# FINANCE AND THE SOURCES OF GROWTH AT VARIOUS STAGES OF ECONOMIC DEVELOPMENT

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*This article studies the effects of financial development on the sources of growth in different groups of countries. Recent theoretical work shows that financial development may affect productivity and capital accumulation in different ways in industrial versus developing countries. This hypothesis is tested with panel data from 74 countries using GMM dynamic panel techniques. Results are consistent with the hypothesis: finance has a strong positive influence on productivity growth primarily in more developed economies. In less developed economies, the effect of finance on output growth occurs primarily through capital accumulation.* (*JEL* O4, G1)

## I. INTRODUCTION

The effects of financial development on economic growth have been widely discussed in the academic literature. The increased availability of financial instruments and institutions reduces transaction and information costs in an economy. Larger and more efficient financial markets help economic agents hedge, trade, and pool risk, raising investment and economic growth.[1] The hypothesis that finance increases growth has been tested in various ways, mostly finding a significant positive effect.[2] However, there are two issues that have received less attention: first, whether finance affects growth in different ways in industrial versus developing countries, and second, how financial development affects the *sources* of growth.[3] Although there have been some studies of these two issues separately, they have not been analyzed in a unified fashion as perhaps they should be given some recent theoretical work.

Specifically, Acemoglu et al. (2002) show that a developing country that is behind the technological frontier will typically pursue a capital accumulation growth strategy ("investment-based growth"). At this development stage, there is less incentive to be highly selective of firms and managers because this is costly. Hence, we observe long-term business relationships between financial market agents and firms, which result in funds flowing to those established firms for capital accumulation purposes. Conversely, industrial countries that are at the technological frontier have a strong incentive for innovation, so they are very selective of firms and managers that can attain this goal. Financial markets will then fund these innovation activities leading to

*We would like to thank Piriya Pholpirul and Abel Embaye for their excellent research assistance.

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1. The theoretical literature goes back to Schumpeter (1912), Robinson (1952), Hicks (1969), McKinnon (1973), Goldsmith (1969), and Fry (1995).

2. The empirical literature includes King and Levine (1993a; 1993b; 1993c), Roubini and Sala-i-Martin (1992), Pagano (1993), Jayaratne and Strahan (1996), Levine (1997; 1998), Arestis and Demetriades (1997), Rajan and Zingales (1998), Lindh (2000), and Levine et al. (2000). Some papers, like Demetriades and Hussein (1996) and Luintel and Khan (1999), fail to find a causal effect of finance on growth.

3. Beck et al. (2000) have recently studied the effect of financial development on the sources of economic growth. They find that finance affects economic growth primarily through productivity growth. Arestis et al. (forthcoming) find different effects of certain financial policies on capital productivity in different countries.

**ABBREVIATIONS**

GMM: Generalised Method of Moments
GDP: Gross Domestic Product



Economic Inquiry
(ISSN 0095-2583)
Vol. 42, No. 1, January 2004, 127–140

DOI: 10.1093/ei/cbh049

larger productivity gains ("innovation-based growth").[4]

Further theoretical support is found in Lee (1996), who models a process of learning-by-doing in which lending decisions improve over time as lenders acquire project-specific information by making investment decisions. Again, this points to more efficient allocation of funds, which go to the most productive firms in developed economies (see also Acemoglu and Zilibotti [1997]).

Hence, as financial markets are crucial to fund production-related activities, we may observe a differential effect of financial development—not only on *economic* growth but on the *sources* of growth based on a country's relative position. We propose to empirically test the following propositions:

- Does financial development have a larger effect on *capital* accumulation in developing countries than in industrial countries?
- Does financial development have a larger effect on *productivity* growth in industrial countries than in developing countries?

Our article closely follows Beck et al. (2000) in estimating the effect of financial development on the sources of economic growth. We extend their analysis by exploring whether those effects differ in systematic ways depending on the level of economic development of a country. We use a large panel data set of 74 countries that covers the 1961–95 period. Furthermore, we apply generalized method of moments (GMM) dynamic panel techniques to deal with the possible simultaneity of financial development and economic growth and to control for country-specific effects. Our results are consistent with previous empirical work that finds that the effects of finance on *economic* growth may vary in different types of countries.[5] Our results go further finding that finance has a strong positive influence on productivity growth primarily in more developed economies. Conversely, in less developed economies, the effect of finance on output growth occurs primarily through capital accumulation and not productivity.

The remainder of the article is organized as follows. Section II discusses the measures and data; section III describes the methodology. Section IV presents and discusses the results, and section V concludes.

## II. DATA

Following the empirical literature, we use three common financial development measures: Private Credit, Commercial versus Central Bank, and Liquid Liabilities. Private Credit is the credit issued to the private sector as percent of gross domestic product (GDP) and is the preferred measure of Beck et al. (2000). Commercial versus Central Bank is defined as commercial bank assets divided by commercial bank plus central bank assets. This measures the relative importance of commercial banks versus central banks in allocating savings. This variable is commonly used in the literature to measure financial development because presumably commercial banks are better at evaluating the potential returns and risks of various projects. Finally, Liquid Liabilities is defined as currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries as percent of GDP. This variable, like Private Credit, is a size or "financial depth" measure that has been used in the literature by Goldsmith (1969) and King and Levine (1993b), among others.

There are three dependent variables of interest in this article: economic growth defined as the rate of growth of real per capita GDP, capital growth defined as the rate of growth of per capita physical capital stock, and productivity growth defined as the rate of growth of the "residual" (after capital and labor growth are accounted for).

4. There have been studies in the growth accounting literature that suggest that the engines for growth may vary in different countries. For example, Young (1995) finds that much of the very rapid growth in Southeast Asia in the 1966–90 period is explained not by productivity but by capital accumulation and labor force growth. Similarly for Latin America, Elias (1992) finds that productivity growth accounts for only about one quarter of output growth during 1940–80. Agenor and Montiel (1999, 676) report that productivity growth accounted for only 4.4% of growth in African countries in the 1970s, and capital accumulation accounted for 64.4%. Conversely for industrial countries, Christensen et al. (1981) find that the contribution of productivity was more than 50% during 1947–73.

5. For example, Xu (2000), Demetriades and Hussein (1996), De Gregorio and Guidotti (1995), and Odedokun (1996). These works generally find a stronger effect of finance on economic growth in more developed economies, although the issue has not been systematically studied.

To compute capital growth, Beck et al. (2000) start with an estimate of the initial level of capital stock for each country in 1950 assuming that the capital-output ratio was in steady state. Capital stock in later years is then computed using the real investment series from the Penn World Tables and the perpetual inventory method with a 7% annual depreciation rate.

The measure of productivity is derived starting with the neoclassical production function:

$$Y = AK^{\alpha}L^{1-\alpha}$$

where $Y$ is output, $K$ is physical capital, $L$ is the labor input, and $A$ is productivity.[6] To solve for productivity growth, divide both sides of the production function by $L$, take logs, and differentiate with respect to time. Assuming a capital share $\alpha = 0.3$, this yields the following expression in per person terms:

$$\textit{Productivity growth} = \textit{Output Growth} - 0.3 * \textit{Capital Growth}.$$

Next, we discuss briefly the data set and some useful statistics. The data set consists of a panel of observations for 74 countries for the period 1961–95 and is the same data set used by Beck et al. (2000). The data are averaged over five-year intervals: 1961–65, 1966–70, and so on up to 1991–95, so there are seven observations per country when available. Table 1 presents descriptive statistics for all the variables.

Countries are grouped into three groups: low-, medium-, and high-income, depending on the relative ranking of their income per capita in the middle of the sample period.[7] We use three (rather than two or more than three) groups because much of the policy literature discusses country differences in terms of low-, middle-, and high-income countries. Separating countries into three roughly equal-size groups is fairly mechanical and may leave the positioning of some countries open to skepticism. However, it has the advantage of avoiding subjective judgments on how to group the countries.[8] With few exceptions, the relative position of countries in terms of income has not changed during the sample period.[9]

For further motivation, Table 2 reports output, capital, and productivity growth for the three subsamples of countries, which we later use in the econometric analysis. Table 2 shows that output growth was substantially slower in low-income countries: 0.9% on an annual basis compared to 2% in middle income and 2.3% in high-income countries. The relative contributions of productivity and capital are also very different. Using $\alpha = 0.3$, capital growth accounts for 66.3% of per capita output growth in the low-income group, which is similar to the evidence from previous research. In middle- and high-income countries, productivity accounts for 60% of per capita output growth, substantially more than in low-income countries (33.3%). These differences prompt us to examine whether finance has different channels for influencing economic growth at various levels of development.

Finally, Table 3 reports the average values of the three financial development variables in the three income groups. Higher income is clearly associated with more developed financial markets across all three measures. This however does not imply any causality because finance and growth may be jointly determined as most of the theoretical literature suggests.

6. We use the same decomposition of economic growth into physical capital and productivity growth as Beck et al. (2000). Alternatively, as Klenow and Rodriguez-Clare (1997) and Hall and Jones (1996) have suggested, economic growth can be decomposed into physical capital, human capital, and productivity. They show that the contribution of productivity to economic growth increases substantially after carefully accounting for human capital. In contrast to other studies (such as Young [1995]) they conclude that "differences in productivity growth explain the overwhelming majority of growth differences" (Klenow and Rodriguez-Clare [1997], 3). It is possible that such alternative growth decomposition could alter our results, perhaps yielding a higher estimate of the effect of financial development on productivity growth. However, we do not pursue this alternative decomposition due to data availability and because we follow the previous work of Beck et al. (2000).

7. Countries with income per capita of less than $752 were classified as low-income; those with income per capita between $752 and $2490 were classified as middle-income; and those above $2490 were classified as high-income.

8. For robustness checks, we also grouped countries according to income levels earlier and later in the sample period. We also conducted all estimations with a separation into two groups: high and low income. The estimates are similar and are available on request.

9. In addition, we should point out that in Acemoglu et al. (2002) theoretical piece, the differences in growth strategies also depend on the *relative* income position of a country, that is, on how far it is from the technological frontier.

**TABLE 1**
Descriptive Statistics, 1961–95, 74 Countries

| Variable | GDP Growth | Capital Growth | Prod. Growth | Initial Income per Capita | Sec. Schooling | Private Credit | CCB | LL | Gov. Size | Openness to Trade | Inflation Rate | Black Market Premium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 0.017 | 0.027 | 0.01 | 3883 | 1.12 | 0.37 | 0.76 | 0.41 | 0.14 | 0.55 | 0.16 | 0.6 |
| Maximum | 0.13 | 0.18 | 0.13 | 20134 | 5.15 | 2.05 | 1.00 | 1.91 | 0.45 | 2.00 | 3.44 | 109.9 |
| Minimum | −0.10 | −0.06 | −0.10 | 107 | 0.00 | 0.003 | 0.12 | 0.05 | 0.04 | 0.09 | −0.03 | −0.05 |
| Standard deviation | 0.03 | 0.034 | 0.025 | 4792 | 0.94 | 0.23 | 0.20 | 0.25 | 0.06 | 0.30 | 0.32 | 5.52 |
| *Correlations* | | | | | | | | | | | | |
| GDP growth | 1.00 | | | | | | | | | | | |
| Capital growth | 0.53 | 1.00 | | | | | | | | | | |
| Productivity growth | 0.93 | 0.17 | 1.00 | | | | | | | | | |
| Initial income per capita | 0.10 | 0.02 | 0.10 | 1.00 | | | | | | | | |
| Secondary schooling | 0.15 | 0.01 | 0.17 | 0.69 | 1.00 | | | | | | | |
| Private credit | 0.07 | 0.14 | 0.14 | 0.76 | 0.61 | 1.00 | | | | | | |
| Commercial versus Central Bank (CCB) | 0.28 | 0.28 | 0.22 | 0.51 | 0.32 | 0.58 | 1.00 | | | | | |
| Liquid liabilities (LL) | 0.21 | 0.16 | 0.17 | 0.62 | 0.50 | 0.84 | 0.49 | 1.00 | | | | |
| Government size | −0.01 | −0.03 | 0.01 | 0.44 | 0.26 | 0.23 | 0.25 | 0.23 | 1.00 | | | |
| Openness to trade | 0.07 | 0.05 | 0.07 | 0.01 | 0.03 | 0.05 | 0.18 | 0.10 | 0.19 | 1.00 | | |
| Inflation rate | −0.27 | −0.22 | −0.22 | −0.15 | −0.05 | −0.21 | −0.24 | −0.21 | 0.03 | −0.19 | 1.00 | |
| Black market premium | −0.18 | −0.11 | −0.17 | −0.07 | −0.05 | −0.07 | −0.10 | −0.02 | 0.09 | −0.08 | 0.53 | 1.00 |

**TABLE 2**
Output Growth and Its Sources in Low-, Middle-, and High-Income Countries

| | Low-Income Countries | Middle-Income Countries | High-Income Countries |
|---|---|---|---|
| Output growth | 0.009 | 0.020 | 0.023 |
| Productivity growth | 0.003 (33.3%) | 0.012 (60.0%) | 0.014 (60.1%) |
| Capital growth | 0.024 (66.6%) | 0.027 (40.0%) | 0.032 (39.9%) |

*Notes*: The percentage contribution of productivity and capital growth is in parentheses. The calculation is made using a capital share $\alpha = 0.3$. For example, in the high-income group, $0.023 = 0.014 + 0.3*0.032$.

**TABLE 3**
Financial Development in Low-, Middle-, and High-Income Countries

| | Low-Income Countries | Middle-Income Countries | High-Income Countries |
|---|---|---|---|
| Private credit | 0.17 | 0.28 | 0.61 |
| Liquid liabilities | 0.27 | 0.35 | 0.59 |
| Commercial versus central bank | 0.67 | 0.72 | 0.89 |

Our objective is to go a step further and test for any effect of the exogenous component of finance on growth.

## III. METHODOLOGY

### *GMM Panel Estimation*

Following Beck et al. (2000), we use recently developed dynamic panel GMM techniques to address potential endogeneity in the data.[10] Let $y_{it}$ be the log of real per capita GDP in country $i$ at time $t$. We are interested in the following equation:

$$(1)\quad y_{i,t} - y_{i,t-1} = (\alpha - 1) y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t},$$

where $y_{i,t} - y_{i,t-1}$ is the growth rate of real per capita GDP, $X_{i,t}$ is a set of explanatory variables, including our measures for financial development, $\eta_i$ captures unobserved country-specific effects, and $\varepsilon_{it}$ is an error term. Rewrite equation (1) as:

$$(2)\quad y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t}.$$

Notice in (2) that the lagged dependent variable, which enters as an independent explanatory variable, is correlated with the country-specific component of the error term. To resolve this problem, as a first step, the GMM procedure involves taking first differences to eliminate the country-specific effect:

$$(3)\quad y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}).$$

By construction, in equation (3), however, the lagged difference in per capita GDP is correlated with the error term, which along with the potential endogeneity of the explanatory variables $X$ requires the use of instruments. The GMM *difference* estimator uses the lagged levels of the explanatory variables as instruments under the conditions that the error term is not serially correlated and that the lagged levels of the explanatory variables are weakly exogenous (i.e., they are uncorrelated with future error terms). Then the following moment conditions are used to calculate the difference estimator:

$$(4)\quad E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad \text{for} \quad s \geq 2;\ \ t = 3, \ldots T.$$

$$(5)\quad E\lfloor X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})\rfloor = 0 \quad \text{for} \quad s \geq 2;\ \ t = 3, \ldots T.$$

Because persistence in the explanatory variables may adversely affect the small-sample and asymptotic properties of the difference estimator (Blundell and Bond [1998]), the difference estimator is further combined with an estimator in levels to produce a *system* estimator.

10. This method is fully described in Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998).

The equation in levels uses the lagged differences of the explanatory variables as instruments under two conditions. First, the error term is not serially correlated. Second, although there may be correlation between the levels of the explanatory variables and the country-specific error term, there is no correlation between the difference in the explanatory variables and the error term. This yields the following stationarity properties:

$$(6)\quad E[y_{i,t+p}\eta_i] = E[y_{i,t+q}\eta_i] \quad \text{and}$$

$$E[X_{i,t+p}\eta_i] = E[X_{i,t+q}\eta_i] \text{ for all } p \text{ and } q.$$

The additional moment conditions for the regression in levels are

$$(7)\quad E[(y_{i,t-s} - y_{i,t-s-1})(\eta_i + \varepsilon_{i,t})] = 0 \quad \text{for} \quad s = 1$$

$$(8)\quad E[(X_{i,t-s} - X_{i,t-s-1})(\eta_i + \varepsilon_{i,t})] = 0 \quad \text{for} \quad s = 1.$$

In summary, the GMM *system* estimator is obtained using the moment conditions in equations (4), (5), (7), and (8). Following Blundell and Bond (1998), we use two specifications tests: the Sargan test, which tests the validity of the instruments, and a test that the error term is not second-order serially correlated.

In addition to economic growth, we apply the methodology described to estimate the effect of financial development on productivity and capital growth. To capture differences in effects across income groups, we create dummy variables based on the low- and middle-income groups (the high-income group is the omitted group) described in the previous section. The dummy variables are then interacted with the financial development variable and included in equation (1). The estimated effects for the three groups are reported in the Results section. We report the overall effect for each group, that is, the sum of the coefficient of financial development and the interaction term for a particular income group. Thus the reported coefficients can be directly interpreted as the effect of financial development on growth in the various income groups.

*Cross-Sectional Estimation*

For completeness, we also report the results of cross-sectional estimations. In these estimations, we use country averages over the full 35-year period (1961–95) for all variables except the initial GDP per capita. Unlike the GMM panel procedure described above, such estimation suffers from potential endogeneity problems as the relationship between growth and financial development may be spurious. Therefore, following Levine et al. (2000), we use the legal origin of a country as an instrument for the level of financial development. The data for legal origin are obtained from La Porta et al. (1998) who classify countries into four groups depending on the origin of their legal systems: English, German, French, and Scandinavian. That paper provides a discussion on the construction of those variables and their relevance for financial development. We do not replicate that discussion here for brevity. The results of the two-step procedure using the cross-sectional data are reported alongside the GMM panel estimates for comparison. We should point out that our preferred estimates are obtained using the panel procedure because they utilize information from the time dimension of the data.

## IV. RESULTS

We first estimate the effect of financial development on economic growth and its sources *without* breaking the sample into three groups of countries. This is done to have a reference point for comparison to latter estimates with three groups of countries. Table 4 presents these results. Following the literature (Beck et al. [2000]), we use two conditioning sets. The "simple" conditioning set includes only initial income per capita and secondary schooling as controls. The "policy" conditioning set includes those two variables plus government size, openness to trade, the inflation rate, and the black market premium.[11]

11. The rationale for each variable's inclusion is as follows. First, the initial level of real per capita GDP controls for the convergence effect implied in the standard Solow-Swan growth theory. Second, average years of secondary schooling is a measure of educational attainment which controls for the level of human capital in the country. Third, government size (% of GDP), the inflation rate,

**TABLE 4**
Financial Development and Sources of Growth (No Breaks): Panel

| Variable | Conditioning Set | Economic Growth | Productivity Growth | Capital Growth |
|---|---|---|---|---|
| Private credit | Simple | 0.022 | 0.014 | 0.002 |
| | | (0.005) | (0.004) | (0.005) |
| | | *[0.001]* | *[0.001]* | *[0.580]* |
| | Policy | 0.010 | 0.006 | 0.012 |
| | | (0.003) | (0.003) | (0.003) |
| | | *[0.001]* | *[0.014]* | *[0.001]* |
| Comm. versus central bank | Simple | 0.015 | 0.005 | 0.027 |
| | | (0.004) | (0.003) | (0.002) |
| | | *[0.001]* | *[0.070]* | *[0.001]* |
| | Policy | 0.017 | 0.009 | 0.007 |
| | | (0.009) | (0.008) | (0.003) |
| | | *[0.057]* | *[0.245]* | *[0.360]* |
| Liquid liabilities | Simple | 0.025 | 0.015 | 0.036 |
| | | (0.012) | (0.009) | (0.012) |
| | | *[0.052]* | *[0.075]* | *[0.004]* |
| | Policy | 0.014 | 0.042 | 0.060 |
| | | (0.007) | (0.017) | (0.007) |
| | | *[0.031]* | *[0.012]* | *[0.001]* |

*Notes:* Numbers in parentheses are standard errors; *p*-values are in brackets. Simple conditioning set includes initial income per capita and secondary schooling. Policy conditioning set includes initial income per capita, secondary schooling, government size, openness to trade, inflation rate, and black market premium.

We only present the panel results in Table 4 for brevity. We find that in general there is a positive, statistically significant effect of the three financial development measures on economic growth, productivity growth, and capital growth. We defer in-depth discussion on the coefficients to subsequent tables where our results using three groups of countries are presented.

### *Financial Development and Economic Growth*

The economic growth effects of the Private Credit measure of financial development are described in Table 5. Private Credit is the preferred measure in the literature (Levine et al. [2000]). Regression (1) shows the estimates without breaking countries into groups for comparison. Regression (2) estimates the potentially different effects in three groups of countries: low-, middle-, and high-income. We find that the estimated coefficients for middle- and high-income countries are statistically significant at the 1% levels, but the low-income coefficient is not statistically significant. The coefficient for middle-income countries (0.012) is smaller in magnitude than that for the high-income countries (0.020), although they are not statistically different from one another.[12] The economic interpretation of these coefficients is that a 10-percentage-point increase in financial development (keep in mind the variable is in logs) would lead to a 0.20-percentage-point higher growth rate in a high-income country, but it would have no discernible effect in a low-income country.

The results presented in Table 6 using the other two financial development measures are similar. Consider, first, the panel results. Using the Commercial versus Central Bank and Liquid Liabilities measures, the estimated coefficients are statistically significant only in the high-income group.[13] It is also interesting to observe that the coefficients for the low-income group are negative using all three

openness to trade ([exports + imports]/GDP), and the black market premium are all controls for policy in the country. Large government sectors and high inflation are presumed to affect growth adversely, whereas more openness to trade is presumed to affect growth positively. These regressions also included time dummies, but those coefficients are not reported.

12. A *t* test for the difference in coefficients is used but not reported here and throughout the article. These results are available on request.

13. For these estimations, as well as others presented, the Sargan tests are consistent with the instruments being correlated with the residuals. The serial correlation tests show no evidence of second-order serial correlation.

**TABLE 5**
Private Credit and Economic Growth: Panel

| Regressors | (1) | (2) |
|---|---|---|
| *Private credit*[a] | 0.010 | — |
| | (0.003) | |
| | *[0.001]* | |
| Low income[a] | — | −0.001 |
| | | (0.005) |
| | | *[0.946]* |
| Middle income[a] | — | 0.012 |
| | | (0.003) |
| | | *[0.001]* |
| High income[a] | — | 0.020 |
| | | (0.007) |
| | | *[0.002]* |
| Initial income per capita[a] | 0.002 | −0.018 |
| | (0.007) | (0.009) |
| | *[0.787]* | *[0.060]* |
| Government size[a] | −0.019 | −0.016 |
| | (0.010) | (0.011) |
| | *[0.062]* | *[0.154]* |
| Openness to trade[a] | 0.001 | 0.008 |
| | (0.007) | (0.008) |
| | *[0.944]* | *[0.305]* |
| Inflation[b] | −0.051 | −0.051 |
| | (0.014) | (0.013) |
| | *[0.001]* | *[0.001]* |
| Average years of secondary schooling | −0.012 | −0.011 |
| | (0.010) | (0.010) |
| | *[0.206]* | *[0.283]* |
| Black market premium[b] | 0.002 | 0.003 |
| | (0.004) | (0.005) |
| | *[0.651]* | *[0.483]* |
| Constant | −0.034 | 0.108 |
| | (0.041) | (0.059) |
| | *[0.399]* | *[0.066]* |
| Sargan test[c] (*p*-value) | 0.49 | 0.40 |
| Serial correlation test[d] (*p*-value) | 0.53 | 0.57 |
| Number of observations | 451 | 451 |

[a]In the regression, this variable is included as log (variable).

[b]In the regression, this variable is included as log (1 + variable).

[c]The null hypothesis is that the instruments used are not correlated with the residuals.

[d]The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

*Note:* Numbers in parentheses are standard errors; *p*-values are in brackets.

**TABLE 6**
Alternative Measures of Financial Development and Economic Growth

| Financial Variable | Cross-Section | Panel |
|---|---|---|
| *Commercial versus central bank* | | |
| Low income | 0.019 | −0.020 |
| | (0.007) | (0.012) |
| | *[0.011]* | *[0.091]* |
| Middle income | 0.024 | 0.002 |
| | (0.007) | (0.012) |
| | *[0.002]* | *[0.850]* |
| High income | 0.025 | 0.042 |
| | (0.007) | (0.018) |
| | *[0.001]* | *[0.018]* |
| Sargan test[a] | — | 0.43 |
| Serial correlation test[b] | — | 0.47 |
| *Liquid liabilities* | | |
| Low income | 0.018 | −0.018 |
| | (0.004) | (0.013) |
| | *[0.001]* | *[0.179]* |
| Middle income | 0.022 | 0.012 |
| | (0.004) | (0.009) |
| | *[0.001]* | *[0.171]* |
| High income | 0.023 | 0.034 |
| | (0.004) | (0.012) |
| | *[0.001]* | *[0.011]* |
| Sargan test[a] | — | 0.42 |
| Serial correlation test[b] | — | 0.50 |
| *Private credit* | | |
| Low income | 0.011 | −0.001 |
| | (0.003) | (0.005) |
| | *[0.002]* | *[0.946]* |
| Middle income | 0.016 | 0.012 |
| | (0.003) | (0.003) |
| | *[0.001]* | *[0.001]* |
| High income | 0.017 | 0.020 |
| | (0.004) | (0.007) |
| | *[0.001]* | *[0.002]* |
| Sargan test[a] | — | *0.40* |
| Serial correlation test[b] | — | *0.57* |

[a]The null hypothesis is that the instruments used are not correlated with the residuals.

[b]The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

measures, although they are not statistically significant. De Gregorio and Guidotti (1995) find a negative effect of financial development on growth in a sample of Latin American economies, which they link to rapid financial market liberalization.

The coefficient estimates from the cross-sectional estimation are positive and significant across the board, but the estimated sizes of the coefficients are larger for richer countries. Using Commercial versus Central Bank, the estimates are 0.019, 0.024, and 0.025 for the low-, middle-, and high-income groups. For the Liquid Liabilities and the Private Credit measures, the coefficient estimates are, respectively, 0.018; 0.022 and 0.023; and 0.011,

0.016, and 0.017. For each of the three measures, the coefficient estimates in the middle- and high-income groups are statistically different from (greater than) the coefficient estimate in the low region. Overall, the cross-section results match those obtained using panel data with the exception of a positive effect in the low-income group for the cross-section regressions.

The result that the effect of financial development on *economic* growth seems to be positive and large in higher-income countries is intuitively and theoretically supported by Acemoglu and Zilibotti (1997) and Lee (1996). For instance, in Acemoglu and Zilibotti (1997) projects with higher rates of return are indivisible and have minimum size requirements. In that environment, the financial sector has to develop a certain minimum size before sufficient funds can be pooled together to finance such larger projects. Hence the effect of finance on growth may be larger in more advanced economies. Our results are also consistent with previous empirical findings in Xu (2000), Demetriades and Hussein (1996), and De Gregorio and Guidotti (1995). We now turn to analyze the effects on the sources of growth.

### *Financial Development and Productivity Growth*

Table 7 shows the effects of Private Credit on productivity growth using the panel approach. As in the previous section, regression (1) is estimated without breaking countries into groups. Private Credit has a positive, statistically significant effect on productivity growth, which agrees with Beck et al. (2000).[14]

Regression (2) in Table 7 separates countries into three groups. We find that the coefficient estimates in the middle- and high-income groups are statistically significant, but the estimate for the low-income group is not. Hence, finance appears to not have an effect on productivity growth in the low-income countries. In addition, the effect of Private Credit on productivity appears larger in the high-income group (0.013) than in the middle-income countries (0.010). However, these two coefficients are not statistically different from each other.

14. As Beck et al. (2000), we keep the same set of control variables across all regressions to be consistent.

**TABLE 7**
Private Credit and Productivity Growth: Panel

| Regressors | (1) | (2) |
|---|---|---|
| *Private credit*[a] | 0.006 | — |
| | (0.003) | |
| | *[0.014]* | |
| Low income[a] | — | − 0.002 |
| | | (0.004) |
| | | *[0.700]* |
| Middle income[a] | — | 0.010 |
| | | (0.003) |
| | | *[0.001]* |
| High income[a] | — | 0.013 |
| | | (0.007) |
| | | *[0.064]* |
| Initial income per capita[a] | − 0.006 | − 0.017 |
| | (0.007) | (0.010) |
| | *[0.403]* | *[0.056]* |
| Government size[a] | − 0.027 | − 0.017 |
| | (0.009) | (0.011) |
| | *[0.005]* | *[0.128]* |
| Openness to trade[a] | − 0.001 | 0.006 |
| | (0.007) | (0.008) |
| | *[0.874]* | *[0.372]* |
| Inflation[b] | − 0.052 | − 0.052 |
| | (0.014) | (0.015) |
| | *[0.001]* | *[0.001]* |
| Average years of secondary school | − 0.002 | − 0.002 |
| | (0.008) | (0.008) |
| | *[0.848]* | *[0.764]* |
| Black market premium[b] | 0.007 | 0.007 |
| | (0.003) | (0.004) |
| | *[0.025]* | *[0.058]* |
| Constant | − 0.011 | 0.096 |
| | (0.042) | (0.060) |
| | *[0.801]* | *[0.111]* |
| Sargan test[c] (*p*-value) | 0.52 | 0.42 |
| Serial correlation test[d] (*p*-value) | 0.35 | 0.31 |
| Number of observations | 445 | 445 |

[a]In the regression, this variable is included as log (variable).

[b]In the regression, this variable is included as log (1 + variable).

[c]The null hypothesis is that the instruments used are not correlated with the residuals.

[d]The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

*Note:* Numbers in parentheses are standard errors; *p*-values are in brackets.

Estimates using the Commercial versus Central Bank and Liquid Liabilities measures are presented in Table 8 and are very similar to those already shown. Again, in the panel regressions, the effects on productivity are positive and significant in the richer countries.

**TABLE 8**
Alternative Measures of Financial Development and Productivity Growth

| Financial Variable | Cross-Section | Panel |
|---|---|---|
| *Commercial versus central bank* | | |
| Low income | 0.011 | −0.002 |
| | (0.006) | (0.005) |
| | *[0.089]* | *[0.740]* |
| Middle income | 0.013 | 0.004 |
| | (0.006) | (0.004) |
| | *[0.052]* | *[0.340]* |
| High income | 0.012 | 0.025 |
| | (0.007) | (0.007) |
| | *[0.066]* | *[0.001]* |
| Sargan test[a] (p-value) | — | 0.32 |
| Serial correlation test[b] (p-value) | — | 0.31 |
| *Liquid liabilities* | | |
| Low income | 0.011 | −0.012 |
| | (0.003) | (0.013) |
| | *[0.002]* | *[0.419]* |
| Middle income | 0.013 | 0.015 |
| | (0.003) | (0.010) |
| | *[0.001]* | *[0.179]* |
| High income | 0.013 | 0.036 |
| | (0.004) | (0.014) |
| | *[0.001]* | *[0.011]* |
| Sargan test[a] | — | 0.438 |
| Serial correlation test[b] (p-value) | — | 0.283 |
| *Private credit* | | |
| Low income | 0.010 | −0.002 |
| | (0.003) | (0.004) |
| | *[0.001]* | *[0.700]* |
| Middle income | 0.010 | 0.010 |
| | (0.003) | (0.003) |
| | *[0.001]* | *[0.001]* |
| High income | 0.009 | 0.013 |
| | (0.003) | (0.007) |
| | *[0.009]* | *[0.066]* |
| Sargan test[a] | — | *0.425* |
| Serial correlation test[b] (p-value) | — | 0.312 |

[a]The null hypothesis is that the instruments used are not correlated with the residuals.

[b]The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

For instance, a 10-percentage-point increase in Commercial versus Central Bank would lead to a 0.25-percentage-point increase in productivity growth in the high-income group. In summary, the richer the country the higher the effect of financial development on productivity growth, which agrees with the theoretical results derived by Acemoglu et al. (2002).

As in the economic growth equation, the cross-section estimates are positive and statistically significant across the board for the Liquid Liabilities and Private Credit measures (but only at the 10% level for the Commercial versus Central Bank measure). However, the coefficients for the different groups are not statistically different from one another.

### *Financial Development and Capital Growth*

The effects of Private Credit on the growth of capital stock per person are depicted in Table 9. The coefficient estimates for the low-income group and the middle-income group are positive and statistically significant, whereas the estimate for the high-income group is not. In addition the coefficient in the low-income group (0.029) is larger than the coefficient in the middle-income group (0.012). The difference between the two is statistically significant at the 1% level. These coefficients can be interpreted as follows. A 10-percentage-point increase in Private Credit in the low-income group would lead to a 0.29-percentage-point increase in the capital growth rate and a 0.12-percentage-point increase in the middle-income group.[15]

Using the Commercial versus Central Bank and Liquid Liabilities measure (Table 10), panel estimates for all three groups are positive and statistically significant. However, the estimates for each group are not statistically different from one another. This is also the general result obtained from the cross-section estimates. Summarizing, the results for physical capital growth are not as definitive as those for productivity. With the exception of Private Credit, financial development appears to have roughly the same effect in different groups of countries.

### *Stock Markets*

Several recent papers (e.g., Levine and Zervos [1998], Beck and Levine [2002; forthcoming], and Demirguc-Kunt and Maksimovic [2002]) have explored the role of market-based financial systems (e.g., stock markets) along with the traditional bank-based measures of financial development (e.g., Private Credit). These studies generally

15. The lag value of capital growth is included as a regressor to deal with the serial correlation in this equation. This approach is suggested by Beck et al. (2000), who also find serial correlation in their capital growth equation.

**TABLE 9**
Private Credit and Capital Growth: Panel

| Regressors | (1) | (2) |
|---|---|---|
| *Private Credit*[a] | 0.012 | — |
| | (0.003) | |
| | *[0.001]* | |
| Low income[a] | — | 0.029 |
| | | (0.007) |
| | | *[0.001]* |
| Middle income[a] | — | 0.012 |
| | | (0.005) |
| | | *[0.020]* |
| High income[a] | — | −0.005 |
| | | (0.005) |
| | | *[0.250]* |
| Initial income per capita[a] | 0.001 | 0.040 |
| | (0.003) | (0.008) |
| | *[0.743]* | *[0.001]* |
| Government size[a] | −0.006 | −0.016 |
| | (0.009) | (0.014) |
| | *[0.471]* | *[0.244]* |
| Openness to trade[a] | 0.023 | 0.020 |
| | (0.007) | (0.011) |
| | *[0.002]* | *[0.035]* |
| Inflation[b] | 0.018 | 0.014 |
| | (0.012) | (0.014) |
| | *[0.136]* | *[0.318]* |
| Average years of secondary school | 0.004 | −0.012 |
| | (0.006) | (0.009) |
| | *[0.492]* | *[0.160]* |
| Black market premium[b] | −0.001 | −0.002 |
| | (0.006) | (0.006) |
| | *[0.917]* | *[0.746]* |
| Capital growth (−1) | 0.501 | 0.447 |
| | (0.028) | (0.047) |
| | *[0.001]* | *[0.001]* |
| Constant | −0.021 | −0.301 |
| | (0.029) | (0.078) |
| | *[0.476]* | *[0.001]* |
| *Sargan test*[c] *(p-value)* | 0.36 | 0.32 |
| *Serial correlation test*[d] *(p-value)* | 0.36 | 0.47 |
| Number of observations | 401 | 401 |

[a]In the regression, this variable is included as log (variable).

[b]In the regression, this variable is included as log (1 + variable).

[c]The null hypothesis is that the instruments used are not correlated with the residuals.

[d]The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

*Note:* Numbers in parentheses are standard errors; *p*-values are in brackets.

**TABLE 10**
Alternative Measures of Financial Development and Capital Growth

| Financial Variable | Cross-Section | Panel |
|---|---|---|
| *Commercial versus central bank* | | |
| Low income | 0.011 | 0.069 |
| | (0.006) | (0.011) |
| | *[0.089]* | *[0.001]* |
| Middle income | 0.013 | 0.073 |
| | (0.006) | (0.012) |
| | *[0.052]* | *[0.001]* |
| High income | 0.012 | 0.070 |
| | (0.007) | (0.017) |
| | *[0.065]* | *[0.001]* |
| Sargan test[a] (p-value) | — | 0.27 |
| Serial correlation test[b] (p-value) | — | 0.97 |
| *Liquid liabilities* | | |
| Low income | 0.023 | 0.028 |
| | (0.007) | (0.009) |
| | *[0.001]* | *[0.003]* |
| Middle income | 0.025 | 0.024 |
| | (0.007) | (0.009) |
| | *[0.001]* | *[0.010]* |
| High income | 0.028 | 0.029 |
| | (0.007) | (0.011) |
| | *[0.001]* | *[0.018]* |
| Sargan test[a] | — | 0.40 |
| Serial correlation test[b] (p-value) | — | 0.88 |
| *Private credit* | | |
| Low income | 0.014 | 0.029 |
| | (0.005) | (0.007) |
| | *[0.012]* | *[0.001]* |
| Middle income | 0.016 | 0.012 |
| | (0.006) | (0.005) |
| | *[0.005]* | *[0.020]* |
| High income | 0.020 | −0.005 |
| | (0.007) | (0.005) |
| | *[0.004]* | *[0.250]* |
| Sargan test[a] | — | 0.32 |
| Serial correlation test[b] (p-value) | — | 0.47 |

[a]The null hypothesis is that the instruments used are not correlated with the residuals.

[b]The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

find that although the overall effect of financial development (captured by joint significance of bank and stock market measures) on growth is positive, there is no clear evidence that a bank-based or a market-based financial system produces stronger effects. Nevertheless, stock markets may be an important source of financing, especially in high-income countries. Hence, we perform robustness checks for our results by including stock market measures.

Data on stock markets from Beck et al. (1999) are used. Unfortunately, these data are only available for about 40 countries and start in 1976. This means that our sample

**TABLE 11**
Adding Stock Markets: Panel

| | Economic Growth | | | Productivity Growth | | | Capital Growth | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Private credit, low region | −0.001 | 0.001 | −0.001 | −0.002 | −0.001 | −0.001 | 0.029 | 0.030 | 0.030 |
| | (0.005) | (0.004) | (0.005) | (0.004) | (0.004) | (0.005) | (0.007) | (0.008) | (0.007) |
| | *[0.946]* | *[0.800]* | *[0.940]* | *[0.700]* | *[0.800]* | *[0.960]* | *[0.001]* | *[0.001]* | *[0.001]* |
| Private credit, middle region | 0.012 | 0.012 | 0.015 | 0.010 | 0.010 | 0.015 | 0.012 | 0.012 | 0.011 |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.005) | (0.005) | (0.005) |
| | *[0.001]* | *[0.001]* | *[0.001]* | *[0.001]* | *[0.001]* | *[0.001]* | *[0.020]* | *[0.022]* | *[0.030]* |
| Private credit, high region | 0.020 | 0.020 | 0.021 | 0.013 | 0.010 | 0.014 | −0.005 | −0.004 | −0.005 |
| | (0.007) | (0.008) | (0.006) | (0.007) | (0.008) | (0.007) | (0.005) | (0.005) | (0.005) |
| | *[0.002]* | *[0.014]* | *[0.001]* | *[0.064]* | *[0.179]* | *[0.064]* | *[0.250]* | *[0.390]* | *[0.255]* |
| Turnover ratio dummy | | 0.010 | | | 0.013 | | | −0.003 | |
| | | (0.009) | | | (0.008) | | | (0.013) | |
| | | *[0.270]* | | | *[0.131]* | | | *[0.835]* | |
| Trade volume dummy | | | 0.018 | | | 0.021 | | | 0.003 |
| | | | (0.006) | | | (0.007) | | | (0.007) |
| | | | *[0.005]* | | | *[0.004]* | | | *[0.716]* |
| # Observations | 451 | 451 | 451 | 445 | 445 | 445 | 401 | 401 | 401 |
| *Sargan test* (*p*-value) | 0.40 | 0.31 | 0.23 | 0.42 | 0.32 | 0.24 | 0.32 | 0.31 | 0.31 |
| *Serial corr. test* (*p*-value) | 0.58 | 0.67 | 0.58 | 0.31 | 0.38 | 0.34 | 0.47 | 0.47 | 0.50 |

would be reduced significantly from about 450 observations to 164. More important, most low-income countries and many middle-income countries would be eliminated from the estimation because data on them are not available. To avoid losing so many observations and still be able to study three groups, we construct dummy variables for the stock market measures in the following way. The dummy variable equals one if the country's stock market variable is larger than the observed median value in the data set and zero otherwise. By doing so, we attempt to pick up countries and time periods where stock markets are an "important" part of the financial system. We recognize that this approach has limitations, because ideally we would like to use stock market data for all countries and periods in our original sample.[16]

Two stock market variables are used: the Turnover Ratio and the Trade Volume (as percent of GDP). The Turnover Ratio measures the value of trades of shares on domestic exchanges divided by the total value of listed shares. The Trade Volume is the total shares traded in the domestic stock market divided by GDP. Both these variables are measures of activity and liquidity in the domestic stock market.

The results of including these variables in the panel regressions with the Private Credit measure are reported on Table 11. Trade volume is a positive, significant determinant for economic growth and productivity growth, but not of capital stock growth. Notice, however, that the coefficients for Private Credit for all three groups are essentially not affected by the inclusion of the stock market dummies.

## V. CONCLUSION

This article investigates the channels through which financial development influences economic growth in a panel of 74 countries during 1961–95. Although some of the empirical literature has studied the effects of finance on the *sources* of growth, it has not allowed for the effects to possibly differ in developing versus industrial countries. We examine this hypothesis, which is further

16. The countries for which we have no stock market data are generally less developed, which may allow us to make the assumption that their stock markets are less developed than the stock markets of the countries that are included in the sample. We therefore split countries into those with "very well-developed stock markets" (with a stock market measure above the 50th percentile in the sample) and the rest. Although much information is lost in this way, such an aggregation is preferable to assuming that the countries excluded from the sample do not have a stock market at all or to using the very restricted sample.

**APPENDIX TABLE A-1**
List of Countries Used in the Estimations Ranked by Per Capita GDP in 1971

| Low-Income | Middle-Income | High-Income |
|---|---|---|
| Cameroon | Algeria | Portugal |
| Central African Republic | Bolivia | Argentina |
| Egypt, Arab Rep. | Brazil | Australia |
| Gambia | Chile | Austria |
| Ghana | Colombia | Belgium |
| Haiti | Costa Rica | Canada |
| Honduras | Cyprus | Denmark |
| India | Dominican Republic | Finland |
| Indonesia | Ecuador | France |
| Kenya | El Salvador | Germany |
| Lesotho | Guatemala | Greece |
| Malawi | Iran, Islamic Rep. | Ireland |
| Niger | Jamaica | Israel |
| Pakistan | Korea, Rep. | Italy |
| Philippines | Malaysia | Japan |
| Rwanda | Mauritius | Netherlands |
| Senegal | Mexico | New Zealand |
| Sierra Leone | Nicaragua | Norway |
| Sri Lanka | Panama | Spain |
| Sudan | Papua New Guinea | Sweden |
| Thailand | Paraguay | Switzerland |
| Togo | Peru | Trinidad and Tobago |
| Zaire | South Africa | United Kingdom |
| Zimbabwe | Syria | United States |
| | Uruguay | Venezuela |

motivated in the theoretical literature (e.g., Acemoglu et al. [2002]) but has not been tested before. In low-income countries, we find that finance affects economic growth predominantly through capital accumulation. In contrast, in middle- and especially in high-income economies, financial development enhances productivity growth. It also contributes to physical capital growth, although the effect is somewhat smaller than in the low-income group. Thus the strong contribution of financial development to productivity growth does not occur until a country has reached a certain income level, roughly in the range that defines our middle-income group. Until then, most of the effect occurs through capital accumulation.

These results are important not only because they provide us with more precise marginal effects but also because policy decisions are based on the profession's understanding of the ways in which finance contributes to growth. For example, should the government of a developing country subsidize credits to particular sectors? If all of finance's contribution is in terms of productivity, intervention in the allocation of credit would be undesirable. However, if the economy pursues "investment-based growth" as in Acemoglu et al. (2002), then financial development through some expansion of directed lending to existing enterprises may not be a bad idea, despite the possible inefficiencies. Also, should it be considered a problem if most of the credit activity in less developed countries is biased toward established larger firms while small-firm credit is limited? In principle, funding for small upstarts is important for technological innovation. With "investment-based growth," however, financing the expansion of established firms may have a larger payoff in terms of growth for some time.

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