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Stock Market Development and Long-Run Growth

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Is there a strong empirical association between stock market development and long-term economic growth? Cross-country regressions suggest that there is a positive and robust association.

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Summary findings

Levine and Zervos empirically evaluate the relationship between stock market development and long-term growth.

The data suggest that stock market development is positively associated with economic growth. Moreover, instrumental variables procedures indicate a strong connection between the predetermined component of stock market development and economic growth in the long run.

While cross-country regressions imply a strong link between stock market development and economic growth, the results should be viewed as suggestive partial correlations that stimulate additional research rather than as conclusive findings.

Much work remains to be done to shed light on the relationship between stock market development and economic growth. Careful case studies might help identify causal relationships and further research could be done on the time-series property of such relationships.

Research should also be done to identify policies that facilitate the development of sound securities markets.

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"STOCK MARKET DEVELOPMENT AND LONG-RUN GROWTH"
BY ROSS LEVINE AND SARA ZERVOS

World stock markets are booming. Developing country stock markets compose a disproportionately large amount of this growth. Over the past 10 years, world stock market capitalization rose from $4.7 trillion to $15.2 trillion, and emerging market capitalization jumped from less than 4 percent to almost 13 percent of total world capitalization. Similarly, over this decade, the trading of shares on emerging stock exchanges rose from less than 3 percent to 17 percent of the total value of transactions on the world's stock exchanges. Further, Korajczyk (1996) shows that emerging markets have become more integrated with world capital markets during the past seven years. The blossoming of emerging stock markets has attracted the attention of international investors. Portfolio equity flows to emerging markets jumped from $150 million in 1984 to over $39 billion in 1995. Yet, there exists very little empirical evidence on the relationship between stock market development and long-run economic growth.

To assess whether stock markets are merely burgeoning casinos where more and more players are coming to place bets or whether stock markets are importantly linked to economic growth, this paper reviews a diffuse theoretical literature and presents new empirical evidence. In terms of theory, a growing literature argues that stock markets provide services that boost economic growth. Specifically, Greenwood and Smith (1996) show that large stock markets can lower the cost of mobilizing savings and thereby facilitate investment in the most productive technologies. Bencivenga, Smith, and Starr (1996) and Levine (1991) argue that stock market liquidity -- the ability to trade equity easily -- is important for growth. Specifically, although many profitable investments require a long-run commitment of capital, savers do not like to relinquish control of their savings for long periods. Liquid equity markets ease this tension by providing an asset to savers that they can quickly and inexpensively sell. Simultaneously, firms have permanent access to capital raised through equity issues. Moreover, Kyle (1984) and Holmstrom and Tirole (1995) argue that liquid stock markets can increase incentives to get information about firms and improve corporate governance. Finally, Obstfeld (1994) shows that international risk sharing

through internationally integrated stock markets improves resource allocation and can accelerate the rate of economic growth.

Theoretical disagreement exists, however, about the importance of stock markets for economic growth. Mayer (1988) argues that even large stock markets are unimportant sources of corporate finance. Stiglitz (1985, 1993) says that stock market liquidity will not enhance incentives for acquiring information about firms or exerting corporate governance. Moreover, Devereux and Smith (1994) emphasize that greater risk sharing through internationally integrated stock markets can actually reduce saving rates and slow economic growth. Finally, Shleifer and Summers' (1988) and Morck, Shleifer, and Vishny's (1990a,b) analyses suggest that stock market development can hurt economic growth by easing counterproductive corporate takeovers.

Considering the conflicting theoretical perspectives on the importance of well-functioning stock markets for economic growth, this paper uses cross-country regressions to examine the association between stock market development and economic growth. To conduct this investigation, we need measures of stock market development. Theory, however, does not provide a unique concept or measure of stock market development. Theory suggests that stock market size, liquidity, and integration with world capital markets may affect economic growth. Consequently, this paper uses a conglomerate index of overall stock market development constructed by Demirguc-Kunt and Levine (1996). This index combines information on stock market size, liquidity, and international integration to produce an overall measure of stock market development.

More specifically, we use pooled cross-country, time-series regressions to evaluate the relationship between stock market development and economic growth. Using data on 41 countries over the period 1976-1993, we split the sample period, so that each country has two observations (data permitting) with data averaged over each sub-period. In the tradition of recent work [Barro (1991)], we regress the growth rate of Gross Domestic Product (GDP) per capita on a variety of variables designed to control for initial conditions, political stability, investment in human capital, and macroeconomic conditions. We then include the conglomerate index of stock market development. Thus, we evaluate whether there is a relationship between economic growth

and stock market development that is independent of other variables associated with economic growth.

This paper builds on Atje and Jovanovic's (1993) study of stock market trading and economic growth in two ways. We use conglomerate indexes of stock market development that combine information on stock market size, trading, and integration. Second, we control for initial conditions and other factors that may affect economic growth in light of evidence that many cross-country regression results are fragile to changes in the conditioning information set [Levine and Renelt (1992)]. Thus, we gauge the robustness of the relationship between overall stock market development and economic growth to changes in the conditioning information set.

We find a strong correlation between overall stock market development and long-run economic growth. After controlling for the initial level of GDP per capita, initial investment in human capital, political stability, and measures monetary, fiscal, and exchange rate policy, stock market development remains positively and significantly correlated with long-run economic growth. The results are consistent with theories that imply a positive relationship between stock market development and long-run economic growth. The results are inconsistent with theories that predict no correlation or a negative association between stock market development and economic performance.

Cross-country growth regressions suffer from measurement, statistical, and conceptual problems. In terms of measurement problems, country officials sometimes define, collect, and measure variables inconsistently across countries. Further, people with detailed country knowledge frequently find discrepancies between published data and what they know happened. In terms of statistical problems, regression analysis assumes that the observations are drawn from the same population. Yet, vastly different countries appear in cross-country regressions. Many countries may be sufficiently different such that they warrant separate analyses. Conceptually, we should interpret the coefficients from cross-country regressions cautiously. When averaging over long periods, many changes are occurring simultaneously: countries change policies; economies experience business cycles; and governments rise and fall. Thus, aggregation may blur important events and differences across countries. Eventually, analysts should extend this research by

examining the time-series relationship between stock market development and economic growth. Also, cross-country regressions do not resolve issues of causality. Consequently, we should not view the coefficients as elasticities that predict by how much growth will change following a particular policy change. Rather, the coefficient estimates and the associated t-statistics evaluate the strength of the partial correlation between stock market development and economic growth.

These measurement, statistical, and conceptual problems, however, should not blur the benefits that can accrue from cross-country comparisons. Elucidating cross-country empirical regularities between stock market development and economic growth will influence beliefs about this relationship and shape future theoretical and empirical research. Put differently, beliefs about stock markets and growth that cross-country comparisons do not support will be viewed more skeptically than those views confirmed by cross-country regressions.

We organize the remainder of the paper as follows. Section I reviews the theoretical literature on the functioning of stock markets and economic growth. Some theories suggest that large, liquid, internationally integrated stock markets boost economic growth. Alternative theories, however, suggest that well-developed stock markets are relatively unimportant for aggregate economic activity. Furthermore, some research predicts that larger, more liquid, and internationally integrated markets hurt economic performance. Section II turns to the data and constructs a conglomerate measure of stock market development. Section III evaluates the strength of the empirical link between stock market development and long-run economic growth, and Section IV concludes.

I. Theoretical Framework and Motivation

Considerable debate exists on the question: Is the financial system important for economic growth? One line of research stresses the importance of the financial system in mobilizing savings, allocating capital, exerting corporate control, and easing risk management. A second branch of the literature argues that the financial system is unimportant for economic growth.

Consider first the view that finance is unimportant. In a recent survey of development economics, Nicholas Stern (1989) does not mention the role of the financial system in economic growth. Furthermore, at the end of Professor Stern's review, he lists various issues that he did not have sufficient space to cover. Finance is not even included in the list of omitted topics. Similarly, a recent collection of essays by the 'pioneers of development economics,' including three Nobel Laureates, does not describe the role of the financial system in economic growth [Meir and Seers (1984)]. Clearly, according to these economists, the financial system plays an inconsequential role in economic development. Furthermore, the most recent Nobel Prize winner, Robert Lucas (1988), argues that economists frequently exaggerate the role of financial factors in economic development. Moreover, Joan Robinson (1952) argues that the financial system does not spur economic growth; financial development simply responds to developments in the real sector. Thus, many influential economists give a very minor, if any, role to the financial system in economic growth.[1]

In contrast, a prominent line of research stresses the role of the financial system in economic growth. Bagehot (1873), Schumpeter (1911), Cameron, et. al. (1967), Goldsmith (1969), and McKinnon (1973) provide conceptual descriptions of how and empirical examples of when the financial system affects economic growth. Building on these seminal contributions, Gelb (1989), Ghani (1992), King and Levine (1993a,b), and DeGregorio and Giudotti (1995) show that measures of banking development are strongly correlated with economic growth in a broad cross-section of countries. According to this vein of research, a well-functioning financial system is critical for sustained economic growth. Thus, considerable debate exists on the importance of the

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[1] Many of these references are from Chandavarkar's (1992) insightful discussion of financial and economic development.

relationship between the financial system and economic growth. This paper contributes to the historical debate on the role of the financial system by examining the empirical link between stock market development and economic growth.

Besides evaluating the general importance of the financial system, this paper provides empirical evidence regarding the growing debate concerning the specific role of stock markets in economic growth. A burgeoning theoretical literature suggests that the functioning of equity markets affects

(a) liquidity,

(b) risk diversification,

(c) information acquisition about firms,

(d) corporate control, and

(e) savings mobilization.

By altering the quality of these services, the functioning of stock markets can alter the rate of economic growth. Debate exists, however, over the sign of this effect. Specifically, some models suggest that stock market development slows growth, while other models predict a positive relationship between stock market development and economic growth.

One way stock markets may affect economic activity is through their liquidity. Many high-return projects require a long-run commitment of capital. Investors, however, are generally reluctant to relinquish control of their savings for long-periods. Without liquid markets or other financial arrangements that promote liquidity, therefore, less investment may occur in the high-return projects. As shown by Levine (1991) and Bencivenga, Smith, Starr (1996), stock markets may arise to provide liquidity: savers have liquid assets - like equities - while firms have permanent use of the capital raised by issuing equities. Specifically, liquid stock markets reduce the downside risk and costs of investing in projects that do not pay off for a long time: with a liquid equity market, the initial investors do not lose access to their savings for the duration of the investment project because they can quickly, cheaply, and confidently sell their stake in the company. Thus, more liquid stock markets ease investment in long-run, potentially more profitable projects, thereby improving the allocation of capital and enhancing prospects for long-

term growth. Theory is unclear, however about the growth effects of greater liquidity. Bencivenga and Smith (1991) show that by reducing uncertainty, greater liquidity may reduce saving rates enough so that growth slows.

Risk diversification through internationally integrated stock markets is a second vehicle through which stock market development may influence economic growth. Saint-Paul (1992), Devereux and Smith (1994), and Obstfeld (1994) demonstrate that stock markets provide a vehicle for diversifying risk. These models also show that greater risk diversification can influence growth by shifting investment into higher-return projects. Intuitively, since high-expected-return projects also tend to be comparatively risky, better risk diversification through internationally integrated stock markets will foster investment in higher return projects. Again, however, theory suggests circumstances when greater risk sharing slows growth. Devereux and Smith (1994) and Obstfeld (1994) show that reduced risk through internationally integrated stock markets can depress saving rates, slow growth, and reduce economic welfare.

Stock markets may also promote the acquisition of information about firms [Grossman and Stiglitz (1980), Kyle (1984), and Holmstrom and Tirole (1994)]. Specifically, in larger, more liquid markets, it will be easier for an investor who has gotten information to trade at posted prices. This will enable the investor to make money before the information becomes widely available and prices change. The ability to profit from information will stimulate investors to research and monitor firms. Better information about firms will improve resource allocation and spur economic growth. Opinions differ, however, over the importance of stock markets in stimulating information acquisition. Stiglitz (1985, 1993), for example, argues that well-functioning stock markets quickly reveal information through price changes. This quick public revelation will reduce - not enhance - incentives for expending private resources to obtain information. Thus, theoretical debate still exists on the importance of stock markets in enhancing information.

Stock market development may also influence corporate control. Diamond and Verracchia (1982) and Jensen and Murphy (1990) show that efficient stock markets help mitigate the principal-agent problem. Efficient stock markets make it easier to tie manager compensation to stock performance. This helps align the interests of managers and owners. Furthermore, Laffont and Tirole (1988) and Scharfstein (1988) argue that takeover threats induce managers to maximize the firm's equity price. Thus, well-functioning stock markets that ease corporate takeovers can mitigate the principal-agent problem and promote efficient resource allocation and growth. Opinion differs on this issue too. Stiglitz (1985) argues that outsiders will be reluctant to takeover firms because outsiders generally have worse information about firms than existing owners. Thus, the takeover threat will not be a useful mechanism for exerting corporate control; stock market development, therefore, will not importantly improve corporate control [Stiglitz (1985)]. Moreover, Shleifer and Vishny (1986), and Bhide (1993) argue that greater stock market development encourages more diffuse ownership and this diffusion of ownership impedes effective corporate governance. Finally, Shleifer and Summers (1988) note that by simplifying takeovers, stock market development can stimulate welfare-reducing changes in ownership and management.

In terms of raising capital, Greenwood and Smith (1996) show that large, liquid, and efficient stock markets can ease savings mobilization. By agglomerating savings, stock markets enlarge the set of feasible investment projects. Since some worthy projects require large capital injections and some enjoy economies of scale, stock markets that ease resource mobilization can boost economic efficiency and accelerate long-run growth. Disagreement exists, however, over the importance of stock markets for raising capital. Mayer (1988), for example, argues that new equity issues account for a very small fraction of corporate investment.

Thus, some theories provide a conceptual basis for believing that larger, more liquid, more efficient stock markets boost economic growth. Other theoretical models, however, have a more pessimistic opinion about the importance of stock markets. Given these dissenting views, this paper examines the empirical relationship between stock market development and growth.

II. Measures of Stock Market Development

Considering these dissenting theories, we examine the empirical relationship between stock market development and economic growth. Theory, however, does not provide a unique concept of stock market development to guide empirical research. The body of theoretical work suggests that stock market development is multifaceted, involving issues of market size, market liquidity, and integration with world capital markets. As detailed above, each individual theoretical model focuses on one characteristic -- size, or liquidity, or integration, etc. -- of the functioning of stock markets. Consequently, one research strategy is to evaluate empirically -- characteristic by characteristic -- the predictions from each individual theoretical model. While useful, this strategy is model specific and focuses narrowly on individual characteristics. Here, as in Demirguc-Kunt and Levine (1996) and Demirguc-Kunt and Maksimovic (1996), we take a different approach. We use a multifaceted measure of overall stock market development that combines the different individual characteristics of the functioning of stock markets. Thus, we provide an empirical assessment of whether overall stock market development is strongly connected with long-run economic growth. Specifically, we use an aggregate index of overall stock market development constructed by Demirguc-Kunt and Levine (1996). This index combines information on stock market size, liquidity, and integration with world capital markets.[2] Since Demirguc-Kunt and Levine (1996) analyze and discuss the individual indicators and aggregate index at length, here we only briefly define the individual indicators and the construction of the overall indexes.

A. Individual stock market development indicators

Size: To measure the size of the stock market, we use the ratio of market capitalization divided by Gross Domestic Product (GDP). Market capitalization equals the total value of all listed shares. The assumption underlying the use of this variable as an indicator of stock market development is that the size of the stock market is positively correlated with the ability to mobilize capital and diversify risk.

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[2] We used all of the aggregate indexes discussed in Demirguc-Kunt and Levine (1996). We only report the results using one index, however, since the results are very similar.

Liquidity: To measure the liquidity of the stock market, we use two measures. First, we compute the ratio of total value of trades on the major stock exchanges divided by GDP. This measures the value of equity transactions relative to the size of the economy. This liquidity measure complements the measure of stock market size since markets may be large but inactive. Our second measure of liquidity equals the ratio of the total value of trades on the major stock exchanges divided by market capitalization and is frequently called the turnover ratio. This measures the value of equity transactions relative to the size of the equity market. The turnover ratio also complements the measure of stock market size since markets may be large but inactive. Turnover also complements the first liquidity measure - the total value of equity transactions divided by GDP - since markets may be small (compared with the whole economy) but liquid. These indicators do not directly measure the ease with which agents can buy and sell securities at posted prices. The indicators do, however, measure the degree of trading, compared with the size of the economy and the size of the market. Since liquidity may importantly influence growth by easing investment in large, long-term projects and by promoting the acquisition of information about firms and managers, we include these two liquidity measures in our stock market development index.

Risk Diversification - International Integration: Theory suggests that the ability to diversify risk -- by investing in an internationally diversified portfolio of stocks -- can influence investment decisions and long-run growth rates [Devereux and Smith (1994) and Obstfeld (1994)]. Barriers to international capital flows -- such as taxes, regulatory restrictions, information asymmetries, sovereign risk, etc. -- may impede the ability of investors to diversify risk internationally. Thus, international capital flow barriers will impede risk diversification, reduce capital market integration, and keep arbitragers from equalizing the price of risk internationally. To measure the ability of agents to diversify risk internationally, we use Korajczyk's (1996) estimate of the degree of international integration of national stock markets.

Specifically, Korajczyk (1996) uses a multifactor International Arbitrage Pricing Model (IAPM) to measure stock market integration. The IAPM implies that the expected excess return on each asset is linearly related to a linear combination of benchmark portfolios. For the

benchmark portfolios, P, Korajczyk (1996) estimates the common factors based on an international portfolio of equities using the asymptotic principal components procedures of Connor and Korajczyk (1986). Given m assets and T periods, consider the following regression:

$$(1) \qquad R_{i,t} = \alpha_i + b_i P_t + \varepsilon_{i,t}, \quad i = 1, 2, ..., m; t = 1, 2, ..., T,$$

where $R_{i,t}$ is the excess return on asset i in period t above the return on a risk free asset or zero-beta asset. In perfectly integrated stock markets, the intercept in a regression of any asset's excess return on P should be zero. Specifically, the IAPM plus the assumption of perfect integration imply that

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

One can interpret rejection of the restrictions defined by equation (2) as rejection of the underlying asset pricing model or rejection of the assumption of market integration.

Korajczyk (1996) refers to α_i as the mispricing of asset i relative to the benchmark portfolio. We interpret estimates of the absolute value of the intercept terms from the multivariate regression (1) as measures of market integration and the ability of agents to diversify risk internationally. Larger absolute values imply less integrated stock markets. To compute estimates of stock market integration for each national market, we compute the average of the absolute value of α_i across all assets in each country. [3]

B. Simple indexes of stock market development

To measure overall stock market development, we construct an index. STOCK equals the average of the means-removed values of the market capitalization ratio, total value traded ratio, turnover ratio, and the IAPM pricing error measure of stock market integration. Note, we multiply the absolute value of Korajczyk's (1996) pricing error measure by negative one before

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[3] For alternative ways of measuring the ability of agents to diversify risk internationally, see Bekaert and Harvey (1995) and Harvey (1995).

constructing the index, STOCK. Thus, larger (less negative) values imply better stock market development. Specifically, the means-removed market capitalization ratio for country *i* equals the market capitalization ratio for country *i* minus the mean for all countries, divided by the mean for all countries. Then we take a simple average of the means-removed market capitalization ratio, total value traded ratio, turnover ratio and IAPM integration measure to obtain an index of stock market development. More formally, let S(i,j) equal the average value (over the relevant period) of variable *j* for country *i*. Let S(j) equal the average value of variable j across all countries. Define the means-removed value of S(i,j) as s(i,j), where

$$s(i,j) = \{S(i,j) - S(j)\} / S(j). \tag{3}$$

Then, INDEX-1 for country *i* is

$$\text{INDEX-1}(i) = \sum_j s(i,j), \tag{4}$$

where we take the average across all the variables for country *i*. This includes the market capitalization ratio, total value traded ratio, turnover ratio, and IAPM measure of integration.[4]

C. Financial Depth

Gelb (1989), Ghani (1992), King and Levine (1993a,b), and DeGregorio and Giudotti (1995) identify a significant correlation between financial depth and long-run economic growth rates in a broad cross-country sample. To measure financial depth, these authors typically use a measure of broad money, such as M2, divided by GDP. For example, King and Levine (1993a,b) measure financial depth by the ratio of liquid liabilities of the financial system to GDP. Liquid

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[4] STOCK equals the stock market development index, INDEX-2, of Demirguc-Kunt and Levine (1996). All of the indexes discussed by Demirguc-Kunt and Levine (1996) yield similar results in the growth regressions. Thus, we simply report the results using one index. We call this index STOCK instead of INDEX-2 for expositional purposes. Also, the IAPM pricing errors are only available for 24 countries. Since the indexes are means-removed averages of the available indicators, STOCK has values for all 41 countries. For 24 countries, STOCK aggregates information on size, liquidity, and IAPM pricing errors. For the remaining 17 countries, STOCK aggregates information only on size and liquidity.

liabilities consist of currency held outside the banking system plus demand and interest-bearing liabilities of banks and nonbanks financial intermediaries. We use the King and Levine (1993 a,b) measure of financial depth, DEPTH, to evaluate whether stock market development is significantly correlated with growth even after controlling for financial depth.

D. Stock market data and summary statistics

We have data on stock market size and liquidity for 41 over the 1976-1993 period. The data are from the International Finance Corporation's (IFC) *Emerging Market Data Base* (EMDB) and the International Monetary Fund's (IMF) *International Financial Statistics*. For the IAPM pricing error indicator, we only have data for 24 countries over the 1976-1993 period. Specifically, we have data for the following countries, where a "*" indicates that these countries are also in the 24 country sample with pricing error data: Argentina(*), Australia(*), Austria, Belgium, Brazil (*), Canada, Chile(*), Colombia(*), Germany, Denmark, Spain, Finland, France, United Kingdom (*), Greece(*), Hong Kong, Indonesia(*), India(*), Israel, Italy, Jordan(*), Japan(*), Korea(*), Luxembourg, Mexico(*), Malaysia(*), Nigeria(*), The Netherlands, Norway, New Zealand, Pakistan(*), Philippines(*), Portugal(*), Singapore, Sweden, Thailand(*), Turkey(*), Taiwan(*), United States(*), Venezuela(*), and Zimbabwe(*).

III. Stock Market Development and Long-Run Economic Growth

A. Cross-country growth regression framework

Structure: This section empirically evaluates whether the index of stock market development, STOCK, is strongly linked to long-run economic growth. To conduct this analysis, we use pooled cross-country, time-series growth regressions. Each country has two observations, data permitting.[5] The first observation for each country uses data from the 1976-1985 period. The second observation uses data from the 1986-1993 period. Thus, the dependent variable, GROWTH, is the real per capita growth rate averaged over the relevant period.

[5] The maximum potential number of observations is 82. In fact, we have 79 observations because we are missing data on Turkey, Pakistan, and New Zealand for the 1976-1985 period.

The structure of our regression equation is the following:

$$\text{GROWTH} = \alpha\mathbf{X} + \beta(\text{STOCK}) + u, \tag{5}$$

where is $\mathbf{X}$ is a set of control variables α is a vector of coefficients on the variables in $\mathbf{X}$, is the estimated coefficient on STOCK and u is an error term.[6]

The goal of the empirical analysis is to assess the strength of the independent partial correlation between stock market development and economic growth. Consequently, we use a large set of control variables, $\mathbf{X}$, to control for a variety of factors that may be associated with economic growth. Specifically, $\mathbf{X}$ includes the logarithm of initial real per capita GDP (LRGDP), the logarithm of the initial secondary school enrollment rate (LSEC), the number of revolutions and coups (REV), the ratio of government consumption expenditures to GDP (GOVY), the inflation rate (PI), and the black market exchange rate premium (BMP).

We include the logarithm of initial real per capita GDP and the logarithm of the initial secondary school enrollment rate because recent theoretical work suggests an important link between long-run growth and the initial per capita levels of physical and human capital [see Lucas (1988) and Mankiw, Romer, Weil (1992)]. We follow Barro (1991), Barro and Sala-i-Martin (1992), and others in using LSEC and LRGDP to proxy for the initial levels of per capita human and physical capital. We include the number of revolutions and coups, since political instability may be negatively associated with economic growth.

We include a variety of macroeconomic indicators to evaluate the strength of the partial correlation between stock market development indexes and economic growth [e.g., Levine and Renelt (1992) and Levine and Zervos (1993)]. Specifically, we include GOVY and PI because the evidence suggests a strong connection between macroeconomic policy and economic activity

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[6] Throughout the analysis we use heteroskedasticity consistent standard errors as developed by White (1980). We also examine the statistical distribution of the error term and check for the importance of outliers. Bekaert and Harvey (1995) find that stock returns are often not normally distributed. Consequently, some readers may have concerns about the distribution of the error term. Our paper, however, does not use data on stock returns. This paper uses an aggregate index of stock market size, liquidity, and integration. For a discussion of the properties of the error term from cross-section, time-series regressions involving asset pricing errors, see Bekaert and Harvey (1995).

as shown by Fischer (1993), Easterly and Rebelo (1993), Bruno and Easterly (1995). Similarly, we include BMP since international price distortions may impede economic growth as suggested by Dollar (1993) and Levine and Zervos (1994). Thus, we include GOVY, PI, and BMP - and expect them to enter negatively - to gauge the strength of the partial correlation between stock market development and long-run growth.

Estimation: We use instrumental variables to estimate equation (5) for two reasons. First, instrumental variables will help us examine the relationship between growth and the predetermined component of stock market development. If the predetermined component of stock market development (as identified by the instruments) is positively correlated with economic growth, this will indicate that (a) stock market development does not simply follow economic development, and (b) it is not only contemporaneous shock to both stock market development and economic growth that are driving the results. Thus, we use two-stage least squares to examine whether predetermined stock market development is closely associated with economic growth. The second reason we use two-stage least squares involves measurement error. The IAPM pricing errors are generated regressors, which can lead to inconsistent standard errors. Thus, we use two-stage least squares to derive consistent standard error as suggested by Pagan (1984).[7]

For the instrumental variables, we use the logarithm of initial real per capita GDP, the logarithm of the initial secondary school enrollment rate, the number of revolutions and coups, the initial black market exchange rate premium, the initial inflation rate, the initial ratio of government spending to GDP, the initial ratio of exports plus imports divided by GDP, the initial ratio of market capitalization to GDP, the initial ratio of total value traded to GDP, and the initial

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[7] The two-stage least squares estimator is consistent. Furthermore, we use White's (1980) heteroskedasticity-consistent standard errors. While the Generalized Method of Moments (GMM) estimator is sometimes used in pooled cross-section, time-series samples to obtain more efficient estimators in the presence of heteroskedasticity and serial correlation in large samples, GMM does not offer much value added in the current context. As will be shown, the results are already highly significant, so that a potentially more efficient estimator will only make the t-statistics larger. Furthermore, we are working with a small sample of only 79 observations. Also, we do not have a true time-series dimension to the data. There are only two periods because we average the data over long-time periods in order to focus on the relationship between stock market development and *long-run* growth. Thus, GMM procedures will not improve the efficiency of the estimates by allowing for serial correlation because there is not a true time-series dimension to the data. Finally, we already control for heteroskedasticity.

turnover ratio.[8] These instruments, except REV, are predetermined. We use these instrumental variables to extract the predetermined component of GOVY, PI, BMP, and STOCK. Throughout the analysis, we use White's (1980) heteroskedasticity-consistent standard errors.

Data: As discussed earlier, we obtained the stock market data from the IFC's EMDB and the IMF's IFS. Data on real per capita GDP growth, LSEC, GOVY, PI, and information on export and imports are from the World Bank's National Accounts data base. We obtained REV from Barro (1991) and computed LRGDP from Summers and Heston (1988). BMP data are from Picks Currency Yearbook, World Currency Yearbook, and from International Currency Analysis.

[8] We use the term "initial" to refer to variables measured at the start of the estimation period. Since we use pooled cross-country time-series data over the period 1976-1985 and 1986-1993, "initial" refers to measures in 1976 and 1986 respectively.

B. Results

Tables 1 summarizes the results on the links between stock market development and economic growth. All the regressions contain 79 observations. Regression (1) presents the regression results when we only include a constant, LRGDP, LSEC, and REV. Regression (2) also includes GOVY, PI, and BMP. All of the variables enter with the anticipated signs, but only initial income, LRGDP, and political instability, REV, are consistently significant at the 0.05 level. We list the P-values in brackets and the standard errors in parentheses.

Regressions (3) and (4) include STOCK. There is a significant, positive correlation between the predetermined component of stock market development and real per capita GDP growth. The relationship between STOCK and growth remains significant at the 0.05 level whether we control for GOVY, PI, and BMP or not. Thus, stock market development is positively correlated with economic growth even after controlling for other factors associated with long-run growth.

As shown by Demirguc-Kunt and Levine (1996), stock market development is positively correlated with measures of financial intermediary development. Consequently, to assess the independent empirical link between stock market development and growth, we include a measure of financial depth, DEPTH, in the growth regression. As shown in regression (5), the predetermined component of DEPTH is positively and significantly correlated with long-run growth at the 0.05 significance level when STOCK is excluded. When all of the variables are included together in regression (6), the predetermined component of STOCK remains positively and significantly correlated with growth. DEPTH, however, becomes insignificant.[9] Importantly, the empirical relationship between stock market development and long-run growth remains strong

[9] Note, these results to do not necessarily conflict with the findings of Gelb (1989), Ghani (1992), King and Levine (1993a,b), and DeGregorio and Giudotti (1995). First, these studies of financial depth typically cover 80 countries over 30 years. This paper, due to data availability on stock market development, covers only 41 countries over 18 years. Second, financial depth is a widely available indicator of overall financial sector development. In contrast, the stock market development index measures the functioning of only one part of the financial system. Clearly, researchers should attempt to build models of and develop data on the links between growth and the different components of the financial system: banks (private and public), nonbanks (mutual funds, private pension funds, insurance companies, etc.), stock markets, bond markets, derivatives markets, etc. By adding stock markets to the study of the ties between finance and growth, we see this paper as a small building block toward this longer-term objective.

even after controlling for initial conditions, inflation, the size of the government, black market exchange rate premiums, and the predetermined component of financial depth.

C. Discussion

The results suggest a strong positive relationship between stock market development and long-run economic growth. The instrumental variable results show that the predetermined component of stock market development - as extracted by the first-stage regressions - is strongly, positively correlated with economic growth. Moreover, the results hold after checking for outliers and removing individual countries. As discussed in the introduction, measurement, statistical, and conceptual problems plague cross-country growth regressions. Nonetheless, the results suggest a comparatively strong link between the functioning of stock markets and economic growth.

V. Conclusions

This paper empirically evaluated the relationship between stock market development and long-run growth. The data suggest that stock market development is positively associated with economic growth. Moreover, the instrumental variables procedures indicate a strong connection between the predetermined component of stock market development and long-run economic growth. While these cross-country growth regressions imply a strong link between stock market development and economic growth, the results should be viewed as suggestive partial correlations that stimulate additional research rather than as conclusive findings.

Much work remains to better understand the relationship between stock market development and economic growth. Specifically, careful case studies might better identify the causal interactions between stock market development and economic growth. Similarly, this paper examined the cross-sectional relationship between stock market development and growth. Future research could also exploit the time-series properties of the relationship. Finally, this paper says nothing about policy. While stock market development is strongly correlated with long-run economic growth, future research needs to identify the policies that will ease sound securities market development.

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Table 1: Stock Market Development and Growth: Pooled 1976-1986-1993, Instrumental Variables

Independent Variable	(1)	(2)	(5)	(6)	(5)	(6)
C	0.023	0.061	0.041	0.050	0.042	0.047
	(1.367)	(2.147)	(2.772)	(1.726)	(2.451)	(1.540)
	[0.176]	[0.035]	[0.007]	[0.089]	[0.017]	[0.128]
LRGDP	-0.011	-0.007	-0.012	-0.010	-0.015	-0.007
	(2.256)	(1.378)	(2.625)	(1.835)	(2.637)	(1.430)
	[0.027]	[0.172]	[0.011]	[0.071]	[0.010]	[0.157]
LSEC	0.023	0.013	0.020	0.019	0.018	0.022
	(2.044)	(0.838)	(2.095)	(1.218)	(1.468)	(1.431)
	[0.045]	[0.405]	[0.040]	[0.227]	[0.146]	[0.157]
REV	-0.019	-0.018	-0.015	-0.016	-0.011	-0.021
	(2.710)	(2.362)	(2.514)	(2.337)	(1.518)	(2.241)
	[0.008]	[0.021]	[0.014]	[0.022]	[0.133]	[0.028]
GOVY		-0.128		-0.090		-0.121
		(1.911)		(1.805)		(1.671)
		[0.060]		[0.075]		[0.099]
PI		-0.022		-0.020		-0.035
		(2.001)		(2.354)		(1.844)
		[0.049]		[0.021]		[0.069]
BMP		-0.0002		-0.00001		0.0001
		(1.179)		(0.973)		(0.234)
		[0.242]		[0.812]		[0.816]
DEPTH					0.026	-0.021
					(4.349)	(0.965)
					[0.001]	[0.338]
STOCK			0.015	0.012		0.020
			(5.513)	(4.503)		(2.205)
			[0.000]	[0.000]		[0.031]

(Standard errors in parentheses) [Pvalues in brackets]
Dependent variable is average annual growth rate of per capita GDP. LRDGP is logarithm of initial per capital GDP, LSEC is logarithm of secondary school enrollment rate, REV is number of revolutions and coups, GOVY is governnment consumption divided by GDP, PI is inflation, BMP is black market premium, DEPTH is liquid liabilities of the financial intermediaries divided by GDP, and STOCK is the average of means-removed values of the market capitalization, total value traded, turnover ratios, and APT mis-pricing. Instruments include C, LRGDP, LSEC, REV, initial values of GOVY, PI, BMP, market capitalization, total value traded, and turnover ratios, and international trade to GDP.

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