Stock Markets, Banks, and Economic Growth

By Ross Levine and Sara Zervos*

Do well-functioning stock markets and banks promote long-run economic growth? This paper shows that stock market liquidity and banking development both positively predict growth, capital accumulation, and productivity improvements when entered together in regressions, even after controlling for economic and political factors. The results are consistent with the views that financial markets provide important services for growth, and that stock markets provide different services from banks. The paper also finds that stock market size, volatility, and international integration are not robustly linked with growth, and that none of the financial indicators is closely associated with private saving rates. (*JEL* G00, O16, F36)

Considerable debate exists on the relationships between the financial system and economic growth. Historically, economists have focused on banks. Walter Bagehot (1873) and Joseph A. Schumpeter (1912) emphasize the critical importance of the banking system in economic growth and highlight circumstances when banks can actively spur innovation and future growth by identifying and funding productive investments. In contrast, Robert E. Lucas, Jr. (1988) states that economists "badly over-stress" the role of the financial system, and Joan Robinson (1952) argues that banks respond passively to economic growth. Empirically, Robert G. King and Levine (1993a) show that the level of financial intermediation is a good predictor of long-run rates of economic growth, capital accumulation, and productivity improvements.

* Levine: Department of Economics, University of Virginia, Charlottesville, VA 22903; Zervos: Barclay's Capital Canary Wharf, London, U.K. We thank Mark Baird, Valerie Bencivenga, John Boyd, Jerry Caprio, Asli Demirgüç-Kunt, Doug Diamond, Bill Easterly, Michael Gavin, Bruce Smith, two anonymous referees, and seminar participants at Arizona State University, Cornell University, Dartmouth College, Harvard Institute for International Development, the University of Virginia, and the University of Washington for helpful comments. We received excellent research assistance from Michelle Barnes and Ti Caudron. Much of the work on this paper was done while the authors were employed by the World Bank. Opinions expressed are those of the authors and do not necessarily reflect those of the World Bank, its staff, or member countries.

Besides the historical focus on banking, there is an expanding theoretical literature on the links between stock markets and long-run growth, but very little empirical evidence. Levine (1991) and Valerie R. Bencivenga et al. (1995) derive models where more liquid stock markets—markets where it is less expensive to trade equities—reduce the disincentives to investing in long-duration projects because investors can easily sell their stake in the project if they need their savings before the project matures. Enhanced liquidity, therefore, facilitates investment in longer-run, higher-return projects that boost productivity growth. Similarly, Michael B. Devereux and Gregor W. Smith (1994) and Maurice Obstfeld (1994) show that greater international risk sharing through internationally integrated stock markets induces a portfolio shift from safe, low-return investments to high-return investments, thereby accelerating productivity growth. These liquidity and risk models, however, also imply that greater liquidity and international capital market integration ambiguously affect saving rates. In fact, higher returns and better risk sharing may induce saving rates to fall enough such that overall growth slows with more liquid and internationally integrated financial markets. Moreover, theoretical debate exists about whether greater stock market liquidity actually encourages a shift to higher-return projects that stimulate productivity growth. Since more liquidity makes it easier to sell shares, some argue that more liquidity reduces the incentives of shareholders to undertake the costly task of monitoring managers (Andrei Shleifer and Robert W. Vishny, 1986; Amar Bhide, 1993). In turn, weaker corporate governance impedes effective resource allocation and slows productivity growth. Thus, theoretical debate persists over the links between economic growth and the functioning of stock markets.[1]

This paper empirically investigates whether measures of stock market liquidity, size, volatility, and integration with world capital markets are robustly correlated with current and future rates of economic growth, capital accumulation, productivity improvements, and saving rates using data on 47 countries from 1976 through 1993. This investigation provides empirical evidence on the major theoretical debates regarding the linkages between stock markets and long-run economic growth. Moreover, we integrate this study into recent cross-country research on financial intermediation and growth by extending the King and Levine (1993a) analysis of banking and growth to include measures of the functioning of stock markets. Specifically, we evaluate whether banking and stock market indicators are *both* robustly correlated with current and future rates of economic growth, capital accumulation, productivity growth, and private saving. If they are, then this suggests that both banks and stock markets have an independent empirical connection with contemporaneous and future long-run growth rates.

We find that stock market liquidity—*as measured both by the value of stock trading relative to the size of the market and by the value of trading relative to the size of the economy*—is positively and significantly correlated with current and future rates of economic growth, capital accumulation, and productivity growth. Stock market liquidity is a robust predictor of real per capita gross domestic product (GDP) growth, physical capital growth, and productivity growth after controlling for initial income, initial investment in education, political stability, fiscal policy, openness to trade, macroeconomic stability, and the forward-looking nature of stock prices. Moreover, the level of banking development—*as measured by bank loans to private enterprises divided by GDP*—also enters these regressions significantly. Banking development and stock market liquidity are both good predictors of economic growth, capital accumulation, and productivity growth. The other stock market indicators do not have a robust link with long-run growth. Volatility is insignificantly correlated with growth in most specifications. Similarly, market size and international integration are not robustly linked with growth, capital accumulation, and productivity improvements. Finally, none of the financial indicators is robustly related to private saving rates.

The results have implications for a variety of theoretical models. The strong, positive connections between stock market liquidity and faster rates of growth, productivity improvements, and capital accumulation confirm Levine's (1991) and Bencivenga et al.'s (1995) theoretical predictions. We do not find any support, however, for theories that more liquid or more internationally integrated capital markets negatively affect saving and growth rates or that greater liquidity retards productivity growth.[2] Further, the evidence does not support the belief that stock return volatility hinders investment and resource al-

[1] In terms of banks, Douglas W. Diamond (1984), John H. Boyd and Edward C. Prescott (1986), and Stephen D. Williamson (1986) develop models where financial intermediaries—coalitions of agents—lower the costs of obtaining information about firms from what those costs would be in atomistic capital markets where each investor must acquire information individually. Based on these core models, King and Levine (1993b) show that, by lowering information costs, financial intermediaries foster more efficient resource allocation and thereby accelerate technological innovation and long-run growth. Jeremy Greenwood and Boyan Jovanovic (1990) develop a model in which financial intermediaries affect, and are affected by, economic growth. See the review by Levine (1997).

[2] See Bencivenga and Smith (1991) and Obstfeld (1994) for parameter values that lead to lower saving and growth rates with greater liquidity or risk sharing, respectively. The data are inconsistent with these parameter values. Note, however, that these models have parameter values that are consistent with our empirical findings that: (a) liquidity is positively associated with economic growth; and (b) neither liquidity nor international capital market integration is associated with private saving rates.

location (J. Bradford DeLong et al., 1989). Finally, the data also suggest that banks provide different services from those of stock markets. Measures of both banking development and stock market liquidity enter the growth regression significantly. Thus, to understand the relationship between financial systems and economic growth, we need theories in which stock markets and banks arise simultaneously to provide different bundles of financial services.

A few points are worth emphasizing in interpreting the results. First, since Levine and David Renelt (1992) show that past researchers have been unable to identify empirical links between growth and macroeconomic indicators that are robust to small changes in the conditioning information set, we check the sensitivity of the results to changes in a large conditioning information set. Stock market liquidity and banking development are positively and robustly correlated with current and future rates of economic growth even after controlling for many other factors associated with economic growth. Second, almost all previous cross-country studies of growth focus on data where both the dependent and explanatory variables are averaged over the entire sample period. Besides examining this contemporaneous relationship, we study whether stock market and banking development measured at the beginning of the period robustly predict future rates of economic growth, capital accumulation, productivity growth, and private saving rates. We find that stock market liquidity and banking development both predict long-run growth, capital accumulation, and productivity improvements. Although this investigation does not establish the direction of causality between financial-sector development and growth, the results show that the strong link between financial development and growth does not merely reflect contemporaneous shocks to both, that stock market and banking development do not simply follow economic growth, and that the predictive content of the financial development indicators does not just represent the forward-looking nature of stock prices. This paper's results are certainly consistent with the view that the services provided by financial institutions and markets are important for long-run growth. Finally, this paper's aggregate cross-country analyses complement recent microeconomic evidence. Asli Demirgüç-Kunt and Vojislav Maksimovic (1996) show that firms in countries with better-functioning banks and equity markets grow faster than predicted by individual firm characteristics, and Raghuram G. Rajan and Luigi Zingales (1998) show that industries that rely more on external finance prosper more in countries with better-developed financial markets.

Raymond Atje and Jovanovic (1993) present a cross-country study of stock markets and economic growth. They find a significant correlation between growth over the period 1980–1988 and the value of stock market trading divided by GDP for 40 countries. We make several contributions. Besides increasing the number of countries by almost 20 percent and almost doubling the number of years in the sample, we construct additional measures of stock market liquidity, a measure of stock return volatility, and two measures of stock market integration in world capital markets and incorporate these measures into our study of stock markets, banks, and economic growth. Furthermore, we control for economic and political factors that may influence growth to gauge the sensitivity of the results to changes in the conditioning information set. Moreover, we control for the potential forward-looking nature of financial prices since we want to gauge whether the functioning of stock markets and banks is tied to economic performance, not whether agents anticipate faster growth. Also, we use the standard cross-country growth regression framework of Robert J. Barro (1991) to make comparisons with other work easier, systematically test for the importance of influential observations, and correct for heteroskedasticity. Finally, besides the direct link with growth, we also study the empirical connections between stock market development and physical capital accumulation, productivity improvements, and private saving rates.

The next section presents measures of stock market and banking development, as well as four *growth indicators*—measures of the rate of economic growth, capital accumulation, productivity growth, and private saving. Section II examines the relationship between the four growth indicators and stock market liquidity, size, volatility, international capital market integration, as well as the level of banking development. Section III concludes.

I. Measuring Stock Market and Banking Development and the Growth Indicators

To assess the relationship between economic growth and both stock market and banking development, we need: (1) empirical indicators of stock market liquidity, size, volatility, and integration with world capital markets; (2) a measure of banking development; and (3) measures of economic growth and its components. This section first defines six stock market development indicators: one measure of stock market size, two measures of stock market liquidity, a measure of stock market volatility, and two measures of stock market integration with world capital markets. Although each of these indicators has shortcomings, using a variety of measures provides a richer picture of the ties between stock market development and economic growth than if we used only a single indicator. Second, we describe the empirical indicator of banking development. The third subsection defines the growth indicators: real per capita GDP growth, real per capita physical capital stock growth, productivity growth, and the ratio of private savings to GDP. Finally, we present summary statistics on these variables. The Appendix lists data sources, sample periods, and countries.

A. *Stock Market Development Indicators*

1. *Size—Capitalization* measures the size of the stock market and equals the value of listed domestic shares on domestic exchanges divided by GDP. Although large markets do not necessarily function effectively and taxes may distort incentives to list on the exchange, many observers use Capitalization as an indicator of market development.

2. *Liquidity indicators*—We use two related measures of market liquidity. First, *Turnover* equals the value of the trades of domestic shares on domestic exchanges divided by the value of listed domestic shares. Turnover measures the volume of domestic equities traded on domestic exchanges relative to the size of the market. High Turnover is often used as an indicator of low transactions costs. Importantly, a large stock market is not necessarily a liquid market: a large but inactive market will have large Capitalization but small Turnover.

The second measure of market liquidity is *Value Traded,* which equals the value of the trades of domestic shares on domestic exchanges divided by GDP. While not a direct measure of trading costs or the uncertainty associated with trading on a particular exchange, theoretical models of stock market liquidity and economic growth directly motivate Value Traded (Levine, 1991; Bencivenga et al., 1995). Value Traded measures trading volume as a share of national output and should therefore positively reflect liquidity on an economywide basis. Value Traded may be importantly different from Turnover as shown by Demirgüç-Kunt and Levine (1996). While Value Traded captures trading relative to the size of the economy, Turnover measures trading relative to the size of the stock market. Thus, a small, liquid market will have high Turnover but small Value Traded.

Since financial markets are forward looking, Value Traded has one potential pitfall. If markets anticipate large corporate profits, stock prices will rise today. This price rise would increase the value of stock transactions and therefore raise Value Traded. Problematically, the liquidity indicator would rise without a rise in the number of transactions or a fall in transaction costs. This price effect plagues Capitalization too. One way to gauge the influence of the price effect is to look at Capitalization and Value Traded together. The price effect influences both indicators, but only Value Traded is directly related to trading. Therefore, we include both Capitalization and Value Traded indicators together in our regressions. If Value Traded remains significantly correlated with growth while controlling for Capitalization, then the price effect is not dominating the relationship between Value Traded and growth. A second way to gauge the importance of the price effect is to examine Turnover. The price effect does not influence Turnover because stock prices enter the numerator and denominator of Turnover. If Turnover is positively and robustly associated with economic growth, then this implies that the price effect is not dominating the relationship between liquidity and long-run economic growth.

3. *International integration measures*—Besides liquidity and size, we use two indicators of the degree of integration with world financial markets to provide evidence on theories that link market integration with economic growth. In perfectly integrated markets, capital flows across international borders to equate the price of risk. If capital controls or other barriers impede capital movements, then the price of risk may differ internationally. To compute measures of integration, we use the international capital asset pricing model (CAPM) and international arbitrage pricing theory (APT).

Since these models are well known, we only cursorily outline the estimation procedures. Both asset pricing models imply that the expected return on each asset is linearly related to a benchmark portfolio or linear combination of a group of benchmark portfolios. Following Robert A. Korajczyk and Claude J. Viallet (1989 p. 562–64), let **P** denote the vector of excess returns on a benchmark portfolio. For the CAPM, **P** is the excess return on a value-weighted portfolio of common stocks. For the APT, **P** represents the estimated common factors based on the excess returns of an international portfolio of assets using the asymptotic principal components technique of Gregory Connor and Korajczyk (1986). Firm-level stock returns from 24 national markets are used to form the value-weighted portfolio for the CAPM and to estimate the common factors for the APT. Given m assets and T periods, consider the following regression:

$$(1) \qquad R_{i,t} = \alpha_i + b_i \mathbf{P}_t + \varepsilon_{i,t},$$

$$i = 1, 2, \ldots, m; \qquad t = 1, 2, \ldots, T,$$

where $R_{i,t}$ is the excess return on asset i in period t, i.e., the return above the return on a risk-free asset or zero-beta asset (an asset with zero correlation with the benchmark portfolio). The $R_{i,t}$'s are based on monthly, firm-level stock returns that have been adjusted for dividends and stock splits. For an average month, there are 6,851 firms with return data from the 24 markets. If stock markets are perfectly integrated, then the intercept in a regression of any asset's excess return on the appropriate benchmark portfolio, **P**, should be zero:

$$(2) \qquad \alpha_1 = \alpha_2 = \cdots = \alpha_m = 0.$$

Rejection of the restrictions defined by (2) may be interpreted as rejection of the underlying asset pricing model or rejection of market integration.

Under the assumption that the CAPM and APT are reasonable models of asset pricing, we interpret the monthly estimates of the absolute value of the intercept terms from the multivariate regression (1) as measures of market integration. To compute monthly estimates of stock market integration for each national market, we compute the average of the absolute value of α_i across all stocks in each country each month. Then, we multiply this final value by negative one. Thus, these *CAPM Integration* and *APT Integration* measures are designed to be positively correlated with integration. Moreover, Korajczyk (1996) shows that international integration measures will be negatively correlated with higher official barriers and taxes to international asset trading, bigger transaction costs, and larger impediments to the flow of information about firms.[3]

4. *Volatility*—We measure the volatility of stock returns, *Volatility,* as a 12-month rolling standard deviation estimate that is based on market returns. We cleanse the return series of monthly means and 12 months of autocorrelations using the procedure defined by G. William Schwert (1989). Specifically, we estimate a 12th-order autoregression of monthly returns, R_t, including dummy variables, D_{jt}, to allow for different monthly mean returns:

$$(3) \qquad R_t = \sum_{j=1}^{12} a_j D_{jt} + \sum_{k=1}^{12} b_k R_{t-k} + \nu_t.$$

[3] The CAPM and APT Integration measures rely on asset pricing models that the data frequently rejected as good representations of the pricing of risk. For this paper, however, we seek a numerical index of, for example, how much more the United States is integrated into world capital markets than is Nigeria. We are not concerned with whether the index is based at zero. Thus, even if the integration measures include a constant bias, the CAPM and APT Integration measures still provide information on cross-country differences in market integration.

We collect the absolute value of the residuals from equation (3), and then estimate a 12th-order autoregression of the absolute value of the residuals including dummy variables for each month to allow for different monthly standard deviations of returns:

$$(4) \quad |\hat{\nu}| = \sum_{j=1}^{12} c_j D_{jt} + \sum_{k=1}^{12} d_k |\hat{\nu}_{t-k}| + \mu_t.$$

The fitted values from this last equation give estimates of the conditional standard deviation of returns.[4] We include this measure because of the intense interest in market volatility by academics, practitioners, and policy makers.

B. *Banking Development*

An extensive theoretical literature examines the ties between banks and economic activity. Ideally, researchers would construct cross-country measures of how well banks identify profitable activities, exert corporate governance, mobilize resources, manage risk, and facilitate transactions. Economists, however, have not been able to accurately measure these financial services for a broad cross section of countries. Consequently, researchers traditionally use measures of the overall size of the banking sector to proxy for "financial depth" (e.g., Raymond W. Goldsmith, 1969; Ronald I. McKinnon, 1973). Thus, researchers often divide the stock of broad money (M2) by GDP to measure financial depth. As noted by King and Levine (1993a), however, this type of financial depth indicator does not measure whether the liabilities are those of banks, the central bank, or other financial intermediaries, nor does this financial depth measure identify where the financial system allocates capital. Thus, we use the value of loans made by commercial banks and other deposit-taking banks to the private sector divided by GDP, and call this measure *Bank Credit.* Bank Credit improves upon traditional financial depth measures of banking development by isolating credit issued by banks, as opposed to credit issued by the central bank or other intermediaries, and by identifying credit to the private sector, as opposed to credit issued to governments. In our empirical work, we also used traditional measures of financial depth and discuss some of these results below. We focus almost exclusively on the results with Bank Credit.

C. *Channels to Growth*

Besides examining the relationship between these financial development indicators and long-run real per capita GDP growth, *Output Growth,* we also study two channels through which banks and stock markets may be linked to growth: the rate of real per capita physical capital stock growth, *Capital Stock Growth,* and everything else, *Productivity Growth.* Specifically, let Output Growth equal κ*(Capital Stock Growth) + Productivity Growth. To obtain empirical estimates, we: (a) obtain Output Growth from national accounts data; (b) use Capital Stock Growth from King and Levine (1994); (c) select a value for κ ($\kappa = 0.3$), and then compute Productivity Growth as a residual.[5] If Capital Stock Growth accurately reflects changes in physical capital and if capacity utilization remains stable when averaged over 18 years, then Productivity Growth should provide a reasonable conglomerate indicator of technological change, quality advances, and resource allocation enhancements.[6]

The last growth indicator we consider, *Savings,* equals gross private savings from Paul Masson et al. (1995). Measuring private saving rates is subject to considerable measurement error, and data on gross private savings

[4] As in Schwert (1989), we use iterated weighted least-squares estimates, iterating three times between (3) and (4), to obtain more efficient estimates.

[5] To compute capital stocks, King and Levine (1994) estimate the capital-output ratio for over 100 countries in 1950, data permitting, and then iterate forward using Robert Summers and Alan Heston (1991) real investment data and a depreciation rate of 0.07. We update these estimates through 1990 using Summers and Heston (1993) data. Estimates of the capital share parameter, κ, typically range between 0.25 and 0.40 (see King and Levine [1994] for citations). We experimented with values in this range, and since the results do not importantly change, we report the results with $\kappa = 0.3$.

[6] In the regressions, we include a term for investment in human capital.

are available for many fewer countries in our sample (32) than, for example, Output Growth data (47). Nevertheless, these data offer a unique opportunity to shed some empirical light on important theoretical issues: what is the relationship between private saving rates and stock market liquidity, international risk sharing through integrated capital markets, and the level of banking development?

We term the four variables—Output Growth, Capital Stock Growth, Productivity Growth, and Savings—growth indicators. Thus, this paper evaluates the empirical relationship between the four growth indicators and the six stock market indicators (Turnover, Value Traded, Capitalization, Volatility, CAPM Integration, and APT Integration) plus the banking development indicator (Bank Credit).

D. *Summary Statistics and Correlations*

Table 1 presents summary statistics on the six stock market development indicators, the bank development indicator, and four growth indicators. We have data for a maximum of 47 countries over the 1976–1993 period. Table 1 shows substantial variance among the countries in the growth and financial development indicators. For example, Korea averaged 9.7 percent annual growth over the 1976–1993 period and had a private savings rate of almost 30 percent of GDP, while Cote d'Ivoire grew at −2.5 percent in real per capita terms over the same period and Bangladesh's savings rate was 9 percent of GDP; Taiwan had Value Traded equal to almost 1.2, while Nigeria's Value Traded averaged 0.0002 from 1976–1993.

Table 2 presents correlations. Data permitting, we average the data over the 1976–1993 period so that each country has one observation per variable. We compute the correlations for Capital Stock Growth and Productivity Growth using data averaged over the 1976–1990 period. Three correlations are worth highlighting. First, Bank Credit is highly correlated with the growth indicators and all of the stock market indicators. Second, Bank Credit is very highly correlated with Capitalization (0.65), which suggests that it will be difficult to distinguish between measures of the overall size of the equity market and the measure of bank credit to private enterprises divided by GDP. Third, the liquidity measures are positively and significantly correlated with Output Growth, Capital Stock Growth, and Productivity Growth at the 0.05-percent level.

II. Stock Markets, Banks, and Economic Growth

This section evaluates whether measures of banking development and stock market liquidity, size, volatility, and integration with world capital markets are robustly correlated with economic growth, capital accumulation, productivity growth, and private saving rates. The first two subsections use least-squares regressions to study the ties between the growth indicators and measures of banking development, stock market liquidity, market size, and stock return volatility. The next subsection uses instrumental variables to examine the links between the growth indicators, banking development, and measures of capital market integration. We use instrumental variables because the international integration measures are estimated regressors. The final subsection conducts a number of sensitivity checks on the robustness of the results.

A. *Framework: Banking, Liquidity, Size, and Volatility*

This subsection uses cross-country regressions to gauge the strength of the partial correlation between each of the four growth indicators and measures of banking and stock market development. The growth indicators are averaged over the 1976–1993 period. The banking and stock market development indicators are computed at the beginning of the period 1976 (data permitting). There is one observation per country. We organize the investigation around the four stock market development indicators and always control for the level of banking development. Thus, we run 16 basic regressions, where the dependent variable is either Output Growth, Capital Stock Growth, Productivity Growth, or Savings averaged over the 1976–1993 period. The four stock market variables are either Turnover, Value Traded, Capitalization, or Volatility measured at the beginning of the sample period.

TABLE 1—SUMMARY STATISTICS: ANNUAL AVERAGES 1976–1993

	Mean	Median	Maximum	Minimum	Standard deviation	Observations
Output Growth	0.021	0.019	0.097	−0.025	0.022	47
Capital Stock Growth	0.028	0.024	0.095	−0.023	0.026	46
Productivity Growth	0.016	0.014	0.079	−0.019	0.017	46
Savings	20.0	20.8	29.7	9.1	5.1	32
Capitalization	0.32	0.17	2.45	0.01	0.43	46
Value Traded	0.11	0.04	1.16	0.00	0.19	47
Turnover	0.30	0.23	2.05	0.01	0.33	46
Volatility	0.07	0.05	0.31	0.03	0.06	36
Bank Credit	0.80	0.75	2.27	0.12	0.50	47
APT Integration	−4.30	−3.95	−2.17	−6.67	1.48	24
CAPM Integration	−4.08	−3.65	−2.00	−9.98	1.86	24

Notes: Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings as a percent of GDP; Capitalization = value of domestic shares as a share of GDP; Value Traded = value of the trades of domestic shares as a share of GDP; Turnover = value of the trades of domestic shares as a share of market capitalization; Volatility = measure of stock return volatility; Bank Credit = bank credit to the private sector as a share of GDP; APT Integration = the arbitrage pricing theory measure of stock market integration; CAPM Integration = the international capital asset pricing model measure of stock market integration.

Traditionally, the growth literature uses growth and explanatory variables averaged over long periods. This approach, however, is frequently criticized because: (i) a common shock to the dependent and explanatory variables during the sample period may be driving the empirical findings; and (ii) *contemporaneous regressions*—regressions using dependent and explanatory variables averaged over the same period—do not account for the potential endogenous determination of growth and the explanatory variables. Besides conducting the contemporaneous regressions, we focus on the "initial value" regressions, where we use the values of the banking and stock market indicators in 1976. While this analysis does not resolve the issue of causality, the initial value regressions show that the strong relationship between financial development and the growth indicators does not merely reflect contemporaneous shocks to both, and that stock market and banking development do not simply follow economic development.

To assess the strength of the independent relationship between the initial levels of stock market and banking development and the growth variables, we include a wide array of control variables, X. Specifically, we include the logarithm of initial real per capital GDP, *Initial Output,* and the logarithm of the initial secondary-school enrollment rate, *Enrollment,* because theory and evidence suggest an important link between long-run growth and initial income and investment in human capital accumulation (Robert M. Solow, 1956; Lucas, 1988; N. Gregory Mankiw et al., 1992; Barro and Xavier Sala-i-Martin, 1995). The number of revolutions and coups, *Revolutions and Coups,* is included since many authors find that political instability is negatively associated with economic growth (see Barro and

TABLE 2—CORRELATIONS

	Capital Stock Growth	Productivity Growth	Savings	Capitalization	Value Traded	Turnover	CAPM Integration	APT Integration	Volatility	Bank Credit
Output Growth	0.773 (0.001)	0.957 (0.001)	0.4466 (0.008)	0.037 (0.037)	0.522 (0.001)	0.487 (0.001)	0.343 (0.101)	0.28 (0.186)	−0.08 (0.644)	0.347 (0.013)
Capital Stock Growth	—	0.557 (0.001)	0.5300 (0.001)	0.203 (0.171)	0.425 (0.003)	0.356 (0.014)	0.228 (0.296)	0.182 (0.407)	−0.104 (0.547)	0.324 (0.023)
Productivity Growth	—	—	0.4191 (0.014)	0.222 (0.134)	0.417 (0.003)	0.444 (0.002)	0.277 (0.200)	0.209 (0.339)	−0.169 (0.325)	0.372 (0.008)
Savings	—	—	—	−0.0792 (0.656)	0.1601 (0.366)	0.4470 (0.008)	−0.1394 (0.620)	−0.3504 (0.200)	0.1189 (0.555)	0.1189 (0.168)
Capitalization	—	—	—	—	0.331 (0.022)	0.05 (0.735)	0.476 (0.019)	0.36 (0.084)	−0.261 (0.124)	0.647 (0.001)
Value Traded	—	—	—	—	—	0.831 (0.001)	0.188 (0.380)	0.068 (0.752)	0.085 (0.622)	0.449 (0.001)
Turnover	—	—	—	—	—	—	0.074 (0.730)	−0.003 (0.991)	0.186 (0.278)	0.328 (0.023)
CAPM Integration	—	—	—	—	—	—	—	0.78 (0.001)	−0.838 (0.001)	0.45 (0.027)
ATP Integration	—	—	—	—	—	—	—	—	0.573 (0.005)	0.454 (0.026)
Volatility	—	—	—	—	—	—	—	—	—	−0.404 (0.014)

Notes: p-values in parentheses. Output Growth = real per capital GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Capitalization = value of domestic shares as a share of GDP; Value Traded = value of the trades of domestic shares as a share of GDP; Turnover = value of the trades of domestic shares as a share market capitalization; Volatility = measure of stock return volatility; Bank Credit = bank credit to the private sector as a share of GDP; APT Integration = the arbitrage pricing theory measure of stock market integration; CAPM Integration = the international capital asset pricing model measure of stock market integration.

Sala-i-Martin [1995] for evidence and citations). We also include a variety of macroeconomic indicators in the conditioning information set. The initial values of government consumption expenditures to GDP, *Government,* and the rate of inflation, *Inflation,* are included because theory and some evidence suggests a negative relationship between macroeconomic instability and economic activity (William Easterly and Sergio Rebelo, 1993; Stanley Fischer, 1993; Michael Bruno and Easterly, 1998). Similarly, the initial value of the black market exchange rate premium, *Black Market Premium,* is part of the *X* variables since international price distortions may impede efficient investment decisions and economic growth (David Dollar, 1992). Moreover, the black market premium is a general indicator of policy, price, and trade distortions and therefore is a useful variable to use in assessing the independent relationship between the growth indicators and measures of financial sector development. As discussed below, alternative control variables and combinations of *X* variables do not materially affect the results on the relationship between financial development and economic growth.

B. *Results: Banking, Liquidity, Size, and Volatility*

First, consider the results on stock market liquidity and banking development. Table 3 presents four regressions, where the dependent variable is Output Growth, Capital Stock Growth, Productivity Growth, and Savings,

TABLE 3—INITIAL TURNOVER, BANKS, AND GROWTH, 1976–1993

Independent variables	Dependent variables: Output Growth	Capital Stock Growth	Productivity Growth	Savings
Bank Credit	0.0131 (0.0055)	0.0148 (0.0063)	0.0111 (0.0046)	3.8376 (2.3069)
Turnover	0.0269 (0.0090)	0.0222 (0.0094)	0.0201 (0.0088)	7.7643 (5.6864)
R^2	0.5038	0.5075	0.4027	0.4429
Observations	42	41	41	29

Notes: Heteroskedasticity-consistent standard errors in parentheses. Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Bank Credit = initial bank credit to the private sector as a share of GDP; Turnover = initial value of the trades of domestic shares as a share of market capitalization. Other explanatory variables included in each of the regressions: Initial Output, Enrollment, Revolutions and Coups, Government, Inflation, and Black Market Premium.

respectively, and the liquidity measure is initial Turnover. White's heteroskedasticity-consistent standard errors are reported in parentheses. *Both* the stock market liquidity and banking development indicators enter the Output Growth, Capital Stock Growth, and Productivity Growth regressions significantly at the 0.05-percent significance level. To economize on space, we only present the coefficient estimates for the stock market and bank indicators. The full regression results for Table 3 are given in the Appendix [see Table A1]. The other explanatory variables generally enter the regressions as expected. Initial income enters with a significantly negative coefficient and the size of the convergence coefficient is very similar to other studies (Barro and Sala-i-Martin, 1995). Secondary-school enrollment enters the growth regression positively, while political instability enters with a significantly negative coefficient. Although the values of government consumption expenditures divided by GDP and inflation in 1976 enter the growth regression with negative coefficients, they are statistically insignificant, though inflation has a strong negative relationship with capital accumulation and private saving rates. In this sample of countries and with the extensive set of control variables, the black market exchange rate premium does not enter the Output Growth regression significantly, which confirms Levine and Renelt (1992). The growth regression R^2 of 0.50 is consistent with other cross-country growth studies (e.g., Barro and Sala-i-Martin, 1995).

In sum, we find that both the initial level of banking development and the initial level of stock market liquidity have statistically significant relationships with future values of Output Growth, Capital Stock Growth, and Productivity Growth even after controlling for many other factors associated with long-run economic performance. These results are consistent with the view that stock market liquidity and banks facilitate long-run growth (Levine, 1991; Bengt Holmstrom and Jean Tirole, 1993; Bencivenga et al., 1995). The results are not supportive of models that emphasize the negative implications of stock market liquidity (Shleifer and Vishny, 1986; Shleifer and Lawrence Summers, 1988).

We do not find a statistically significant link between private saving rates and either stock market liquidity or banking development. Although the saving results should be viewed very skeptically because there are only 29 observations in the regressions, Catherine Bonser-Neal and Kathryn Dewenter (1996) find similar results using annual data with 174 observations: there is not a systematic association between stock market liquidity and private saving rates. It is also worth noting that these results do not contradict Tullio Jappelli and Marco Pagano's (1994) findings that countries where households are liquidity constrained tend to have higher saving rates. In Jappelli and Pagano (1994), "liquidity constrained" means that households find it relatively difficult to obtain mortgages or consumer credit. In contrast, this paper uses the term liquidity to refer to the ease with which agents can trade equities. Taken together, the two sets of findings imply that countries with large impediments to obtaining mortgage and consumer credit tend to have higher saving rates, while the level of activity on a country's stock exchange is unrelated to saving rates.[7] Furthermore, our finding that stock market liquidity is unrelated to private saving rates is not inconsistent with our finding that stock market liquidity is positively related to physical capital accumulation: (a) Capital Stock Growth is generated by private-sector, public-sector, and foreign investment, while Savings only measures gross private savings of domestic residents; and (b) the savings analysis is based on a much smaller sample of countries.[8] Moreover, while financial development is significantly associated with future Capital Stock Growth, economically, the major channel through which growth is linked to stock markets and banks is through Productivity Growth, not Capital Stock Growth, as we discuss below. Finally, the lack of a strong link between financial-sector development and private savings has implications for Mankiw et al.'s (1992) evaluation of the neoclassical growth model. One weakness in their analysis is that savings rates may be endogenous or proxying for some other country-specific factor. This paper's results suggest that saving rates are not proxying for financial-sector development.

Besides being statistically significant, the estimated coefficients suggest that the relationships between financial-sector development and future rates of long-run growth, capital accumulation, and productivity improvements are economically large. For example, the estimated coefficient implies that a one-standard-deviation increase in initial stock market liquidity (0.3) would increase per capita growth by 0.8 percentage points per year ($0.027*0.3$) over this period. Accumulating over 18 years, this implies that real GDP per capita would have been over 15 percent higher by 1994 ($\exp\{18*0.008\}$). The estimated coefficient on Bank Credit also suggests a similarly large economic relationship between banking development and growth. Specifically, a one-standard-deviation increase in initial banking development (0.5) would increase Output Growth by 0.7 percentage points per year ($0.013*0.5$). Taken together, the results imply that if a county had increased both stock market and banking development in 1976 by one standard deviation, then by 1994 real per capita GDP would have been 31 percent larger, the capital stock per person would have been 29 percent higher, and productivity would have been 24 percent greater. These conceptual experiments do not consider the question of causality nor how to change the financial sector. Nonetheless, the examples illustrate the potentially large economic consequences of stock market liquidity and banking development and the potentially large economic costs of impediments to financial-sector development.

The Value Traded measure of stock market liquidity confirms these findings. Table 4 presents the same type of regressions as in Table 3 except we replace Turnover with Value Traded. Again, the initial liquidity and banking development indicators are significantly and robustly correlated with future rates of economic growth, capital accumulation, and

[7] More generally, Jappelli and Pagano (1994 p. 102) note that the finding that financial development is positively linked with economic growth does not contradict their findings, because they focus on "... the effect of imperfections in the mortgage and consumer credit markets, which have no necessary correlation with the development of lending to firms."

[8] It is also true that in the regression analyses, Savings is only available for about 70 percent of the countries for which we have Capital Stock Growth data. However, the Bonser-Neal and Dewenter (1996) findings suggest that this smaller sample is not driving the results. Moreover, we restricted the Capital Stock Growth regressions to those countries with Savings data. While the t-statistics on the financial indicators fall, financial development generally remains a significant predictor of Capital Stock Growth even in this smaller sample.

TABLE 4—INITIAL VALUE TRADED, BANKS, AND GROWTH, 1976–1993

Independent variables	Dependent variables: Output Growth	Capital Stock Growth	Productivity Growth	Savings
Bank Credit	0.0146 (0.0056)	0.0148 (0.0061)	0.0125 (0.0047)	3.4917 (2.1920)
Value Traded	0.0954 (0.0315)	0.0927 (0.0324)	0.0736 (0.0220)	15.8456 (14.0757)
R^2	0.4655	0.5224	0.3726	0.4278
Observations	43	42	42	29

Notes: Heteroskedasticity-consistent standard errors in parentheses. Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Bank Credit = initial bank credit to the private sector as a share of GDP; Value Traded = initial value of the trades of domestic shares as a share of GDP. Other explanatory variables included in each of the regressions: Initial Output, Enrollment, Revolutions and Coups, Government, Inflation, and Black Market Premium.

productivity growth. Again, the estimated coefficients suggest an economically large relationship between initial financial development and future long-run growth rates. For example, the results imply that if in 1976 Mexico had had the sample mean value of Value Traded (0.046) instead of its actual value of (0.004), annual per capita growth would have been almost 0.4 percentage points faster (0.095∗0.04) over the sample period, such that GDP per capita would have been 7.5 percent higher by 1994 (exp{18∗0.004}). The economic implications of a symmetric change in banking are even larger. If Mexico had had the sample mean value of banking development in 1976 (0.65) instead of its actual value of (0.13), growth would have been 0.8 percentage points faster per year (0.015∗0.52). Combined, these improvements in stock market liquidity and banking development in 1976 are consistent with Mexico enjoying almost 23-percent higher GDP per capita by 1994.

The findings in Tables 3 and 4 also provide some information on the relative importance of the Capital Stock Growth and Productivity Growth channels. For example, the estimated parameter values imply that a one-standard-deviation increase in Value Traded in 1976 (0.2) would increase Output Growth and Capital Stock Growth by about 1.9 percentage points per year. Since growth accounting exercises generally give Productivity Growth a weight that is about two times the weight on physical capital accumulation (i.e., $\kappa = 1/3$), this implies that Productivity Growth accounts for about 1.3 percentage points (1.9 − (1/3)∗1.9) of the 1.9-percentage-point increase in Output Growth generated by the increase in Value Traded. Thus, the main channel linking financial development with growth runs through Productivity Growth rather than Capital Stock Growth, which is consistent with the findings in Jose DeGregorio and Pablo E. Guidotti (1995).[9] As noted above, the estimated coefficients should not be viewed as exploitable elasticities. Rather, these conceptual experiments are meant to illustrate the economic size of the coefficients.

The forward-looking nature of stock prices—the ''price-effect''—is not driving the strong link between market liquidity and the growth indicators. This can be deduced from two results. First, the price effect does not influence Turnover, and Turnover is robustly linked

[9] The Productivity Growth channel is also the main link between Bank Credit Output Growth in the Table 3 and 4 results.

TABLE 5—INITIAL VALUE TRADED, CAPITALIZATION, BANKS, AND GROWTH, 1976–1993

	Dependent variables			
Independent variables	Output Growth	Capital Stock Growth	Productivity Growth	Savings
Bank Credit	0.0083	0.0111	0.0086	2.9614
	(0.0054)	(0.0055)	(0.0046)	(2.0960)
Capitalization	0.0148	0.0088	0.0070	−7.5606
	(0.0068)	(0.0092)	(0.0056)	(7.0266)
Value Traded	0.0700	0.0780	0.0592	23.5929
	(0.0322)	(0.0382)	(0.0227)	(15.7283)
R^2	0.5186	0.5297	0.4083	0.4499
Observations	42	41	41	29

Notes: Heteroskedasticity-consistent standard errors in parentheses. Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Bank Credit = initial bank credit to the private sector as a share of GDP; Value Traded = initial value of the trades of domestic shares as a share of GDP; Capitalization = initial value of domestic shares as a share of GDP. Other explanatory variables included in each of the regressions: Initial Output, Enrollment, Revolutions and Coups, Government, Inflation, and Black Market Premium.

with future rates of economic growth, capital accumulation, and productivity growth. Second, we include Capitalization and Value Traded together in the same regression to test whether the price-effect is producing the strong empirical links between Value Traded and the growth indicators. The price-effect influences both Capitalization and Value Traded. If the price-effect is driving the empirical association between Value Traded and the growth indicators reported in Table 4, then Value Traded should not remain significantly correlated with the growth indicators when we simultaneously include Capitalization and Value Traded. This is not the case. As reported in Table 5, Value Traded in 1976 remains significantly correlated with future rates of economic growth, capital accumulation, and productivity growth even when controlling for market capitalization (with little change in the estimated coefficients). Thus, the evidence is inconsistent with the view that expectations of future growth, which are reflected in current stock prices, are driving the strong empirical relationship between stock market liquidity and growth. The evidence is consistent with the view that the ability to trade ownership of an economy's productive technologies easily promotes more efficient resource allocation, capital formation, and faster growth.[10]

Importantly, initial stock market size and stock return volatility are not generally robust predictors of the growth indicators. Although the coefficients presented in Table 6 indicate a positive association between Capitalization and both Output Growth and Capital Stock Growth, this relationship is strongly influenced by a few countries. Specifically, if Jamaica, Korea, and Singapore are removed from the regression, Capitalization no longer

[10] The strong link between liquidity and capital accumulation suggests an area for future research. Specifically, three empirical findings need to be reconciled: (1) stock market liquidity is positively tied to capital formation, but (2) equity sales do not finance much of this capital formation (Colin Mayer, 1988), and (3) stock market liquidity is *positively* associated with corporate debt-equity ratios in developing countries (Demirgüç-Kunt and Maksimovic, 1996). These findings imply interactions between stock markets, banks, corporate finance, and corporate investment decisions that many existing theories do not fully capture (though, see Boyd and Smith [1996] and Elisabeth Huybens and Smith [1998]).

TABLE 6—INITIAL CAPITALIZATION, BANKS, AND GROWTH, 1976–1993

	Dependent variables			
Independent variables	Output Growth	Capital Stock Growth	Productivity Growth	Savings
Bank Credit	0.0089	0.0090	0.0094	5.1226
	(0.0061)	(0.0078)	(0.0050)	(2.0927)
Capitalization	0.0230	0.0207	0.0135	−0.7291
	(0.0065)	(0.0081)	(0.0055)	(7.1411)
R^2	0.4577	0.3754	0.3423	0.3189
Observations	45	44	44	31

Notes: Heteroskedasticity-consistent standard errors in parentheses. Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Bank Credit = initial bank credit to the private sector as a share of GDP; Capitalization = initial value of domestic shares as a share of GDP. Other explanatory variables included in each of the regressions: Initial Output, Enrollment, Revolutions and Coups, Government, Inflation, and Black Market Premium.

enters the regression significantly.[11] Similarly, the results on market volatility do not suggest a reliable link to the growth indicators. As shown in Table 7, stock return volatility is not closely linked with future growth, productivity improvements, or private saving rates, and Volatility is positively correlated with capital accumulation. As discussed below, the results on market liquidity are much more robust to the removal of outliers. More importantly, the relationship between stock market size and the growth indicators vanishes when controlling for stock market liquidity (Table 5). Thus, it is not just listing securities on an exchange; it is the ability to trade those securities that is closely tied to economic performance.

C. *International Capital Market Integration, Banking, and the Growth Indicators*

To investigate the relationship between the growth indicators and international capital market integration, we slightly revise the analytical framework in two ways. First, we only have data on capital market integration for 24 countries. Thus, we use pooled cross-section time-series data averaged over the periods 1976–1985 and 1986–1993, so that each country has potentially two observations for a maximum of 48 observations.[12] Second, CAPM Integration and APT Integration are estimated regressors. Therefore, we use two-stage least squares to derive consistent standard errors as suggested by Adrian Pagan (1984).[13]

Tables 8 and 9 report the results on capital market integration. The CAPM and APT Integration measures enter the growth equations with a positive coefficient suggesting that greater capital market integration is positively related to economic performance. Furthermore, the point estimates imply a potentially large effect. For example, a one-standard-

[11] That is, the p-value on the coefficient on Capitalization rises above 0.10.

[12] We choose this asymmetric dividing point because the data for some countries start in 1978.

[13] For instruments, we use Initial Output, Enrollment, Revolutions and Coups, initial Capitalization, initial Value Traded, initial Turnover, initial Inflation, initial ratio of international trade to GDP (*Trade*), initial Government, and initial Black Market Premium. The first-stage R^2's are 0.73 for the CAPM Integration measure and 0.52 for the APT Integration measure and the F-statistic for both rejects the null hypothesis that none of the cross-sectional variation in capital market integration is explained by the explanatory variables. Furthermore, the simple OLS regressions yield virtually identical results to the instrumental variable results presented in Tables 8 and 9.

TABLE 7—INITIAL VOLATILITY, BANKS, AND GROWTH, 1976–1993

	Dependent variables			
Independent variables	Output Growth	Capital Stock Growth	Productivity Growth	Savings
Bank Credit	0.0150	0.0140	0.0130	3.5945
	(0.0074)	(0.0085)	(0.0066)	(1.9631)
Volatility	0.0150	0.4998	0.0211	115.0991
	(0.0074)	(0.1580)	(0.2146)	(99.4063)
R^2	0.4183	0.6817	0.2938	0.7708
Observations	32	32	32	23

Notes: Heteroskedasticity-consistent standard errors in parentheses. Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Bank Credit = initial bank credit to the private sector as a share of GDP; Volatility = initial measure of stock return volatility. Other explanatory variables included in each of the regressions: Initial Output, Enrollment, Revolutions and Coups, Government, Inflation, and Black Market Premium.

deviation increase in CAPM Integration (1.86) would increase Output Growth by about 1.2 percentage points per year (1.86*0.0065). Nonetheless, the data do not suggest a statistically strong link between capital market integration and the growth indicators. The CAPM and APT Integration measures are not significantly correlated with Output Growth at the 0.10 level. Moreover, the reported regressions exclude Inflation, which is very highly correlated with stock market integration. With inflation included, the *t*-statistics on CAPM Integration and APT Integration become even smaller. While the very small sample may lower confidence in these results, the findings do not support the hypothesis that greater risk sharing through internationally integrated markets affect growth, capital accumulation, productivity growth, or private saving rates.

D. *Sensitivity Analyses*

We conducted a wide array of sensitivity analyses to check the robustness of these results.[14] As mentioned above, regressions using values of the dependent and explanatory variables averaged over the entire sample period yield similar results. Furthermore, changing the conditioning information set did not materially affect our results.[15] For example, altering the set of explanatory variables included in the regression, adding measures of legal efficiency or institutional development, as defined in Paulo Mauro (1995), or using the King and Levine (1993a) measure of financial depth did not affect the strong link between stock market liquidity and growth.[16] We also experimented with an alternative measure of stock market liquidity that gauges trading relative to stock price movements. Specifically, we divide Value Traded by Volatility. All things equal, more liquid markets should be able to support more trading with less price volatility. This alternative measure produced similar results.

We test for the potential influence of outliers in two ways. First, we use the procedure for

[14] Unpublished appendices with numerous additional sensitivity analyses are available at http://www.worldbank.org/html/prdmg/grthweb/growth_t.htm.

[15] Furthermore, we used Summers and Heston (1993) data, instead of own currency prices, to compute Government and Output Growth. This did not affect the results.

[16] When the legal efficiency and institutional development indicators are included with enough additional explanatory variables, the sample size falls dramatically, such that the Bank Credit becomes insignificant at the 0.05-percent level in some specifications.

TABLE 8—STOCK MARKET INTEGRATION (CAPM), BANKS, AND GROWTH, 1976–1993, POOLED, INSTRUMENTAL VARIABLES

	Dependent variables			
Independent variables	Output Growth	Capital Stock Growth	Productivity Growth	Savings
Bank Credit	0.0096	0.0143	0.0032	−4.3598
	(0.0134)	(0.0172)	(0.0136)	(2.9495)
CAPM Integration	0.0065	0.0014	0.0085	2.0167
	(0.0043)	(0.0045)	(0.0048)	(2.0609)
Observations	38	38	38	25

Notes: First-stage R^2 for CAPM Integration: 0.73. Heteroskedasticity-consistent standard errors in parentheses. Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Bank Credit = initial bank credit to the private sector as a share of GDP; CAPM Integration = the international capital asset pricing model measure of stock market integration. Instruments: a constant, Initial Output, Enrollment, Revolutions and Coups, and initial values of Government, Black Market Premium, Trade, Capitalization, Value Traded, Turnover, and Bank Credit.

TABLE 9—STOCK MARKET INTEGRATION (APT), BANKS, AND GROWTH, 1976–1993, POOLED, INSTRUMENTAL VARIABLES

	Dependent variables			
Independent variables	Output Growth	Capital Stock Growth	Productivity Growth	Savings
Bank Credit	0.0148	0.0186	0.0117	−3.8182
	(0.0143)	(0.0166)	(0.0150)	(2.3952)
APT Integration	0.0075	−0.0008	0.0086	2.8466
	(0.0074)	(0.0076)	(0.0073)	(1.7108)
Observations	38	38	38	25

Notes: First-stage R^2 for APT Integration: 0.52. Heteroskedasticity-consistent standard errors in parentheses. Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Bank Credit = initial bank credit to the private sector as a share of GDP; APT Integration = the arbitrage pricing theory measure of stock market integration. Instruments: a constant, Initial Output, Enrollment, Revolutions and Coups, and initial values of Government, Black Market Premium, Trade, Capitalization, Value Traded, Turnover, and Bank Credit.

analyzing the influence of particular observations described in William Greene (1993 pp. 287–88). This procedure identifies countries that exert a large effect on each equation's residuals. Using a critical value of 2.5, we find that removing particularly influential observations does not affect our conclusions. Second, we use a more subjective method for identifying influential observations; we use scatterplots of the partial relationship between each of the growth indicators and the individual stock market indicators to identify outliers that may be excessively influencing the slope and significance of the estimated regression line.[17] Removing influ-

[17] Specifically, in the multivariate regression of $G(i)$ on X, Bank Credit, and $S(k)$, where $S(k)$ represents each particular stock market indicator taken in turn, the partial scatterplot is computed as follows: regress $G(i)$ on X and

TABLE 10—INITIAL STOCK MARKET DEVELOPMENT, BANKS, AND GROWTH, 78-COUNTRY SAMPLE

Dependent variable: Output Growth	78-country sample		Original sample	
Stock market indicator (SMI):	Bank Credit	SMI	Bank Credit	SMI
Turnover	0.015	0.022	0.013	0.027
	(2.753)	(2.448)	(2.753)	(2.448)
Value Traded	0.013	0.111	0.015	0.095
	(2.630)	(4.242)	(2.536)	(3.854)
Capitalization	0.012	0.018	0.009	0.023
	(2.047)	(2.826)	(1.866)	(2.672)

Notes: Heteroskedasticity-consistent t-statistics in parentheses. Output Growth = real per capita GDP growth; Bank Credit = initial bank credit to the private sector as a share of GDP; Turnover = initial value of trades of domestic shares as a share of market capitalization; Capitalization = initial value of domestic shares as a share of GDP; Value Traded = initial value of trades of domestic shares as a share of GDP; Other explanatory variables included in each of the regressions: Initial Output, Enrollment, Revolutions and Coups, Government, Inflation, and Black Market Premium.

ential observations importantly weakens the relationship between the growth indicators and market size, as noted above. The other results do not change. In particular, stock market liquidity remains robustly correlated with growth, capital accumulation, and productivity growth after removing potential outliers.

We were also concerned about a potential sample selection problem: we only include countries with sufficient stock market activity to warrant inclusion in data bases. We have data on all the non-stock market data for an additional 31 countries. Although we do not have explicit observations on stock transactions in these economies, anecdotal information and a review of official documents suggest that stock market activity in these countries was inconsequential in 1976. Thus, for these 31 countries, we enter values of zero for Capitalization, Value Traded, and Turnover.[18] Zero is not an extreme guess. Recall from Table 1 that the minimum values for Capitalization, Value Traded, and Turnover are 0.01, 0.0002, and 0.006 with standard deviations of 0.43, 0.19, and 0.33, respectively. As shown in Table 10, the link between economic growth and the initial levels of both stock market liquidity and banking development remains strong even when including data on these additional 31 countries.[19]

III. Conclusion

This paper studied the empirical relationship between various measures of stock market development, banking development, and long-run economic growth. We find that,

Bank Credit and collect the residuals, $U(G(i))$. Regress $S(k)$ on X and Bank Credit and collect the residuals, $U(S(k))$. Then plot $U(G(i))$ against $U(S(k))$. This gives a two-dimensional graph of the relationship between $G(i)$ and $S(k)$ controlling for X and Bank Credit. This helps identify particularly influential observations.

[18] These 31 countries are Bolivia, Botswana, Cameroon, Central African Republic, Costa Rica, Dominican Republic, Ecuador, Ethiopia, Ghana, Guatemala, Guyana, Haiti, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Nicaragua, Niger, Paraguay, Rwanda, Senegal, Somalia, Sri Lanka, Tunisia, Uruguay, Zaire, and Zambia.

[19] Using these additional 31 countries does not alter the conclusions about the robust links between the financial indicators and Capital Stock Growth and Productivity Growth.

even after controlling for many factors associated with growth, stock market liquidity and banking development are both positively and robustly correlated with contemporaneous and future rates of economic growth, capital accumulation, and productivity growth. This result is consistent with the view that a greater ability to trade ownership of an economy's productive technologies facilitates efficient resource allocation, physical capital formation, and faster economic growth. Furthermore, since measures of stock market liquidity and banking development both enter the growth regressions significantly, the findings suggest that banks provided different financial services from those provided by stock markets. Thus, to understand the relationship between the financial system and long-run growth more comprehensively, we need theories in which both stock markets and banks arise and develop simultaneously while providing different bundles of financial services to the economy. We find no support for the contentions that stock market liquidity, international capital market integration, or stock return volatility reduce private saving rates or hinder long-run growth. This paper finds a strong, positive link between financial development and economic growth and the results suggest that financial factors are an integral part of the growth process.

Data Appendix

A. *Variables and Sources*

Data are available at the web site http://www.worldbank.org/html/prdmg/grthweb/growth_t.htm.

CAPM Integration and *APT Integration:* Measure of each stock market's integration with world equity markets based on the capital asset pricing model and arbitrage pricing theory, respectively. (Sources: Korajczyk, 1994, 1996.)

Bank Credit: Stock of credit by commercial and deposit-taking banks to the private sector divided by GDP. (Source: International Monetary Fund's (IMF's) *International Financial Statistics.*)

Black Market Premium: Black market exchange rate premium. (Sources: *Picks Currency Yearbook* through 1989 and *World Currency Yearbook.*)

Capital Stock Growth: Growth rate in capital stock per person, available through 1990. (Sources: King and Levine, 1994.)

Capitalization: Average value of listed domestic shares on domestic exchanges in a year divided by GDP that year. (Sources: International Finance Corporation's (IFC's) *Emerging Markets Data Base* (electronic version) and the IMF's *International Financial Statistics.*)

Government: Government consumption share of GDP. (Sources: IMF's *International Financial Statistics* and World Bank's *World Development Indicators.*)

Inflation: Rate of change in the GDP deflator; if unavailable, consumer price index is used. (Sources: IMF's *International Financial Statistics* and World Bank's *World Development Indicators.*)

Initial Output: Logarithm of real per capita GDP in 1976. (Source: IMF's *International Financial Statistics.*)

Enrollment: Logarithm of the secondary-school enrollment rate in 1976. (Sources: IMF's *International Financial Statistics* and World Bank's *World Development Indicators.*)

Output Growth: Growth of real per capita gross domestic product. (Source: IMF's *International Financial Statistics.*)

Productivity Growth: Output Growth minus 0.3 times Capital Stock Growth, available through 1990. (Source: King and Levine, 1994.)

Revolutions and Coups: Number of revolutions and coups per year, averaged over the 1980's. (Source: Arthur S. Banks, 1994.)

Savings: Gross private saving as a percent of GDP, available from 1982 onward for countries classified as "developing" by the IMF and for the entire sample period for industrial countries. (Source: Masson et al., 1995.)

Trade: Exports plus imports divided by GDP. (Sources: IMF's *International Financial Statistics* and World Bank's *World Development Indicators.*)

Turnover: Value of the trades of domestic shares on domestic exchanges over the year divided by the average value of domestic shares listed on domestic exchanges in that

year. (Sources: IFC's *Emerging Markets Data Base* (electronic version) and the IMF's *International Financial Statistics.*)
Value Traded: Value of the trades of domestic shares on domestic exchanges over the year divided by GDP. (Sources: IFC's *Emerging Markets Data Base* (electronic version) and the IMF's *International Financial Statistics.*)
Volatility: Measure of the volatility of stock returns, based on the stock market index value. (Sources: IFC's *Emerging Markets Data Base* (electronic version) and the IMF's *International Financial Statistics.*)

B. *Countries Coverage and Sample Period*

The following countries were used in the analyses: Argentina (i, v), Australia (i, s, v), Austria (s, v), Bangladesh (s), Belgium (s, v), Brazil (i, v), Canada (s, v), Chile (i, s, v), Colombia (i, s, v), Cote d'Ivoire, Germany (s, v), Denmark (s, v), Egypt (s), Spain (s, v), Finland (s, v), France (s, v), United Kingdom (i, s, v), Greece (i, s, v), Hong Kong, Indonesia (i, s), India (i, s, v), Israel (v), Italy (i, s, v), Jamaica (s), Jordan (i, v), Japan (i, s, v), Korea (i, s, v), Luxembourg, Mexico (i, v), Malaysia (i, s, v), Morocco (s), Nigeria (i, s), The Netherlands (s, v), Norway (s, v), New Zealand (s, v), Pakistan (i, v), Peru, Philippines (i, v), Portugal (i, s, v), Singapore, Sweden (s, v), Thailand (i, v), Turkey (s, v), Taiwan (i, v), United States (i, s, v), Venezuela (i, v), and Zimbabwe (i, s, v).

The "v" in parentheses indicates that this country is one of the 36 countries for which we computed Volatility from monthly stock returns. The "i" in parentheses indicates that this country is one of the 24 with CAPM and APT Integration data in Korajczyk (1994, 1996). The "s" in parentheses indicates that this country is one of the 32 countries with private savings data in Masson et al. (1995). Unless indicated otherwise, the data are averages over the period 1976–1993.

Table A1 follows.

TABLE A1—COMPLETE TABLE 3 RESULTS—INITIAL TURNOVER, BANKS, AND GROWTH, 1976–1993

	Dependent variables			
Independent variables	Output Growth	Capital Stock Growth	Productivity Growth	Savings
Constant	0.0464	0.1049	0.0324	29.2948
	(0.0246)	(0.0341)	(0.0150)	(6.0756)
Initial Output	−0.0139	−0.0120	−0.0078	−0.5831
	(0.0049)	(0.0073)	(0.0042)	(1.8875)
Enrollment	0.0230	0.0049	0.0118	−0.3602
	(0.0125)	(0.0152)	(0.0097)	(4.7179)
Revolutions and Coups	−0.0346	−0.0306	−0.0227	−13.0141
	(0.0108)	(0.0113)	(0.0083)	(4.3871)
Government	−0.0619	−0.0021	−0.0407	−21.5703
	(0.0379)	(0.0532)	(0.0031)	(20.6724)
Inflation	−0.0071	−0.0296	−0.0085	−11.3403
	(0.0065)	(0.0107)	(0.0082)	(5.9731)
Black Market Premium	0.000	−0.0002	0.0000	−0.0036
	(0.0000)	(0.0001)	(0.0000)	(0.0204)
Bank Credit	0.0131	0.0148	0.0111	3.8376
	(0.0055)	(0.0063)	(0.0046)	(2.3069)

TABLE A1—*Continued.*

	Dependent variables			
Independent variables	Output Growth	Capital Stock Growth	Productivity Growth	Savings
Turnover	0.0269	0.0222	0.0201	7.7643
	(0.0090)	(0.0094)	(0.0088)	(5.6864)
R^2	0.5038	0.5075	0.4027	0.4429
Observations	42	41	41	29

Notes: Heteroskedasticity-consistent standard errors in parentheses. Output Growth = real per capita GDP growth; Capital Stock Growth = real per capita capital stock growth; Productivity Growth = Output Growth-(0.3) (Capital Stock Growth); Savings = private savings divided by GDP; Initial Output = logarithm of initial real per capita GDP; Enrollment = logarithm of initial secondary school enrollment; Revolutions and Coups = number of revolutions and coups per year; Government = initial government consumption expenditures divided by GDP; Inflation = initial inflation rate; Black Market Premium = initial black market exchange rate premium; Bank Credit = initial bank credit to the private sector as a share of GDP; Turnover = initial value of the trades of domestic shares as a share of market capitalization.

REFERENCES

Atje, Raymond and Jovanovic, Boyan. ''Stock Markets and Development.'' *European Economic Review*, April 1993, *37*(2/3), pp. 632–40.

Bagehot, Walter. *Lombard Street*. Homewood, IL: Irwin, 1873.

Banks, Arthur S. ''Cross-National Time Series Data Archive.'' Center for Social Analysis, State University of New York, Binghamton, 1994.

Barro, Robert J. ''Economic Growth in a Cross Section of Countries.'' *Quarterly Journal of Economics*, May 1991, *56*(2), pp. 407–43.

Barro, Robert J. and Sala-i-Martin, Xavier. *Economic growth*. New York: McGraw-Hill, 1995.

Bencivenga, Valerie R. and Smith, Bruce D. ''Financial Intermediation and Endogenous Growth.'' *Review of Economic Studies*, April 1991, *58*(2), pp. 195–209.

Bencivenga, Valerie R.; Smith, Bruce D. and Starr, Ross M. ''Transactions Costs, Technological Choice, and Endogenous Growth.'' *Journal of Economic Theory*, October 1995, *67*(1), pp. 53–177.

Bhide, Amar. ''The Hidden Costs of Stock Market Liquidity.'' *Journal of Financial Economics*, August 1993, *34*(2), pp. 31–51.

Bonser-Neal, Catherine and Dewenter, Kathryn. ''Does Financial Market Development Stimulate Savings? Evidence From Emerging Market Stock Markets.'' Mimeo, University of Indiana, 1996.

Boyd, John H. and Prescott, Edward C. ''Financial Intermediary-Coalitions.'' *Journal of Economics Theory*, April 1986, *38*(2), pp. 211–32.

Boyd, John H. and Smith, Bruce D. ''The Co-evolution of the Real and Financial Sectors in the Growth Process.'' *World Bank Economic Review*, May 1996, *10*(2), pp. 371–96.

Bruno, Michael and Easterly, William. ''Inflation Crises and Long-Run Growth.'' *Journal of Monetary Economics*, March 1998, *41*(1), pp. 3–26.

Connor, Gregory and Korajczyk, Robert A. ''Performance Measurement with the Arbitrage Pricing Theory: A New Framework for Analysis.'' *Journal of Financial Economics*, March 1986, *15*(3), pp. 373–94.

DeGregorio, Jose and Guidotti, Pablo E. ''Financial Development and Economic Growth.'' *World Development*, March 1995, *23*(3), pp. 433–48.

De Long, J. Bradford; Shleifer, Andrei; Summers, Lawrence H. and Waldmann, Robert J. ''The Size and Incidence of the Losses from Noise Trading.'' *Journal of Finance*, July 1989, *44*(3), pp. 681–96.

Demirgüç-Kunt, Asli and Levine, Ross. ''Stock Market Development and Financial Intermediaries: Stylized Facts.'' *World Bank Economic Review*, May 1996, *19*(2), 291–322.

Demirgüç-Kunt, Asli and Maksimovic, Vojislav. "Financial Constraints, Uses of Funds, and Firm Growth: An International Comparison." Mimeo, World Bank, 1996.

Devereux, Michael B. and Smith, Gregor W. "International Risk Sharing and Economic Growth." *International Economic Review*, August 1994, *35*(4), pp. 535–50.

Diamond, Douglas W. "Financial Intermediation and Delegated Monitoring." *Review of Economic Studies*, July 1984, *51*(3), pp. 393–414.

Dollar, David. "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976–1985." *Economic Development and Cultural Change*, April 1992, *40*(3), pp. 523–44.

Easterly, William and Rebelo, Sergio. "Fiscal Policy and Economic Growth: An Empirical Investigation." *Journal of Monetary Economics*, December 1993, *32*(3), pp. 417–58.

Fischer, Stanley. "The Role of Macroeconomic Factors in Growth." *Journal of Monetary Economics*, December 1993, *32*(3), pp. 485–511.

Goldsmith, Raymond W. *Financial structure and development*. New Haven, CT: Yale University Press, 1969.

Greene, William H. *Economic analysis*. Englewood Cliffs, NJ: Prentice Hall, 1993.

Greenwood, Jeremy and Jovanovic, Boyan. "Financial Development, Growth, and the Distribution of Income." *Journal of Political Economy*, October 1990, Pt. 1, *98*(5), pp. 1076–107.

Holmstrom, Bengt and Tirole, Jean. "Market Liquidity and Performance Monitoring." *Journal of Political Economy*, August 1993, *101*(4), pp. 678–709.

Huybens, Elisabeth and Smith, Bruce D. "Inflation, Financial Markets, and Long-Run Growth." *Journal of Monetary Economics*, 1998 (forthcoming).

International Finance Corporation. *Emerging markets data base*. Washington, DC: International Finance Corporation, various issues.

International Monetary Fund. *International financial statistics*. Washington, DC: International Monetary Fund, various issues.

Jappelli, Tullio and Pagano, Marco. "Saving, Growth, and Liquidity Constraints." *Quarterly Journal of Economics*, February 1994, *109*(1), pp. 93–109.

King, Robert G. and Levine, Ross. "Finance and Growth: Schumpeter Might Be Right." *Quarterly Journal of Economics*, August 1993a, *108*(3), pp. 717–38.

______. "Finance, Entrepreneurship, and Growth: Theory and Evidence." *Journal of Monetary Economics*, December 1993b, *32*(3), pp. 513–42.

______. "Capital Fundamentalism, Economic Development, and Economic Growth." *Carnegie-Rochester Series on Public Policy*, June 1994, *40*, pp. 259–92.

Korajczyk, Robert A. "Measuring Integration of Developed and Emerging Markets." Mimeo, Northwestern University, 1994.

______. "A Measure of Stock Market Integration for Developed and Emerging Markets." *World Bank Economic Review*, May 1996, *10*(2), pp. 267–89.

Korajczyk, Robert A. and Viallet, Claude J. "An Empirical Investigation of International Asset Pricing." *Review of Financial Studies*, September 1989, *2*(4), pp. 553–85.

Levine, Ross. "Stock Markets, Growth, and Tax Policy." *Journal of Finance*, September 1991, *46*(4), pp. 1445–65.

______. "Financial Development and Economic Growth: Views and Agenda." *Journal of Economic Literature*, June 1997, *35*(2), pp. 688–726.

Levine, Ross and Renelt, David. "A Sensitivity Analysis of Cross-Country Growth Regressions." *American Economic Review*, September 1992, *82*(4), pp. 942–63.

Lucas, Robert E., Jr. "On the Mechanics of Economic Development." *Journal of Monetary Economics*, July 1988, *22*(1), pp. 3–42.

Mankiw, N. Gregory; Romer, David and Weil, David. "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics*, May 1992, *107*(2), pp. 407–37.

Masson, Paul; Bayoumi, Tamim and Samiei, Hossein. "Saving Behavior in Industrial and Developing Countries." International Monetary Fund Staff Studies for the

World Economic Outlook, September 1995.

Mauro, Paulo. "Corruption and Growth." *Quarterly Journal of Economics*, August 1995, *110*(3), pp. 681–712.

Mayer, Colin. "New Issues in Corporate Finance." *European Economic Review*, June 1988, *32*(5), pp. 1167–88.

McKinnon, Ronald I. *Money and capital in economic development*. Washington, DC: Brookings Institution, 1973.

Obstfeld, Maurice. "Risk-Taking, Global Diversification, and Growth." *American Economic Review*, December 1994, *84*(5), pp. 1310–29.

Pagan, Adrian. "Econometric Issues in the Analysis of Regressions with Generated Regressors." *International Economic Review*, February 1984, *25*(1), pp. 221–47.

Picks Currency Yearbook. New York: Picks, various issues.

Rajan, Raghuram G. and Zingales, Luigi. "Financial Dependence and Growth." *American Economic Review*, June 1998, *88*(3), pp. 559–86.

Robinson, Joan. "The Generalization of the General Theory." *The rate of interest and other essays*. London: Macmillan, 1952, pp. 67–146.

Schumpeter, Joseph A. *Theorie der wirtschaftlichen entwicklung*. Leipzig, Germany: Dunker & Humblot, 1912.

Schwert, G. William. "Why Does Stock Market Volatility Change Over Time?" *Journal of Finance*, December 1989, *49*(5), pp. 1115–53.

Shleifer, Andrei and Summers, Lawrence. "Breach of Trust in Hostile Takeovers," in A. Auerbach, ed., *Corporate takeovers: Causes and consequences*. Chicago: University of Chicago Press, 1988, pp. 33–56.

Shleifer, Andrei and Vishy, Robert W. "Large Shareholders and Corporate Control." *Journal of Political Economy*, June 1986, *96*(3), pp. 461–88.

Solow, Robert M. "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics*, February 1956, *70*(1), pp. 65–94.

Summers, Robert and Heston, Allan. "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950–1988." *Quarterly Journal of Economics*, May 1991, *106*(2), pp. 327–68.

______. "Penn World Tables, Version 5.5," available on diskette from the National Bureau of Economic Research, Cambridge MA, 1993.

Williamson, Stephen D. "Costly Monitoring, Financial Intermediation, and Equilibrium Credit Rationing." *Journal of Monetary Economics*, September 1986, *18*(2), pp. 159–79.

World Bank. *World development indicators*. Washington, DC: World Bank, various issues.

World Currency Yearbook. New York: International Currency Analysis, Inc., various issues.