighting	No	No	Yes	No	Yes	Yes	Yes
Schooling enrollment controls***	Yes	Yes	Yes	Yes	No	No	Yes
Political variables****	Yes	Yes	Yes	Yes	No	Yes	Yes
Africa, East Asia and sub-Saharan Africa continent dummies	Yes	Yes	Yes	Yes	No	Yes	Yes
Number of observations	64	64	64	64	64	64	64
Adjusted R^2	0.5512				0.1260	0.5848	0.6420

Standard Errors are in parentheses.

* The instruments for this specification include country area, a dummy for landlocked status, an island dummy, a small island dummy, a small country dummy, and interactions of all five of these variables with initial income.

** Here, we use all of the instruments used in regression (2) and dummies for whether the country was a colony and whether the country became independent since WWII, and the interactions between these variables and initial income.

*** Schooling enrollment controls include primary, secondary, and higher education enrollment in 1960.

**** Political variables include the Gastil index of political rights in 1960 and the number of revolutions and coups between 1960 and 1985.

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