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Financial Development and Intersectoral Allocation: A New Approach

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ABSTRACT

This paper uses a new methodology based on industry comovement to examine the role of financial market development in intersectoral allocation. Based on the assumption that there exist common global shocks to growth opportunities, we hypothesize that country pairs should have correlated patterns of sectoral growth if they are able to respond to these shocks. Consistent with financial markets promoting responsiveness to shocks, countries have more highly correlated growth rates across sectors when both countries have well-developed financial markets. This effect is stronger between country pairs at similar levels of economic development, which are more likely to experience similar growth shocks.

ECONOMISTS HAVE LONG CLAIMED that financial market institutions perform an important function in the development process, particularly through their role in allocating resources to their most productive uses. This allocative role of financial institutions was recognized first by Schumpeter (1912), who conjectured that bankers help to identify entrepreneurs with good growth prospects, and therefore help to reallocate resources to their most productive uses. If this is the case, then well-developed financial institutions are crucial to an efficient allocation of resources in response to shocks to growth opportunities. In light of this proposed function, a test of the role of financial development in the allocation of resources would involve examining whether financial development helps firms or industries take advantage of growth opportunities in a timely manner. This is not straightforward, however, since growth opportunities are not generally observable to the econometrician. In this paper, we propose two new (indirect) tests of the financial development a growth hypothesis that circumvents the need to measure these opportunities directly. Our approach utilizes a methodology that focuses on the *composition* of growth, that is, the cross-sectional allocation of growth across industries. Our primary variable of interest is the degree of comovement in growth rates across industries in different countries, which we measure by the correlations in intra-industry growth rates across

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country pairs during the 1980s. This correlation will be high if two countries are growing (or declining) in similar industries during the same time period.[1]

Our tests are based on the following observation: If a pair of countries experiences a similar set of shocks to growth opportunities, they will have correlated growth rates across industries only if both have capital markets that allow each economy to allocate resources efficiently in response to these opportunities. We may use the preceding observations to test the role of financial development in efficient resource allocation by examining whether comovement is predicted by the extent of financial development.

Our specific tests focus on two separate assumptions about the structure of growth shocks across countries. First, we consider the possibility that there exist global shocks that affect a given industry equally across *all* countries. Such opportunities could arise as consequences of technological innovations (e.g., the invention of semiconductors or cellular phones) or global shifts in factor prices (e.g., oil shocks). These global shocks will create new opportunities for growth in some industries and will require reallocation of resources to these industries. If this reallocation process requires well-developed financial institutions, only countries with high levels of financial development will be able to respond to these new growth opportunities. As a result, patterns of growth will be more similar (i.e., we will observe a higher correlation) among countries with well-developed financial markets that are thus able to make this reallocation. This is our first main result—we find that the correlation in growth rates is higher for pairs of countries in which both countries have high levels of financial development. We interpret this as suggesting that high financial development allows industries to respond to industry-specific global shocks.

Next, we relax our assumption on the structure of global shocks, allowing for shocks that depend on some country characteristics. Pairs of countries that share these characteristics will experience more similar growth opportunities, and should therefore have more highly correlated growth rates in response, if resource allocation is efficient. This generates an additional test of the role of finance: Financial development should lead to more correlated patterns of growth rates for pairs of countries that have more similar growth opportunities. This requires a measure of similarities in growth opportunities across countries. We create one such measure based on the intuitive idea that countries at similar levels of per-capita income will experience demand-driven similarities in industrial growth rates. This idea was first proposed by Chenery (1960), and we therefore refer to it below as the Chenery hypothesis. Dornbusch, Fisher, and Samuelson (1977) propose a supply-side theory that generates the same empirical prediction. As an auxiliary result we find support for this hypothesis using our methodology—countries that are closer together in terms of income per capita experience higher correlations in intra-industry growth rates. This

[1] A similar approach utilizing pairwise correlations has been utilized in the past by sociologists examining social networks, and more recently, has been applied to the field of corporate strategy. In particular, Khanna and Rivkin (2001) use this approach to look at the related topic of patterns of profitability across countries.

finding leads to our second approach to identifying unobserved growth opportunities. Specifically, we assume that growth opportunities are more similar in countries at similar levels of per-capita income. In contrast to our first test, which assumes that shocks affect industries in the same way across all countries, this allows different groups of countries to receive different shocks. We argue below that this assumption represents a significant step forward relative to the previous work in this literature (e.g., Rajan and Zingales (1998)). We find support for this more refined test of the financial development—growth hypothesis in the data: Financial development leads to more correlated growth rates primarily for countries at similar levels of industrial development (and hence with similar growth opportunities). More precisely, we find that the interaction of the level of financial development and similarity in income levels has a significant effect on the correlation in industrial growth rates.

To summarize, while we never actually observe growth opportunities, we are able to test the finance and growth hypothesis by looking at *commonalities* and *differences* in growth opportunities. We find support for the finance and growth hypothesis primarily when the level of financial development is measured as domestic credit provided by private sector banking institutions, suggesting that both the level of financial development as well as the ownership structure of financial intermediaries are important. This paper also makes an important methodological contribution: The usefulness of our approach is not limited to the two tests that we propose, and other identifying assumptions are possible avenues for future exploration. In the concluding section we make several suggestions for future applications of our methodology.

Our work is closely related to that of Rajan and Zingales (1998), who have also developed a test of the finance and growth hypothesis. They deal with the nonobservability of growth opportunities by assuming that there are certain industries that are financially dependent, and hence have a greater need for outside financing. Their findings parallel those described above; however, they make the strong assumption that some industries have an *inherent need* for outside financing, and that the level of outside financing of U.S. firms may be used as a proxy for this need in other countries. Our approach is less restrictive in a couple of ways: In a sense, their assumption of the constant industry-specific external financing needs is similar to our first assumption that global shocks to growth opportunities are the same for a given industry, in that both involve an industry characteristic that is constant across countries.[2] However, in our test, we are never required to actually *measure* any industry-specific characteristic, and therefore do not have to rely on U.S. data to generate any industry-specific measures. Furthermore, our second test offers a step forward, as it allows growth opportunities to depend on country-specific characteristics, thereby relaxing the assumption of uniform shocks across countries.

[2] The similarity goes even further, as it is likely that industries that experience shocks to their growth opportunities would require more external financing and would appear to be more financially dependent (see Fisman and Love (2003) for elaboration on this point).

Our paper fits into the more general literature on the role of financial development in the growth process that began with Goldsmith (1969) and has been followed by the empirical work of King and Levine (1993), and more recently by Demirguc-Kunt and Maksimovic (1998), Wurgler (2000), Love (2003), Beck, Demirguc-Kunt, and Levine (2003), and others. Unlike these previous papers ours focuses on the composition rather than on the average level of growth. Our paper is also related to the strand of literature that focuses on disaggregating growth rates into country-, time-, and sector-specific components.[3] These papers look at the percentage of the total variation in growth rates that each of the components can explain, rather than at the underlying factors that cause these components to vary. Our focus is on understanding the underlying determinants of industry comovement.[4]

The rest of this paper is organized as follows. In Section I, we describe our methodology in greater detail. In Section II we describe our data. In Section III.A we introduce our pair-wise correlations methodology with a motivating application and show that the correlation is higher for countries that have similar levels of income. In Section III.B, we present results supporting our first assumption of the common shocks to growth opportunities, and in Section III.C we examine the second assumption and test the interaction of the similarity in growth opportunities and financial development. We conclude in Section IV.

I. Methodology

The difficulty in testing whether financial development helps the allocation of resources to sectors with good growth opportunities, as noted in the introduction, is that growth opportunities are not generally observable to the econometrician: A firm (or industry, or country) may be not growing because there are no growth opportunities, or because there are opportunities, but no financing to allocate resources to them. In the latter case, the availability of financing will affect the relationship between actual (realized) growth and potential growth (i.e., growth opportunities). The test of whether financial development helps an economy shift resources to those industries with good growth opportunities can be formally written as a relationship between actual (realized) growth,

[3] The identification of components in these studies is based on the temporal dimension in growth rates. By estimating the error-components models, the country- and industry-fixed effects (which are referred to as long-run trends), are identified, along with the short-term deviations from these trends (see, e.g., Stockman (1988), Costello (1993), Bayoumi and Prasad (1997), and more recently, Loayza, Lopes, and Ubide (2001)).

[4] A few other distinctions are noteworthy. Since we are using a correlation coefficient as a measure of comovement, the country-level components are differenced out; that is, our correlation measure is not affected by average country-level growth rates. Similarly, we abstract from the temporal dimension by using average growth rates for the decade 1980 to 1990. Finally, unlike previous papers that studied aggregate sectors (primary, manufacturing, and agriculture), we focus on 37 disaggregated industries within the manufacturing sector.

growth opportunities, denoted GO^* (the asterisk emphasizes that this variable is unobservable), and the level of financial development, FD:

$$(Actual)\ Growth_{ic} = \beta GO^*_{ic} * FD_c + e_{ic}, \tag{1}$$

where β is expected to be positive (i.e., financial development increases the alignment of actual growth with potential for growth, i.e., GO^*).[5] Because we cannot actually measure growth opportunities directly, we identify possible commonalities in the shocks to growth opportunities that will allow us to make inferences about comovements in growth rates.

A. Global Industry-Specific Shocks

We begin by assuming that there exist global industry-specific shocks to growth opportunities; that is, some component of GO^*_{ic} is common across countries:

$$GO^*_{ic} = \eta_i + \varepsilon_{ic}. \tag{2}$$

As discussed in the introduction, these global shocks could be caused by technological innovations and/or by shifts in factor prices. If financial development helps industries take advantage of these common shocks, this assumption implies that the comovement of growth rates will be higher in countries with higher levels of financial development. Intuitively, if one country in the pair is not at a high level of financial development, its patterns of development will be dominated by the random component of actual growth (e_{ic} in equation (1)), and so will not be correlated with patterns of growth in the other country in the pair. That is, growth will occur in industries with (randomly distributed) favorable pre-existing conditions, for example, those that have plenty of cash on hand from past profits or those supported by the government through protectionist policies. By contrast, if both countries have well-developed financial institutions, growth will be dominated by GO^*_{ic}, and hence the countries will share a common component, η_i, in their patterns of growth.

As discussed above, our measure of comovement is the correlation between industrial growth rates for any two pairs of countries. So, for any pair of countries c and, we take the growth rates for a set of industries (in our case we have 37 industries aggregated by the three-digit SIC level) and calculate the correlation in the growth rates of these industries in the two countries over the same time horizon.[6] Our unit of observation is therefore a country pair, and the first test results in the following specification:

$$\text{Corr}(Growth_{ic}, Growth_{id}) = \alpha * f(FD_c, FD_d) + \varepsilon_{cd}, \tag{3}$$

[5] The subscripts above emphasize that for each firm or industry i, in a country c, growth opportunities will be industry- and country-specific (the time dimension is suppressed for notational simplicity).

[6] For the purposes of this paper we focus on the average growth rates for the decade of the 1980s, so our correlation does not have a temporal dimension (as it is a correlation in average growth rates over that decade). We are currently working on extending this work to take advantage of the time-series nature of the data.

where $f(\cdot)$ is a function of two countries' levels of financial development. If both countries have a high degree of financial development, the correlation in their growth rates should be high, as both countries in a pair take advantage of η_i. However, if either member of the pair is *not* financially developed, there will be little comovement, as at least one country will not be responding to the common shock η_i. The function $f(\cdot,\cdot)$ that captures this intuition is one that will result in a high value *only* if both countries in a pair have high levels of financial development. This is best represented by a minimum metric, that is, $\text{Min}(FD_c, FD_d)$. We refer to this metric as a measure of *high development of both countries*. Based on the assumption of common industry-specific shocks, the financial development and growth hypothesis implies that α is positive.[7]

B. Differential Growth Opportunities and Financial Development

In this section, we relax the assumption that shocks to growth opportunities are common to all countries in our sample.[8] It is likely that industries in different groups of countries will have different growth opportunities. For example, some theories suggest that as technologies mature, industries using those technologies migrate from developed to developing economies (see Dornbush et al. (1977)). This will result in growth opportunities that are similar for countries at similar levels of economic development. The same pattern is predicted by the early work of Chenery (1960), who also argued that countries at a similar level of development should grow in similar industries, though in his model this pattern is driven by differences in income elasticities of demand. An illustrative example of the differential growth opportunities in countries with different income levels is the recent globalization shock,[9] which resulted in shifting growth opportunities in labor-intensive industries (such as textiles or shoes) from countries with high wages to countries with low wages. Our second test is designed to capture the effect of such shocks, assuming that income level is a reasonable proxy for differential opportunities.

In terms of the pairwise correlations that we are studying here, these theories imply that the correlation will be higher for countries that are more similar in their levels of economic development. We use the absolute value of the difference between two countries' log GDP per capita as a measure of (dis)similarity in the levels of development for a pair of countries. We test this hypothesis by:

$$\text{Corr}(Growth_{ic}, Growth_{id}) = \beta|\log(Income_c) - \log(Income_d)| + \varepsilon_{cd}. \quad (4)$$

[7] It may seem unusual at first to treat a high FD country paired with a low FD country symmetrically with a low FD country paired with a low FD country, since in the former case, at least one country in the pair will indeed have a systematic component to its intersectoral allocation. Note, however, that this immediately will require us to provide some structure for global growth opportunities, rather than treating it as an unobserved, latent variable. See Fisman and Love (2003) for one approach to measuring growth opportunities directly.

[8] As we argued in the introduction, the limitation of our first assumption is similar to that of the methodology in Rajan and Zingales (1998), which relies on the measure of the dependence on external finance constructed using the U.S. data. The technological reasons that result in such an industry-level dependence are likely to be different in countries at a different level of development.

[9] We thank an anonymous referee for this suggestion.

We predict a negative value for β, so that countries that are closer in their level of development (i.e., have smaller distances) have more correlated industrial growth rates. We find strong support for this hypothesis in Section III.A.

This hypothesis facilitates our second test of the financial development—growth hypothesis by providing an empirical validation for the assumption that growth opportunities for each industry i depend on the level of development of the country c:

$$GO^*_{ic} = \eta_i \phi(Income_c) + \varepsilon_{ic}. \tag{5}$$

This implies that countries at a similar level of development will have similar growth opportunities. The test of whether financial development helps industries take advantage of their growth opportunities is now a test of the interaction of the similarity in growth opportunities (i.e., the distance between the per-capita income) and the minimum level of financial development in a pair:

$$\begin{aligned} &\text{Corr}(Growth_{ic}, Growth_{id}) \\ &\quad = \gamma * |\log(Income_c) - \log(Income_d)| * Min(FD_c, FD_d) + \varepsilon_{cd}. \end{aligned} \tag{6}$$

If the finance and development theory holds, firms in both countries will be able to take advantage of these similar opportunities (and hence generate a high correlation in growth rates), only if both countries are at a sufficiently high level of financial development. This implies that the interaction, γ, is expected to be negative. Once again, we underscore that if firms are unable to take advantage of growth opportunities, then similarity in log(*GDP*) should not be predictive of patterns of comovement, since resource allocation will be dominated by the noise term, e_{ic}, in equation (1).

Finally, before continuing, we note that in our regressions, an econometric issue arises because of the use of pair-wise correlations (i.e., we have what is called dyadic data). Since each country appears $N - 1$ times in the data, it is probably not appropriate to assume independence of the error terms in our models.[10] Techniques to deal with this issue have already been developed by social network researchers. Thus, in addition to reporting standard t-statistics, we utilize the nonparametric quadratic assignment procedure (QAP) to calculate significance levels (Baker and Hubert (1981), Krackhardt (1988)).[11]

II. Data

For easy reference to earlier work, our data are drawn primarily from Rajan and Zingales (1998), and are described in detail in that paper. The main variable

[10] For example, if ε_{cd} and ε_{de} are both large, our priors would be that ε_{ce} would be large as well.

[11] QAP is in essence a bootstrap procedure that preserves interdependencies between rows and columns. Repeating this procedure N times generates a distribution of coefficients under the null of no relationship. The reported percentiles correspond to the place of the actual coefficient in this sampling distribution. The percentiles below 2.5% and above 97.5% represent significance at the 5% level. The results reported in the paper used 1,000 repetitions. We thank Bill Simpson for kindly providing us with his STATA routines to implement the QAP.

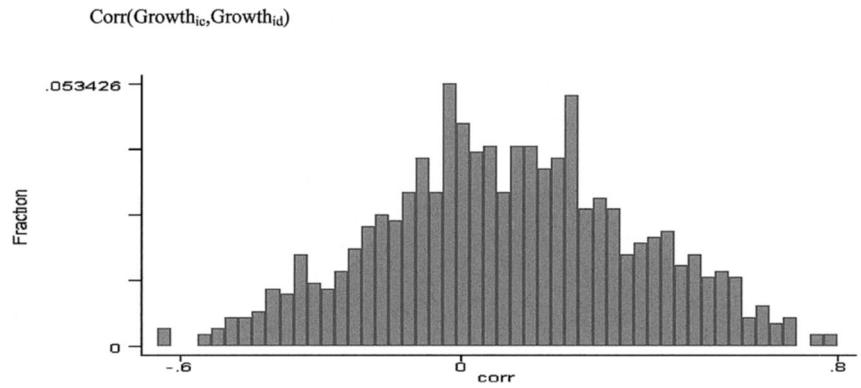


Figure 1. Distribution of the correlation coefficients.

of interest is real growth in valued added, estimated for each of 37 industries in 42 countries obtained from United Nations (1993). To be consistent with previous work we use the total growth for these industries between 1980 and 1990. To study the comovement in growth rates across countries, we calculate the correlation of industry growth rates for each pair of countries (c, d). The correlation will be high if two countries have been growing (or declining) in similar industries during the 1980s. We have a total of $(42 \times 41)/2$ (i.e., 861) of such pairs. Table II shows the basic summary statistics and Figure 1 shows a histogram of the distribution of the correlations for all possible pairs of countries. The average number of industries used in calculating this correlation is 26 because not all data for all industries are available for all countries. The correlations range from -0.65 to 0.8, with an average of 0.096. While the average level of correlation is quite low, among more similar countries it is considerably higher. For example, the average rate of correlation between the United States and all other countries is 0.025; however, the correlation is 0.65 with Canada and 0.58 with the United Kingdom.[12]

We calculate the distance and minimum metrics as discussed above for our country-level variables of interest, which include the per-capita level of income, several measures of financial development as discussed below, and a number of controls. A complete list of the variables used in this paper with the original sources is given in Table I; in Table II we report the correlation matrix for the main country-level measures.

[12] Several examples of the similarities in the growth rates in these countries help to show that, indeed, the same sets of industries seem to be growing (and declining) in this group of similar countries: Plastic products, industry 356, has grown by about 7% in both the United States and Canada and by about 5% in the United Kingdom; drugs, industry 3522, grew by 9.5% in Canada, by 8% in the United States, and by 6% in the United Kingdom. On the other side, footwear, industry 324, has declined by about 5% in the United States, by 4% in Canada, and by 1.5% in the United Kingdom; and petroleum refineries, industry 353, have declined by about 3% in all three countries. Similar growth rates are also observed for motor vehicles, printing and publishing, food and beverage, and many other industries. There are of course dissimilarities as well; for example, tobacco has grown by 10% in the United States and by 0% in the United Kingdom—this is easily incorporated into our model by allowing for a noise term in the expression for GO^*.

Table I
Variable Definitions and Sources

Variable	Description
Industry-level variables	
Industry growth	Annual compounded growth rate in real value added estimated for the period 1980–1990 for each ISIC industry in each country from Rajan and Zingales (1998).
Country-level variables	
Domestic credit	Ratio of domestic credit held by monetary authorities and depositary institutions (excluding inter-bank deposits) scaled by GDP for 1980. Original source is International Financial Statistics (IFS).
Market cap.	Ratio of stock market capitalization to GDP in 1980 (IFS).
log GDP PC	Log of GDP per capita in U.S. dollars in 1980 (IFS).
Private bank credit	Domestic credit provided by nongovernmental financial institutions, calculated using average percent of assets held by private banks over 1970 and 1995, from La Porta et al. (2002).
Legal origin	Dummies for English, French, German or Scandinavian origin of the legal system, from La Porta et al. (1998).
Accounting standards	Amount of disclosure of company's annual reports in each countries, from La Porta et al. (1998).
Education	Percentage of population receiving secondary school education, 1980, from Rajan and Zingales (1998).
Corruption	ICRG Measure of corruption; higher number indicates lower corruption.
Property rights	Index of property rights protection utilized by Keefer and Knack (1995) for 1984, the earliest year with complete coverage.
Govt intervention	Summary index of government intervention in the economy, given by the average of indices reflecting government consumption to GDP, and total transfers and subsidies to GDP, from Gwartney et al. (1995).
Trade openness	Ratio of exports and imports over GDP.
Measures calculated on pairs of countries	
Correlation	Correlation over all industries in industry growth (described above) for all pairs of countries.
$\lvert X_c, X_d \rvert$	Absolute distance in variable X for each pair of countries (c, d) defined as $\lvert X(c) - X(d) \rvert$. If X is the level of development, distance will be small if both countries are either similarly developed or similarly underdeveloped. It is a measure of similarity in the level of X.
$\text{Min}(X_c, X_d)$	Minimum value in variable X for each pair of countries (c, d) defined as $\text{Min}(X(c), X(d))$. Minimum is high only when both countries have high value of X.
$\text{Max}(X_c, X_d)$	Maximum value in variable X for each pair of countries (c, d) defined as $\text{Max}(X(c), X(d))$. Maximum is high when either country has a high value of X.
Total trade flows	Total trade flows between two countries in a pair as a percentage of the sum of the two countries' GDP.
Same legal origin	Equals 1 if both countries come from the same legal origin and 0 otherwise.

Table II

Descriptive Statistics and Correlations

See Table I for variable definitions and sources. All variables are calculated for each pair of countries using formulas given in Table I. Numbers in brackets in the first row in Panel A show the number of industries used in calculating the correlation for each pair of countries. Numbers in parentheses in Panel B show p-values; stars indicate significance at 5% level.

Panel A: Descriptive Statistics

	N Obs.	Min	Mean	Median	Max	Std.
Correlation	861	−0.647	0.096	0.092	0.796	0.27
[Number of industries]		[6]	[26]	[27]	[37]	[9]
|log *GDP PC*|	861	0.002	1.537	1.354	4.780	1.13
|Domestic Credit|	861	0.001	0.260	0.216	0.841	0.19
|Market Capitalization|	861	0.000	0.281	0.144	1.624	0.36
|Private Bank Credit|	861	0.000	0.237	0.197	0.964	0.19
Min(log *GDP PC*)	861	4.793	7.137	7.047	9.505	1.24
Min(Domestic Credit)	861	0.162	0.395	0.378	0.990	0.15
Min(Market Capitalization)	861	0.000	0.080	0.052	1.203	0.11
Min(Private Bank Credit)	861	0.005	0.182	0.137	0.771	0.14

Panel B: Correlations

	Correlation	|GDPPC|	|Dom. Credit|	|Market Cap.|	|Private Bank Credit|	Min (*GDP PC*)	Min (Dom. Credit)	Min (Market Cap.)
|*GDP PC*|	−0.31*							
	(0)							
|Domestic Credit|	−0.06	0.04						
	(0.08)	(022)						
|Market Capitalization|	0.05	−0.08*	−0.08*					
	(0.15)	(0.01)	(0.02)					
|Private Bank Credit|	−0.08*	0.26*	0.41*	−0.03				
	(0.01)	(0)	(0)	(0.32)				
Min (*GDP PC*)	0.32*	−0.71*	0.05	0.08*	−0.08*			
	(0)	(0)	(0.15)	(0.01)	(0)			
Min (Dom. Credit)	0.22*	−0.15*	−0.26*	−0.12*	0.06	0.35*		
	(0)	(0)	(0)	(0)	(0.8)	(0)		
Min (Market Capitalization)	0.05	−0.17*	−0.08*	0.12*	−0.09*	0.27*	0.08*	
	(0.11)	(0)	(0)	(0)	(0.001)	(0)	(0.02)	
Min (Private Bank Credit)	0.31*	−0.35*	−0.03	0.11*	−0.24*	0.61*	0.52*	0.43*
	(0)	(0)	(0.36)	(0)	(0)	(0)	(0)	(0)

A. Measures of Financial Development

We consider a number of measures of financial development. First, to once again be consistent with previous work we use: *DOMCRED* (total domestic credit deflated by the GDP) and *MCAP* (stock market capitalization deflated by the GDP). Furthermore, we take advantage of new data collected by La Porta, Lopez-de-Silanes, and Shleifer (2002), referred to henceforth as LLS, on the ownership of banks around the world. In their work, they look at the impact of government ownership of banks on the level of development, and find that the concentration of banking assets in the hands of the government is negatively correlated with subsequent growth. They claim that may be because government bank ownership results in politically expedient rather than economically efficient resource allocation. Thus, resources may be diverted to industries with political clout rather than to those with positive growth opportunities. Barth, Caprio, and Levine (2000) make similar arguments in claiming that greater state ownership of banks is associated with more poorly developed banks and non-bank financial institutions. This is also consistent with evidence from case studies: for example, Clarke and Cull (1999) find that public banks in Argentina divert a much larger proportion of resources to primary production and government services than do private banks, and that public banks also have a higher percentage of nonperforming loans. Collectively, this suggests that both the *quality* and the *quantity* of financial assets need to be considered.

We extract two variables from the LLS paper: *GOVPCT70* and *GOVPCT95*, which are the proportion of assets of a country's top 10 banking institutions that were held by the public banks in 1970 and 1995, respectively. Since we are interested primarily in government ownership of banks during the 1980s, we take a simple average of these two numbers as our measure of the concentration of government ownership (*GOVPCT*).[13] As our main measure of financial development we define:

$$PRIVCRED = (1 - GOVPCT) * DOMCRED.$$

This gives an estimate of the ratio of total privately provided domestic credit to the GDP, and incorporates both elements of banking asset quantity as well as quality.[14] We refer to this measure as private bank credit.[15]

[13] Not surprisingly, the correlation of GOVPCT70 and GOVPCT95 is fairly high ($\rho = 0.77$). Since most banking privatizations took place during the 1980s and 1990s, GOVPCT70 perhaps deserves more weight. None of our regressions change substantially if we use GOVPCT70 in place of GOVPCT.

[14] We also experimented with other measures of financial development. Instead of total domestic credit we have used private credit, which is credit provided by depositary institutions to the private sector. We have similarly looked at the product of private credit with percent of privately owned banks. Both measures produced virtually identical results to the ones reported below. As alternative measures of stock market development, we used turnover (value traded over market capitalization), value traded over GDP, and new equity issuance over GDP, obtained from Demirgüç-Kunt and Levine (2001). As in the results reported below, no other alternative measure of stock market development produced significant results.

[15] We have also constructed a similar measure using domestic credit to private sector multiplied by the proportion of the private banks; the use of this alternative measure does not affect our results.

III. Results

A. Comovement and Similarity in Level of Development

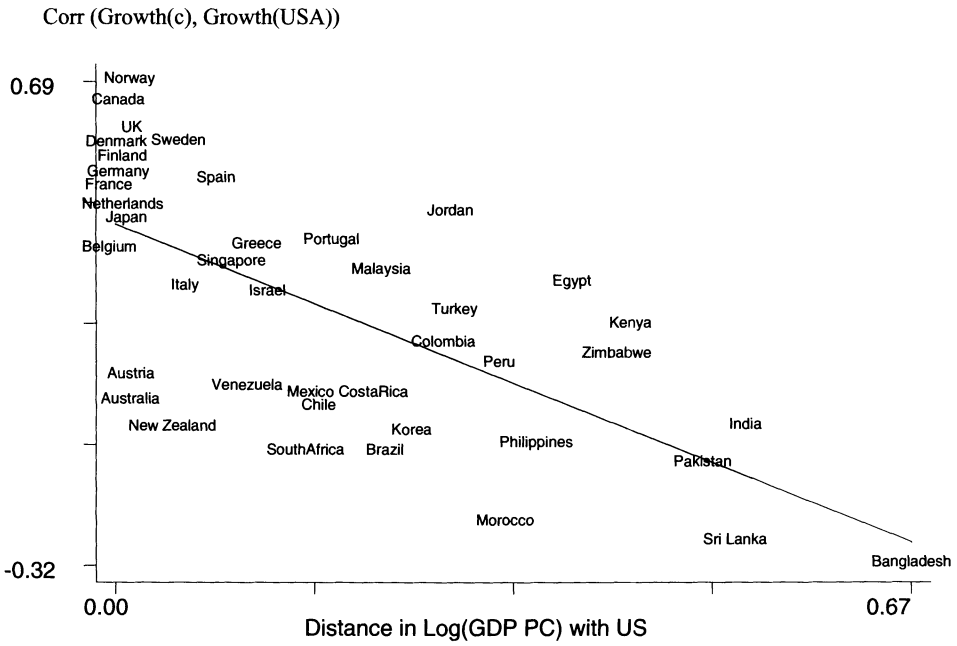
We start our pair-wise analysis with the hypothesis that countries at similar levels of per-capita income will have similar patterns of industrial growth. We begin with this hypothesis in order to (1) illustrate our methodology in an intuitive setting and (2) set the stage for a further test of the role of financial institutions in the resource allocation process.

To test this hypothesis we use the model given in equation (4), which predicts a negative value for β, so that countries that are closer in their levels of economic development have more closely correlated industrial growth rates. In Table II, we observe that the comovement in industry growth (i.e., our correlation measure) and distance between GDP are negatively correlated with coefficient of -0.3, significant at the 1% level. To provide a visual illustration we present in Figure 2, Panel A, the relationship between distance in income and correlation in growth rates for each country paired with the United States. The data show a strong negative correlation: The regression coefficient is -0.99 with a t-statistic of -6.7 and an R^2 of 0.46. In Panel B we present a similar graph for all pairs of countries.

Table III shows our main results for the relationship between similarity in income and correlations in industry growth rates for all pairs of countries. We find strong support for the hypothesis embodied in equation (4): Countries that are closer in per-capita income have industry growth patterns that are more highly correlated. Using the QAP method for calculating standard errors, we find that the coefficient on $|\log(Income_c) - \log(Income_d)|$ is significant at the 1% level. Its size implies that countries that are twice as close in per-capita income (equal to 1 standard deviation (SD); $\sigma = 1.13$) will have a correlation of industry growth rates that is higher by 0.10, which is over one-third of 1 SD for our correlation measure. We add various other measures of development distance metrics as regressors in models (2) to (9). Additional covariates include measures of corruption (as a summary statistic of legal/institution distance); education (a proxy for human capital, which could be an important determinant of industrial composition); accounting standards; population (to proxy for market size); legal origin (we add a dummy equal to one if two countries in a pair have the same legal origin); similarity in income distributions measured by the similarity in Gini coefficients; and two measures of trade: "trade openness" a measure that reflects similarity in the total level of trade (exports + imports) as a fraction of GDP, and "trade flows" that measures the total trade flows between two countries in a pair as a fraction of the sum of the two countries' GDP. We find that only $|Gini\ Coefficient|$ and the trade measures are significant at the 5% level or greater, using QAP bootstrapped standard errors. The most important result of this table is that the significance of $|GDP|$ is unaffected by the inclusion of these covariates.

B. Global Shocks to Growth Opportunities

In this section we test our primary hypothesis that well-developed financial markets are necessary to take advantage of growth opportunities. As discussed



(Panel B)

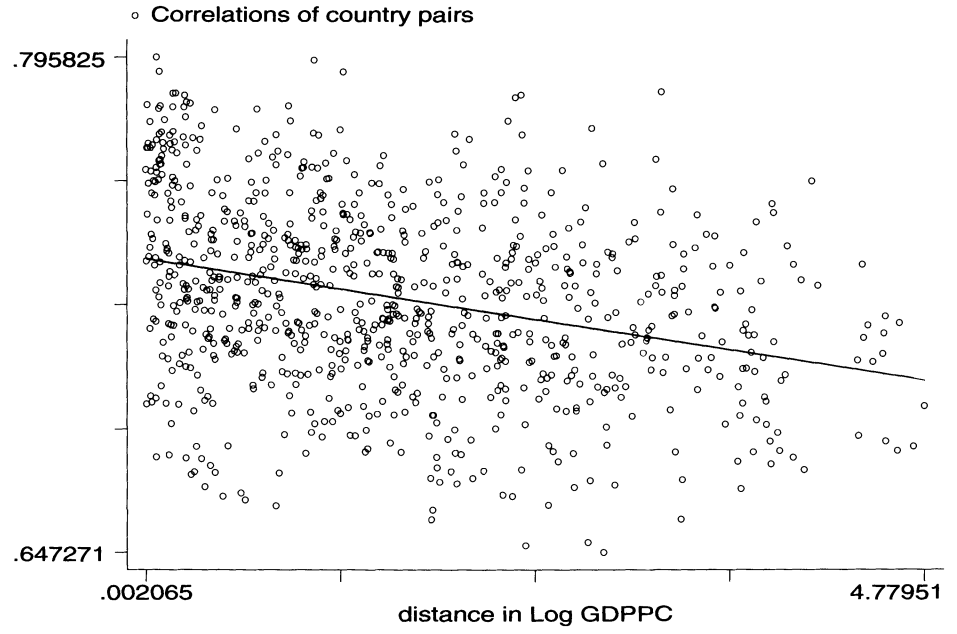


Figure 2. Distance in income levels and correlation of industrial growth patterns. Panel A presents correlation with the United States (the regression coefficient is −0.99 with a t-statistic of −6.7 and an R^2 of 0.46). Panel B presents correlation of industrial growth for country pairs (the regression line corresponds to the Model 1 in Table III).

Table III

Comovement in Growth Rates and Distance in Income

The dependent variable is correlation in growth rates across all industries for each pair of countries. The constant is included in all regressions (not reported). The *t*-statistics are in parentheses and the bootstrapped percentile (using QAP procedure described in text) is in brackets. Percentiles below 2.5% or above 97.5% represent significance at the 5% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Distance in |log *GDP PC*|	−0.074 (−9.65) [0%]	−0.06 (−5.5) [0%]	−0.07 (−5.8) [0%]	−0.07 (−8.9) [0%]	−0.079 (−9.2) [0%]	−0.067 (−8.9) [0%]	−0.075 (−9.7) [0%]	−0.075 (−9.9) [0%]	−0.063 (7.8) [0%]
|Corruption|		−0.02 (−2.8) [4.9%]							
|Accounting Standards|			0.004 (0.5) [59%]						
|log of Population|				0.002 (0.3) [54%]					
|Education|					0.009 (2.3) [92%]				
|Gini Coefficient|						−0.004 (−4) [2%]			
Same Legal Origin							−0.009 (−0.5) [36%]		
|Trade Openness|								−0.022 (3.5) [9.9%]	
Total trade flows									9.85 (3.1) [100%]
N Obs.	861	861	561	820	820	861	861	861	861
R^2	0.094	0.10	0.06	0.085	0.092	0.11	0.095	0.10	0.11

in Section I, our first approach is based on the assumption that there exist global shocks to growth opportunities in particular industries that are common across all countries. Since responses to global shocks require a high level of financial development, growth rates will move together only if *both* countries have high levels of financial development. We implement this idea by considering Min(FD_i, FD_j) as a regressor to explain correlations in growth rates. Given our results in Section III.A, we augment the model given in equation (3) to also include a measure of the distance between income levels to make sure that our measures of financial development are not picking up the effect of similarities in income levels.

These results are reported in Table IV, utilizing various measures of financial development. We find that when *FD* is measured as domestic credit, its

Table IV

Comovement in Growth Rates and the Level of Financial Development

The dependent variable is correlation in growth rates across all industries for each pair of countries. Model 3 excludes South Africa and Singapore, which are outliers on market capitalization. The constant is included in all regressions (not reported). The *t*-statistics are in parentheses and the bootstrapped percentile (using QAP Procedure described in text) is in brackets. Percentiles below 2.5% or above 97.5% represent significance at the 5% level. In models (12) and (13), we present results with the sample split according to global growth rates. Model (12) reports results for industries above the median growth rate; model (13) reports results for industries below the median level; see text for details.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
|log *GDP PC*|	−0.067 (−8.8) [0%]	−0.074 (−9.5) [0%]	−0.074 (−9.5) [0%]	−0.055 (−6.8) [0%]	−0.038 (−3.5) [2.5%]	−0.045 (−4.1) [0.8%]	−0.048 (−4.3) [0.7%]	−0.044 (−4.9) [0.1%]	−0.046 (−4.7) [0.1%]	−0.054 (−6.5) [0%]	−0.049 (−6.06) [0%]	−0.092 (−8.1) [0%]	−0.077 (−8.2) [0%]
Min(Domestic Credit)	0.31 (5.5) [99%]					0.25 (4.4) [97%]							
Min(Market Cap.)		0.004 (0.03) [56%]	0.11 (2.1) [77%]										
Min(Private Bank Credit)				0.44 (7.3) [99.8%]			0.40 (5.6) [99%]	0.33 (4.7) [98%]	0.43 (6.4) [99.7%]	0.45 (7.5) [99.8%]	0.36 (5.53) [99.4%]	0.30 (4.0) [98.7%]	0.33 (4.5) [98.4%]
Min(log *GDP PC*)					0.044 (4.3) [99%]	0.029 (2.7) [91%]	0.01 (0.9) [64%]						
Min(Property Rights)								−0.0043 (2.5) [86.9%]					
Max(Govt Intervention)									−0.029 (−3.93) [4.3%]				
|Trade Openness|										−0.024 (−3.76) [6.4%]			
Trade Flows											7.71 (2.92) [99.8%]		
N Obs.	861	861	780	861	861	861	861	861	861	861	630	861	861
R^2	0.13	0.095	0.11	0.14	0.12	0.13	0.14	0.15	0.14	0.15	0.13	0.11	0.13

coefficient is significant at the 2% level (using QAP percentiles). However, if *FD* is measured as market capitalization, β_2 is no longer significant.[16] Finally, our measure of financial development that accounts for both the size and ownership structure of financial institutions, private bank credit, is significant at the 1% level. The coefficient on this variable takes on values that range from 0.30 to 0.44, depending on the specification. Since the *SD* of Min(*FD*) is 0.14, this implies that an increase in the minimum level of financial development between a pair of countries of 1 *SD* will increase the correlation in their industry growth rates by 0.04–0.06. Given that the average correlation is 0.09, this is quantitatively significant. As an alternative interpretation, we may think of the increase in the correlation in growth rates between Turkey and Denmark (the countries at the 25th and 75th percentiles of private bank credit, respectively) that would result if Turkey were to have the same level of private bank credit as Denmark. Since this would increase Min(*FD*) by 0.2, our model implies that the rate of correlation in their industry growth rates would increase by about 0.08. Finally, we may compare the effect of financial development to the effect of differences in income on comovement, by comparing the coefficients of Min(*FD*) and |log *GDP PC*|. Since the *SD* of |log *GDP PC*| is about 10 times that of Min(*FD*), while the coefficient on Min(*FD*) is about eight times larger than that of |log *GDP PC*|, we conclude that the effects of similarity in income and financial development on comovement are fairly similar.[17] Thus, if we accept the assumption that there is some component of growth opportunities that is common across countries, our results support the hypothesis that well-developed financial institutions, particularly in the form of private sector banking institutions, allow firms to take better advantage of these opportunities.

This baseline specification suffers from a potential omitted variable bias: It may be that Min(FD_c, FD_d) is simply picking up the fact that growth rates are only correlated if both countries are rich; that is, growth opportunities are more closely correlated in generally well-developed countries, but not in underdeveloped countries. One way of examining this possibility is to include Min(log($Income_c$), log($Income_d$)) as an independent variable. We add this variable in model (5) and find that it takes a significantly positive coefficient, indicating that pairs of well-developed countries have higher comovement in industrial growth patterns. We then add this measure along with our two measures of *FD* that were significant on their own—*DOMCRED* and *PRIVCRED*. They both remain significant (although the coefficient on min(*DOMCRED*) is now significant at the 6%, level while Min(*PRIVCRED*) remains significant at the 1% level). However, Min(*GDP*) is no longer significant at conventional levels.

[16] There are two extreme outliers in the market capitalization index, South Africa and Singapore; when we exclude them in model (3), the coefficient becomes weakly significant according to a standard *t*-test but not significant according to the QAP bootstrapped percentile method.

[17] Note that it is difficult to compare the magnitude of our effects with those reported by Rajan and Zingales and others, since the units of our outcome variables are noncomparable (i.e., our methodology considers correlations in growth rates while others look at average levels of growth rates). This further highlights the difference between our methodology and those utilized previously.

Next, we consider a few additional controls to ensure the robustness of our results.[18] As noted by Beck et al. (2003), property rights are an important determinant of financial market development. We therefore include in column (8) a measure of minimum property rights, utilizing the Property Rights Index generated by Keefer and Knack (1995), to ensure that our financial development measure is not proxying for a pattern of greater comovement among countries with more secure property rights.

Furthermore, while we have controlled for government intervention in resource allocation through state-run banks, we wish to control for government intervention in the economy more generally.[19] We therefore include a variable that reflects the extent to which at least one country in each pair has a high level of government intervention in the economy, that is, the maximum level of government intervention in each country pair. The intuition behind using the maximum metric is precisely analogous to our rationale for using the minimum metric for financial development: If the economy in either country is overly dominated by government decisions, rather than by market-oriented allocations, then growth will be dictated by bureaucratic fiat, rather than by growth opportunities. Hence, if either country has a high level of government intervention, the countries' growth rates may be expected to be less correlated. Our measure of government intervention is taken from Gwartney, Lawson, and Block (1996), and reflects government consumption, transfers, and subsidies as a fraction of GDP. The measure Max(*Govt Intervention*) is included as a control in column (9).

Finally, in columns (10) and (11) we add the two measures of trade flows as potential omitted variables that are correlated with both financial development and the comovement in growth rates: |*Trade Openness*|, where openness is measured by the sum of total imports and exports deflated by GDP; and *Trade Flows*, which measures total trade flows between two countries in a pair as a percentage of the sum of the two countries' GDP.

In all cases, we find that the coefficient on Min(*FD*) remains significant. Thus, we find support for our theory of finance and development, which does not seem to be explained by a simple omitted-variable problem.

We also consider the possibility that the effect of financial intermediaries on resource allocation may differ according to whether the reallocation is in response to positive or negative shocks. Financial intermediaries should, in theory, play a similar role regardless of the type of shock, reallocating resources from relatively low-return industries to industries with relative high returns.

[18] We also considered the possibility that a small number of countries with extreme values of financial development could be driving our results. There are three countries in our sample with values of private credit above 0.6 (Japan, Spain, and the Netherlands). When these countries were dropped from the analyses, all results were unaffected.

[19] The role of government intervention in resource allocation is ambiguous. On one side government intervention could channel the resources toward the growing sectors even in the absence of well-developed financial markets, as in the case of government involvement in the computer sector in Taiwan. However, many counter-examples exist, for example, the Korean government's promotion of ship building in the 1970s.

In the case of the negative shocks, financial intermediaries would be crucial in prying funds from declining industries that would otherwise be inefficiently reinvested. Consistent with this argument, Wurgler (2000) finds that in countries with weak shareholder rights (which are associated with low levels of financial development), managers overinvest in declining industries. However, because of difficulties in the seizure of assets, for example, intermediaries may be less effective in taking resources from declining industries than in channeling new funds to booming sectors. To our knowledge, this asymmetric relation between financial development and resource allocation has received neither theoretical nor empirical treatment in the finance literature.[20]

To examine the possibility of an asymmetric role that financial development may have on resource allocation, we begin by calculating the average growth rate for each industry globally, to generate an average world growth rate per industry, g_I. We then split our sample into "grower" and "decliner" industries, according to whether they are above or below the median of g_I.[21] If it is the case that financial development plays a greater role in resource reallocation in response to positive shocks, then we should observe a greater impact of Min(*PRIVCRED*) on industry comovement among growers and relatively little effect among decliners. Models (12) and (13) show the results of this sample split; there does not appear to be any evidence of a differential effect of financial development on growing versus declining industries.

C. Growth Opportunities as a Function of Level of Development

In our initial set of regressions (Table IV), we assumed that there was some component of growth opportunities that was common across all countries (commonalities). In our final set of regressions below, we take advantage of a model that suggests that there are *systematic similarities* in growth opportunities and use this to look for systematic similarities in growth patterns in countries that are financially well developed. In particular, recall that above, we described several theories that predict similar growth opportunities in countries at similar levels of per-capita income. However, if our finance and development theory holds, firms will be able to take advantage of these similar opportunities only if a country is at a sufficiently high level of financial development; hence, a pair of countries at similar levels of development will only have highly correlated patterns of growth if they *also* have well-developed financial institutions to allow firms to take advantage of these opportunities. This implies that the interaction, $\text{Min}(PRIVCRED_c, PRIVCRED_d) * |\log(Income_c) - \log(Income_d)|$, should be negative. We report the results of this interaction in Table V. As predicted, the

[20] We thank an anonymous referee for pointing out this potential asymmetry.

[21] In our sample of average growth rates over the decade of the 1980s, only one industry (ship manufacturing) has experienced an actual decline in terms of the world average mean and median growth rates. While we calculate the global growth rate using a simple average of industry growth rates, rather than weighting by economy size, virtually identical results are obtained if global growth is calculated by using total industry growth rates that effectively puts a greater weight on the growth rates of larger economies.

Table V

Interaction of Financial Development and Distance in GDP PC

The dependent variable is correlation in growth rates across all industries for each pair of countries. The constant is included in all regressions. The *t*-statistics are in parentheses and the bootstrapped percentile (using QAP procedure described in text) is in brackets. Percentiles below 2.5% or above 97.5% represent significance at the 5% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
|log *GDP PC*|	−0.023	−0.077	−0.026	−0.025	0.002	−0.028	−0.029
	(−1.2)	(−7.9)	(−2.5)	(−2.4)	(0.16)	(−2.71)	(2.75)
	[27%]	[0%]	[10%]	[12.7%]	[52%]	[9%]	[8.5%]
Min(Domestic Credit)	0.47						
	(4.7)						
	[99.7%]						
Min(Market Capitalization)		−0.07					
		(−0.3)					
		[38%]					
Min(Private Bank Credit)			0.7	0.61	0.76	0.71	0.59
			(7.9)	(5.6)	(7.4)	(7.9)	(6.24)
			[100%]	[99.9%]	[99.9%]	[100%]	[99.5%]
Interactions							
|log *GDP PC*| * Min(Domestic Credit)	−0.11						
	(2.2)						
	[7.9%]						
|log *GDP PC*| * Min(Market Cap.)		0.059					
		(0.6)					
		[66%]					
|log *GDP PC*| * Min(Private Bank Credit)			−0.19	−0.17	−0.26	−0.18	−0.15
			(4.1)	(3.3)	(4.3)	(3.99)	(3.06)
			[2.2%]	[5.1%]	[3.1%]	[3%]	[5.9%]
Min(Property Rights)				−0.002			
				(1.12)			
				[7%]			
Max(Govt Intervention)					−0.024		
					(−3.2)		
					[8.7%]		
|Trade Openness|						−0.024	
						(3.67)	
						[7%]	
Total trade flows							6.84
							(3.13)
							[99.7%]
N Obs.	861	861	861	861	630	861	861
R^2	0.13	0.095	0.15	0.15	0.14	0.17	0.14

coefficient on this interaction term is negative and significant at the 2% level for our preferred measure of financial development, *PRIVCRED*. The result is robust to inclusion of other control variables, though its significance is affected marginally by the inclusion of some controls.

As a final robustness test we look at the distance in financial development. There is not a priori reason to expect that the distance in financial development between countries should matter for the comovement in growth rates, once we have controlled for the distance in income levels. In other words, we do not expect that pairs of countries that are both underdeveloped financially (i.e., that have similar but low levels of financial development) will exhibit a high

Table VI
Comovement in Growth Rates and Distance in Financial Development

The dependent variable is correlation in growth rates across all industries for each pair of countries. The constant is included in all regressions (not reported). The *t*-statistics are in parentheses and the bootstrapped percentile (using QAP procedure described in text) is in brackets. Percentiles below 2.5% or above 97.5% represent significance at the 5% level.

	(1)	(2)	(3)
|log *GDP PC*|	−0.074	−0.074	−0.074
	(−9.6)	(−9.6)	(−9.1)
	[0%]	[0%]	[0%]
|Domestic Credit|	−0.065		
	(1.4)		
	[19%]		
|Market Capitalization|		0.02	
		(0.7)	
		[61%]	
|Private Bank Credit|			−0.006
			(0.1)
			[45%]
N Obs.	861	861	861
R^2	0.096	0.096	0.095

correlation in their growth rates. However, if our (theoretically motivated) minimum measure is simply another proxy for "level of development," this should be better captured by the distance measure. We find in Table VI that the inclusion of the distance in financial development is not significant, and does not affect the significance levels of our distance measure of income, or the minimum measure of financial development. This further reinforces the differences between the behavior of financial development and the overall level of development in our regressions, and our tests of the role financial development in resource allocation.

IV. Concluding Remarks

In this paper, we extend the literature on finance and development by presenting a heretofore unutilized technique for examining the intersectoral allocation of resources across countries. We argue that this technique allows for a more refined testing of hypotheses than did previous methods that have been utilized in research in finance. Furthermore, our approach does not require that we actually observe growth opportunities: We are able to test the finance and growth hypothesis by looking at *commonalities* and *differences* in growth opportunities across countries. In our first set of results, we assume that there is some component of growth opportunities that is common across all countries. In later results we relax this assumption to allow for *systematic similarities* in growth opportunities, arguing that growth opportunities are more similar for countries at similar levels of economic development, as measured by per-capita

income. As an auxiliary result we also find support for the hypothesis that countries at a similar level of economic development have similar patterns of intersectoral allocation. This result supports our second assumption for identifying growth opportunities.

The second test offers an improvement over previous work, as it allows growth opportunities to depend on country characteristics: that is, countries at a similar level of development have similar growth opportunities. Our methodology thus relaxes the need to assume constant growth opportunities and also does not have to rely on the U.S. data to generate any industry-specific measures (since shocks to growth opportunities are latent in our models).

We find strong support for the allocative role of financial institutions: Countries have correlated intersectoral growth rates only if *both* countries have well-developed financial markets. This is consistent with our model in which only industries in countries with well-functioning financial systems can effectively respond to common shocks to their growth opportunities. Our results also suggest that private financial institutions are particularly important in facilitating resource allocation in response to growth opportunities, as we find that measures of financial development that reflect the presence of private sector banking institutions perform better than previously used measures of total domestic credit.

This methodology could potentially be extended to incorporate many other assumptions about the similarities in growth opportunities across groups of countries. One extension that we are currently investigating takes the changes in the price of oil as an indicator of global shocks that will generate similarities and differences in growth opportunities for different industries and groups of countries. Other extensions will take advantage of the temporal dimension of our data by looking at how correlations change over time, to examine the impact of increased globalization, financial liberalizations and business cycle effects on intra-industry growth. It may also be possible to study regional comovement (using concordance coefficients instead of correlations) to further understand the allocative effects of economic integration.

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