Stock Markets, Banks and the Sources of Economic Growth

Felix Rioja and Neven Valev
Department of Economics
Andrew Young School of Policy Studies
Georgia State University

July 2009

Abstract

This paper studies the effects of stock markets and banks on the sources of economic growth, productivity and capital accumulation, using a large cross country panel for 1976-2004. We find that banks primarily affect capital growth, while stock markets primarily affect productivity. In high income countries, however, there is strong evidence that banks *and* stock markets have independently affected capital growth, whereas productivity seems to benefit from stock market financing only. Conversely, in low income countries bank credit is the primary driver of both sources of growth while stock markets do not appear to have encouraged capital accumulation or productivity growth.

JEL Classification: G1, O4.
Key words: Financial development, capital growth, productivity, stock markets, banking.

Contact information: Rioja (frioja@gsu.edu). Valev (nvalev@gsu.edu).
Acknowledgements: We are grateful to Gustavo Canavire-Bacarreza, Fernando Rios, and Tatyana Zelenskaya for research assistance.

Stock Markets, Banks and the Sources of Economic Growth

I. Introduction

An extensive literature has established that financial development has a strong positive effect on economic growth.[1] Financial markets overcome transaction costs and informational asymmetries to reduce liquidity constraints and improve the allocation of capital. The positive effect on economic growth is obtained through both greater physical capital accumulation and greater productivity growth. The literature also shows that stock markets and banks both enhance economic growth (Beck and Levine, 2004; Rousseau and Wachtel (2000)). Less is known, however, about the effects of stock markets and banks on the two sources of economic growth – physical capital accumulation and productivity growth. In studying these effects, we attempt to answer the following questions:

- Do stock markets and banks both enhance productivity growth? Is the effect of stock markets more pronounced?
- Do stock markets and banks both increase physical capital accumulation? Is the effect of banks more pronounced?
- Do banks have a stronger effect on physical capital accumulation in developing countries?
- Do stock markets have a stronger effect on productivity growth in developed economies?

Our motivation for this analysis is twofold. First, as described in Acemoglu, Aghion, and Zilibotti (2002) countries grow in different ways. A country that is behind the technological frontier will typically pursue a capital accumulation growth strategy ("investment-based growth"). In contrast, industrial countries have a strong incentive for innovation. Financial markets will fund these innovation activities leading to larger productivity gains ("innovation-based growth").[2] It is important then to understand the driving forces for each of the two sources

[1] Levine (2005) provides a comprehensive review of the literature.

[2] There have been studies in the growth accounting literature which suggest that the engines for growth may vary in different countries. For example, Young (1994) finds that much of the very rapid growth in South East Asia in the 1966-90 period is explained not by productivity, but by capital accumulation and labor force growth. Similarly for Latin America, Elias (1992) finds that productivity growth accounts for only about one quarter of output growth during 1940-1980. Agenor and Montiel (1999, p. 676) report that productivity growth accounted for only 4.4% of growth in African countries in the 1970s while capital accumulation accounted for 64.4%. Conversely for industrial countries, Christensen, Cummings, and Jorgenson (1980) find that the contribution of productivity was more than 50% during 1947-1973.

of growth and in particular the role that different components of the financial markets play. Furthermore, Aghion, Howitt and Mayer-Foulkes (2005) and Rioja and Valev (2004) have shown that the effects of finance on growth may vary according to the country's income level. Second, in addition to the effect on economic growth, the literature provides theoretical arguments for the effects of stock markets and banks on the *sources* of growth, but the empirical literature has analyzed primarily their effect on overall growth. Hence, our objective is to focus on the sources of growth.

Both banks and stock markets are expected to enhance productivity. Allen (1993) and Allen and Gale (1999) argue that stock markets are essential for productivity growth. In Allen and Gale's (1999) model, individual investors "agree to disagree" on the feasibility of new investment projects. With disaggregated decision making in stock markets, each investor makes a decision whether or not to invest; as a result more innovative projects receive financing. Similarly, Boyd and Smith (1998) show that stock markets become more important when economies approach the technological frontier where innovation is the primary source of growth. According to theory, banks are also important for productivity growth. Bhide (1993) argues that banks raise productivity by monitoring firm managers and improving corporate governance.

Similarly, both banks and stock markets provide financing for physical capital accumulation. Levine (1991) shows that liquid stock markets allow investors to convert shares into cash in case they experience a liquidity shock. With reduced liquidity risk, investors are willing to commit funds to capital investments. Furthermore, stock markets allow investors to diversify idiosyncratic productivity risks which also serves to raise investment. Other theoretical work shows that banks are also important for physical capital accumulation. For example, Gershenkron (1962) argues that banks can exert pressure on firms to service their debts. Therefore they finance capital investments even in weak institutional environments. Hoshi, Kashyap, and Scharfstein (1991), Fohlin (1998), and Kong (1998) show that non-financial firms enter into long-term relationships with banks increasing their access to credit. Stulz (2001) points out that banks can commit funds to capital investments that require financing in successive stages.

In summary, the theoretical literature argues that banks and stock markets both enhance productivity growth and physical capital accumulation.[3] We use data from a large panel of countries to test this hypothesis. Furthermore, we investigate the influence of stock markets and banks on the sources of growth in developed and developing countries. Banks may be especially important in developing countries where stock markets are smaller and less active. As countries develop, their stock markets may start to play a more significant role. Our empirical findings are that: 1) banks primarily affect capital growth while stock markets primarily affect productivity; 2) in high income countries, however, there is strong evidence that banks and stock markets have independently affected capital growth, while productivity seems to be driven by the stock market only; and 3) in low income countries, conversely, bank credit is the primary driver of both sources of growth.

Our paper is not the first one to consider the effects of stock markets and banks on the sources of growth. Levine and Zervos (1998) find that measures of stock market and credit market development both enter significantly in equations explaining capital and productivity growth. We extend their work in three ways. First, increased data availability allows us to expand the number of countries and the length of the time series used by Levine and Zervos (47 countries from 1976 to 1993). Both credit markets and stock markets have developed significantly since the mid 1990's. We use data for 61 countries covering the period of 1976-2004. Second, we confront well-known potential endogenity problems by using GMM dynamic panel techniques to try to establish causality. Levine and Zervos use cross-country OLS regressions which, while suggestive of a positive effect of finance on the sources of growth, fall short of establishing causality.[4] Third, we investigate the roles of financial markets in developed and developing countries separately. Here, we are motivated by Aghion, Howitt and Mayer-Foulkes (2005) and Rioja and Valev (2004) who find that the effects of finance on growth vary with income.

[3] There are additional related theoretical papers not referenced in the paper. However, the finance and growth literature is voluminous and a comprehensive review is beyond the scope of this paper. The reader is referred to Levine (2005) who provides a detailed summary of the theory and empirical results.

[4] A follow up paper by Beck and Levine (2004) uses GMM techniques to study the effects of stock markets and banks on *economic* growth, but does not study the effects on the *sources of growth*. Rousseau and Wachtel (2000) combine a panel VAR with GMM techniques to study the effects of stock markets and financial intermediation on economic growth.

The remainder of the paper is organized as follows. Section II describes the data and the measures used. Section III describes the methodology and Section IV discusses the results. Section V concludes.

II. Data and Measures

The data set consists of a panel of observations for 61 countries for which we have stock market data for the period 1976-2004. We take advantage of the wider availability of data to expand on the previous work of Levine and Zervos (47 countries, 1976-1993) and Beck and Levine (2004) which had 40 countries for the period 1976-1998. We use the "Financial Structure and Development Data Base" available from the World Bank for the financial market variables. The data for the sources of growth and some control variables is computed from the Penn World Tables 6.2 (Heston, Summers and Aten, 2006). As standard in this literature, the data are averaged over five-year intervals: 1976-1980, 1981-1985, 1986-1990, 1991-1995, 1996-2000, and 2000-2004, so there are six observations per country when available.

The sources of economic growth

We follow a standard method, for example as in Easterly and Levine (2001), to calculate physical capital growth. The calculation starts with an estimate of the initial level of capital stock per person for each country in 1950 assuming that the capital-output ratio was in steady state. Capital stock per person in later years is then computed using the real investment series from the Penn World Tables 6.2 and the perpetual inventory method with a 7% annual depreciation rate. The variable *Capital Growth* is then computed as the growth rate of this capital stock per person.

To calculate *Productivity Growth*, we formulate a production function in per unit of labor terms as: $y = Ak^{\alpha}$. Then taking logarithms, productivity is computed according to,

$$\ln(A) = \ln(y) - \alpha \ln(k), \quad (1)$$

where y is output per person and k is capital per person. This specification is the one that has been most commonly used in the financial development-growth literature in papers by Beck, Levine, and Loayza (2000), and Rioja and Valev (2004).

Summary statistics are presented in Table 1. The average capital growth rate over all countries was 2.19% per year. The maximum capital growth was 13.73% per year observed in

Korea in 1976-1980, and the minimum of -3.01% was observed in Jamaica in the 1981-85 period. For productivity, the average growth was 1.33% with a minimum of -6.38% in Zimbabwe (2000-2004) and a maximum of 11.77% in Trinidad and Tobago (2000-2004).

Financial Sector Variables

Three measures of banking development are used. First, *Bank Credit* is the credit that deposit money banks have issued to the private sector as a share of GDP. Second, *Bank Deposits* is the total amount of demand, time and saving deposits in deposit money banks as a share of GDP. Third, *Private Credit* is the credit issued by all financial intermediaries (excluding central banks) to the private sector as percent of GDP. While this measure includes intermediaries in addition to banks, banks still account for a major share. We choose to use *Private Credit* as an alternative measure because of its widespread use in the literature (Levine, 2005). The descriptive statistics of Table 1 show that *Bank Credit* and *Bank Deposits* average about 50% of GDP, while *Private Credit* is about 60% of GDP. The countries with largest *Bank Credit* and *Bank Deposits* are the Netherlands, Japan, and Switzerland in the latest years of the sample. Countries with the smallest banking sectors include Peru (1986-1990) and Ghana (1991-1995).

Three measures of stock market development and activity are also used. First, the *Turnover Ratio* measures the value of the traded shares in the domestic stock market divided by the total value of shares in the market. It measures how active or liquid the stock market is relative to its size. Beck and Levine (2004) use this measure exclusively in their study. Second, *Value Traded* is the value of all shares traded in the stock market as percent of GDP. It measures how active the stock market is as a share of the economy. Third, *Market Capitalization* is the total value of all shares in the stock market as percent of GDP; it measures the size of the stock market. Hence, the three measures of stock markets capture different aspects: liquidity with respect to market size, liquidity with respect to the economy size, and size with respect to the economy. According to Table 1, the *Turnover Ratio* averages about 40%, while the *Value Traded* is about 20% of the economy, and the average size of the stock market is about 40% of GDP. Clearly there is a wide variation among countries. The most active stock markets are found in the US and Switzerland with *Value Traded* in excess of 200% of GDP, while the least active

stock markets were in several developing countries in the 1970s and 1980s with *Value Traded* less than 1% of GDP.[5]

The control variables are described as follows. *Initial Capital* is the capital stock per person at the beginning of the five-year period and it is computed according to the perpetual inventory method described at the beginning of this section. *Initial Income* is the GDP per capita at the beginning of the corresponding five-year period. Initial Income (or Initial Capital) control for the convergence effect: countries that start poorer are expected to grow faster. *Schooling* is measured as the average years of schooling in the population 25 years-of-age or older from the Barro and Lee (2001) data set. This variable is typically used as a proxy of human capital and a control for the steady state--countries with higher human capital should achieve a higher steady state. We denote Schooling and Initial income (or Initial capital when appropriate) as our Basic Control Set. The remaining control variables are policy related and are standard in this literature. These variables are: Government Size (as percent of GDP), Inflation (rate), and Openness (Exports + Imports / GDP). To re-iterate, the dependent variables and all the control variables (except Schooling) come from the Penn World Tables.

Table 2 presents the simple correlations. Capital Growth and Productivity are positively correlated with the measures of banking and stock markets as expected. The correlations range from 5% to 20%. Of course, the precise relationships have to be estimated using adequate econometric techniques as in the next sections.

III. Methodology

We use dynamic panel generalized-method-of-moments (GMM) techniques to address potential endogeneity in the data.[6] This technique has become standard in the literature in the past few years. While Beck and Levine's (2004) paper on stock markets and banks also uses this approach, we incorporate recent refinements like a small-sample correction for standard errors by Windmeijer (2005). We are also careful in following the guidelines to avoid overfitting issues described by Roodman (2007). The technique can be briefly described as follows.

[5] Clearly, we only use countries in our data set that have stock markets given that we attempt to study their effects.
[6] This method is fully described in Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998).

Let y_{it} be the logarithm of the stock of capital per person (or alternatively, of our measure of productivity) in country *i* at time *t*. We are interested in the following equation:

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

where $y_{i,t}$ - $y_{i,t-1}$ is the growth rate of capital or productivity, $X_{i,t}$ is a set of explanatory variables, including our measures of banking and stock markets, η_i captures unobserved country-specific effects, and ε_{it} is an error term. Rewrite equation (2) as:

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

Notice in (3) that the lagged dependent variable, which enters as an independent explanatory variable is correlated with the country-specific component of the error term. To resolve this problem, as a first step, the GMM procedure involves taking first differences to eliminate the country-specific effect:

$$(4) \qquad y_{i,t} - y_{i,t-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta'\left(X_{i,t} - X_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right).$$

By construction, in equation (4), however, the lagged difference of capital per person is correlated with the error term, which along with the potential endogeneity of the explanatory variables *X*, requires the use of instruments. The GMM *difference* estimator uses the lagged levels of the explanatory variables as instruments under the conditions that the error term is not serially correlated and that the lagged levels of the explanatory variables are weakly exogenous (i.e., they are uncorrelated with future error terms). Then the following moment conditions are used to calculate the difference estimator:

$$(5) \qquad E\left[y_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \quad for \quad s \geq 2; t = 3,....,T,$$

$$(6) \qquad E\left[X_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \quad for \quad s \geq 2; t = 3,....,T.$$

Since persistence in the explanatory variables may adversely affect the small-sample and asymptotic properties of the difference estimator (Blundell and Bond, 1998), the difference estimator is further combined with an estimator in levels to produce a *system* estimator. The inclusion of a levels equation also allows us to use information on cross-country differences.

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

(7) $E\left[y_{i,t+p}\eta_i\right] = E\left[y_{i,t+q}\eta_i\right]$ *and* $E\left[X_{i,t+p}\eta_i\right] = E\left[X_{i,t+q}\eta_i\right]$ for all p and q.

The additional moment conditions for the regression in levels are:

(8) $E\left[\left(y_{i,t-s} - y_{i,t-s-1}\right)\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0$ *for* $s = 1$

(9) $E\left[\left(X_{i,t-s} - X_{i,t-s-1}\right)\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0$ *for* $s = 1$.

In summary, the GMM *system* estimator is obtained using the moment conditions in equations (5), (6), (8), and (9). Two specification tests are used. The Hansen-J test which tests the joint validity of the instruments, and the AR(2) test which tests if the error term is not second-order serially correlated. Roodman (2007) has recently cautioned that using too many instruments can yield very high Hansen-J probability values validating the instruments, where in fact overfitting is present. Hence, we try to follow his rule of thumb of keeping the number of instruments well below the number of cross sectional units by “collapsing” the instrument matrix.

IV. Results

Capital Growth

We ran various specifications to establish how banking and stock markets affect capital growth. Table 3 presents the summary results of running every combination of banks and stock market measures (3x3).[7] The results for the full sample are described in Panel A. All three measures of banking are statistically significant at the 1% level in every regression. The stock market measures, on the other hand, are not statistically significant at conventional 5% levels. These results indicate that, when looking across a wide range of countries, banks have a strong positive effect on capital accumulation, but stock markets do not. While the regressions on Panel A of Table 3 include the Basic Control set, we add other control variables for robustness in the specifications of Table 4 that use the two most commonly used measures of banking and stock markets: *Bank Credit* and *Value Traded*. The control variables *Government Size*, *Inflation*, and *Openness* are added one at a time. Of the three controls added, *Government Size* and *Openness* are statistically significant and show the expected signs. More importantly, *Bank Credit* remains statistically significant at the 1% level in the first three regressions and at the 10% level in regression (4). *Value Traded* is statistically significant at the 10% level in three regressions and at the 5% level in regression (2). Hence, the evidence of a positive effect of *Value Traded* on capital growth is not strong when the sample includes all countries regardless of their income level.[8]

The results are quite different when we focus on high income countries.[9] Panel B in Table 3 presents the results from re-running all the specifications with the 31 High Income

[7] Each equation estimated also included the Basic Control Set (i.e., initial capital and schooling) and time dummies. These coefficients are not reported on Table 4 for conciseness. The coefficients are two-step GMM system estimators with robust standard errors (Windmeijer, 2005). The instruments are lagged values of levels and differences of the financial variables and the controls and the instrument matrix is "collapsed." Each regression on Panel A uses 30 instruments which is well below the number of countries as per Roodman (2007). The Hansen-J test shows that we cannot reject the joint validity of the instruments. The AR(2) tests reject the presence of second-order serial correlation. Full results are available from the authors.

[8] We computed joint significance tests for the combined effects of stock market development and banking system development in every regression that we estimated. In line with the literature, these tests reveal that, looking broadly at the results, overall financial development (banks and stock markets) enhances both capital accumulation and productivity growth. In the large majority of cases, the joint significance test indicated a statistical significant effect when at least one of the financial development variables (either stock market or banking system development) was statistically significant. These results are also available on request.

[9] We split the sample based on income per capita into two groups of 31 and 30 countries and denote them High Income countries and Low Income countries. The Appendix indicates which countries are in which group. Alternatively, we split the sample based on the World Bank income definitions obtaining very similar results which are available from the authors.

countries only. *Both* banks and stock markets are generally statistically significant in this subsample. This implies that banks and stock markets have independent positive effects on capital accumulation in rich countries. It is useful to interpret the coefficients to establish their economic significance. Consider the regression that uses the *Bank Credit* and *Turnover Ratio* measures. The coefficient of Bank credit is 4.023. With a *Bank Credit* at about 75% of GDP, the country of Belgium is at the 33 percentile among High Income countries. Increasing banking system development in Belgium to the median of 85% (France), would raise the capital growth rate by 0.48% per year. A similar calculation can be made for the *Turnover Ratio* coefficient. Greece is at the 33 percentile with a *Turnover Ratio* of 45%. If the stock market activity increased to the median level of 65% (Canada), the capital growth rate would rise by 0.71%.[10] Hence, both of these potential increases in capital growth are economically meaningful.

Panel C in Table 3 shows the results for Low Income countries. These results are quite different than those for the High Income countries. In all nine specifications, while banks are significant determinants of capital growth, stock market measures are not. This is somewhat of a surprising finding given that stock market development in Lower Income countries has received lots of attention in the last 15-20 years. There may be several explanations for this finding. While stock markets have been established and grown in low income countries, perhaps they have not yet reached the minimum levels of size and activity to supply significant amounts of funding to domestic enterprises. Therefore, banks have remained the primary suppliers of funding for capital accumulation. It is also possible that the strong links developed between businesses and banks for many years prior to the establishment of stock markets account for a strong preference by firms to keep borrowing from banks rather than issue equity.

It is also useful to compare the size of the significant coefficients of High versus Low Income countries. We observe that the coefficients of the bank measures are consistently higher for the Low Income country group in all regressions reported. Hence banks have a larger effect on capital growth in Low Income countries than in High Income countries. Since low income countries primarily grow by capital accumulation according to Acemoglu, Aghion, and Zilibotti (2002), our finding implies that banking system expansion will have larger growth effects than in high income countries.

[10] Since the bank and stock market measures enter the regressions in logarithms, the exact calculations are as follows. For Bank Credit, the increase is from -0.29 to -0.17 = 0.12. Hence, 4.023 (coeff) x 0.12 = 0.48. For Turnover Ratio, the increase is from -0.87 to -0.43 = 0.44. Then, 1.612 (coeff) x 0.44 = 0.71.

Productivity Growth

We rerun the above estimations with Productivity Growth as the dependent variable. The results are presented on Table 5. When looking at the all-countries sample, bank measures and stock market measures are significant in less than half of the estimations. When using the Bank Credit and Value Traded measures specifically, and adding other controls variables, Table 6 shows that Value Traded is significant at the 5% level in regressions (1) and (4) and at the 10% level in the other two regressions. Hence the all-countries sample yields mixed results. The picture becomes more clear looking at the High Income countries only. The stock market measure is a positive and significant determinant of productivity growth in most estimations. In fact, each stock market measure is significant at the 5% or 1% when combined with two of the three bank measures. The bank measures, conversely, are not statistically significant in any of the specifications of Panel B. This means that stock markets are very important for productivity growth in High Income countries as Allen and Gale (1999) hypothesize. The economic size of this effect can be understood by interpreting the coefficient of 0.8 from the regression using *Bank Credit* and *Value Traded*. With a *Value Traded* of 24% of GDP, Portugal is at the 33 percentile among the High Income countries. Increasing the activity of its stock market to the median level of 46%, would yield a 0.52% increase in the yearly growth rate of productivity. This is a sizable effect considering that the mean growth rate of productivity in Portugal is 1.18% per year.

Next we examine the results of the Low Income group (Panel C), which are quite different from the High Income group's. Bank measures appear to be more important for productivity growth in Low Income countries, while stock market measures are not significant in any of the specifications. This may also explain the mixed results in the all-countries sample. For productivity growth, banks are relatively more important in Low Income countries, whereas stock markets are more important in High Income countries. Hence, when studying all countries together, the effects of banks and stock markets are harder to distinguish and lose statistical significance.

V. Conclusions

This paper studies the effects of stock markets and banks on capital accumulation and productivity growth. Our results are summarized in Table 7. Studying panel data from 61 countries, we find that stock markets primarily affect productivity growth. This finding confirms theoretical work by Allen (1993), Allen and Gale (1999) and Boyd and Smith (1998). We also find that bank credit primarily affects capital accumulation as predicted by Gershenkron (1962) and Stulz (2001). How do our results compare to Levine and Zervos's (1998) study? Using cross section analysis for 47 countries from 1976 to 1993, they had found that both bank credit and stock markets positively affect both sources of growth. We expand the number of countries and years of observation and use panel techniques which can address potential endogeneity concerns in cross sectional estimations. Hence, our results extend and refine Levine and Zervos (1998) findings.

Further interesting results arise when we study low- and high-income countries separately, which has not been done previously. In high-income countries, both banks and stock markets contribute to capital accumulation. In low-income countries, only bank credit appears to affect capital accumulation. Further, in low-income countries, stock markets do not appear to affect productivity growth. Hence, a major finding is that bank credit is preeminent in funding both capital accumulation and productivity in developing countries. Perhaps the size and activity of equity markets in developing countries has not yet reached levels where they are significant determinants of the sources of growth.

Our results highlight the complex nature of the relationships between the financial sector and real activity. They underscore the importance of differentiating between the sources of growth, the different components of the financial system, and countries at different stages of development. With financial markets flourishing around the world, it has become increasing possible to investigate these effects in broader samples of countries and with longer time series. Future research can expand and reevaluate our findings with even greater detail.

References

Acemoglu, D., Philippe Aghion, and Fabrizio Zilibotti "Distance to Frontier, Selection, and Economic Growth." NBER Working Paper # 9066, 2002.

Agenor, P. and Peter Montiel *Development Macroeconomics*. Princeton, N. J.: Princeton University Press, 1999.

Aghion, Howitt and Mayer-Foulkes. "The Effect of Financial Development on Convergence," *Quarterly Journal of Economics*, 120(1), 2005, 173-222.

Allen, F. "Stock Markets and Resource Allocation." In: Mayer, C., Vives, X (eds.), *Capital Markets and Financial Intermediation*. Cambridge, University Press, Cambridge, 1993, 81-107.

Allen, F. and D. Gale. "Diversity of Opinion and Financing of New Technologies", *Journal of Financial Intermediation*, 8, 1999, 68-89.

Allen, F. and D. Gale. *Comparing Financial Systems*, Cambridge, MA: MIT Press, 2000.

Arellano, M. and S. Bond. "Some Tests of Specification for Panel Data: Monte Carlo Evidence with an Application for Employment Equations." *Review of Economic Studies*, 58(2), 1991, 277-97.

Arellano, M. and O. Bover "Another Look at the Instrumental Variable Estimation of Error-Component Models." *Journal of Econometrics*, 68(1), 1995, 29-51.

Barro, Robert and Jong-Wha Lee. "International Data on Educational Attainment: Updates and Implications," Oxford Economic Papers 53(3), 2001.

Beck, T., R. Levine, and N. Loayza "Finance and the Sources of Growth." *Journal of Financial Economics*, 58(1,2), 2000, 261-300.

Beck, T. and R. Levine. "Industry Growth and Capital Allocation: Does Having a Market- or Bank-Based System Matter." *Journal of Financial Economics*, 64(2), 2002, 147-180.

Beck, T. and R. Levine. "Stock Markets, Banks and Growth: Panel Evidence." *Journal of Banking and Finance*, 28(3), 2004, 423-42.

Bhide, A. "The Hidden Costs of Stock Market Liquidity", *Journal of Financial Economics*, 34, 1993, 1-51.

Blundell, R. and S. Bond. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics*, 87(1), 1998, 115-143.

Boyd, J. H. and B. D. Smith, "The Evolution of Debt and Equity Markets in Economic Development", *Economic Theory*, 12, 1998, 519-560.

Christensen, L., D. Cummings, and Dale Jorgenson "Relative Productivity Levels, 1947-1973: An International Comparison." *European Economic Review*, 16(1), 1981, 61-94.

Easterly, W. and R. Levine. "It's Not Factor Accumulation: Stylized Facts and Growth", *World Bank Economic Review*, 15, 2001, 177-219.

Elias, V. *Sources of Growth: A Study of Seven Latin American Countries*. San Francisco, California: ICS Press, 1992.

Fohlin, C. "Relationship Banking, Liquidity and Investment in the German Industrialization," *The Journal of Finance*, 53(5), 1998, 1737-58.

Gerschenkron, A. *Economic Backwardness in Historical Perspective — A Book of Essays*, Cambridge: Harvard University Press, 1962.

Heston, Alan, Robert Summers and Bettina Aten, Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September 2006.

Hoshi, T., A. Kashyap and D. Scharfstein. "Corporate Structure, Liquidity and Investment: Evidence from Japanese Industrial Firms," *The Quarterly Journal of Economics*, 106(1), 1991, 33-60.

King, R. and R. Levine "Finance and Growth: Schumpeter Might Be Right." *Quarterly Journal Economics*, 108(3), 1993, 717-37.

Kong, M. "Stock Market Development, Liquidity Constraints and Investment: A Case of Korean Jaebol and Non-Jaebol Manufacturing Firms in the 1980's," *Asian Economic Journal*, 12(1), 1998, 1-22.

Levine, R. "Stock Markets, Growth, and Tax Policy," *Journal of Finance* 46, 1991, 1445-65.

Levine, R. "Financial Development and Economic Growth: Views and Agenda," *Journal of Economic Literature* 35, 1997, 688-726.

Levine, R. "Bank-Based or Market-Based Financial Systems: Which Is Better?" *Journal of Financial Intermediation*, 11, 2002, 398-428.

Levine, R. "Finance and Growth: Theory and Evidence." in Philippe Aghion and Steven Durlauf, eds. *Handbook of Economic Growth*. The Netherlands: Elsevier Science. 2005.

Levine, R., N. Loayza, and T. Beck. "Financial Intermediation and Growth: Causality and Causes," *Journal of Monetary Economics*, 46(1), 2000, 31-77.

Levine, R. and S. Zervos. "Stock Markets, Banks, and Economic Growth." *American Economic Review*, 88(3), 1998, 537-58.

Rioja, F. and N. Valev, "Finance and the Sources of Growth at Various Stages of Economic Development", *Economic Inquiry*, 42, 2004, 27-40.

Roodman, David, "A Short Note on the Theme of Too Many Instruments." Working Paper No. 125, August 2007, Center for Global Development (www.cgdev.org).

Rousseau, P.L. and P. Wachtel, "Equity markets and growth: Cross-country evidence on timing and outcomes, 1980–1995," *Journal of Banking and Finance* 24, 2000, pp.1933-1957.

Stulz, R.M. "Financial Structure, Corporate Finance, and Economic Growth." In: Demirgüç-Kunt, A., Levine, R. (eds.), *Financial Structure and Economic Growth: A Cross Country Comparison of Banks, Markets, and Development*. MIT Press, Cambridge, MA, 2001, 143-188.

Windmeijer, F. "A finite sample correction for the variance of linear efficient two-step GMM estimators," *Journal of Econometrics*, 126(1), 2005, pp. 25-51.

World Bank. "Financial Structure and Economic Development Data Base," updated 2005 (http://www.worldbank.org/research/projects/finstructure/database.htm).

World Bank. "Bank Regulation and Supervision Dataset," updated 2003 (http://econ.worldbank.org/external/default/main?menuPK=478071&pagePK=64168176&piPK=64168140&theSitePK=478060)

Young, Alwyn, "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience." *Quarterly Journal of Economics*, August 1995, 110(3), 641-80.

Appendix: Country Averages, 1976-2004

	Capital Growth	Prod. Growth	Bank Credit	Bank Deposits	Private Credit	Turnover Ratio	Value Traded	Market Capit.
Argentina	0.24	0.17	16.3	16.0	16.7	29.5	2.2	17.0
Australia	2.21	1.32	51.7	46.3	51.7	47.2	24.1	51.4
Austria	2.76	1.24	81.9	73.5	81.9	53.6	3.8	9.1
Bangladesh*	3.10	1.17	21.3	28.8	21.3	23.9	0.6	2.0
Barbados	0.17	0.31	41.0	59.5	50.8	3.8	3.6	60.2
Belgium	2.35	1.15	47.1	54.1	47.1	17.2	6.8	36.9
Bolivia*	0.73	0.92	52.1	43.5	52.1	1.3	0.1	10.8
Botswana	6.20	2.00	13.4	21.4	13.4	6.9	0.7	13.1
Brazil*	1.49	0.62	32.9	31.9	28.6	46.1	7.9	16.1
Canada	2.67	1.09	72.0	73.8	90.4	48.3	26.4	57.5
Chile*	2.04	2.02	43.2	28.8	48.1	7.5	4.6	51.5
Colombia*	1.77	0.87	14.7	14.9	26.0	8.4	0.7	8.6
Costa Rica*	2.12	0.25	17.0	29.0	17.8	10.2	0.4	7.3
Cyprus	1.77	2.81	86.3	90.0	121.8	32.7	16.0	31.6
Denmark	1.83	1.07	49.2	42.7	49.2	52.8	14.1	28.8
Ecuador*	-0.83	0.36	22.7	18.9	23.7	4.7	0.4	7.3
Egypt*	0.28	2.89	31.8	61.1	36.6	14.0	2.5	13.5
Finland	1.47	1.44	58.8	45.0	58.8	47.9	30.7	56.9
France	2.36	1.07	76.1	58.4	76.1	56.0	20.8	33.2
Ghana*	0.06	1.90	7.5	14.2	7.5	3.8	0.4	13.9
Greece	1.43	1.31	38.2	51.4	38.2	25.7	13.9	25.8
Hong Kong	5.00	2.77	146.4	183.0	146.4	50.1	80.5	174.3
Iceland	1.55	1.26	68.9	39.6	68.9	36.6	16.4	46.4
India*	3.40	2.42	23.4	32.8	23.4	90.1	18.3	16.8
Indonesia*	5.61	1.35	28.7	30.9	28.5	27.2	4.2	10.2
Iran*	-0.10	3.43	19.5	33.1	26.5	15.3	1.8	14.7
Ireland	4.30	4.54	74.8	60.1	82.6	48.3	20.8	56.6
Israel	1.81	1.08	59.6	63.0	59.6	60.1	19.6	38.4
Italy	2.01	1.23	58.8	58.6	58.8	59.1	14.4	19.5
Jamaica*	-0.20	0.66	23.3	39.1	23.3	7.7	2.1	31.5
Japan	3.51	1.12	147.3	171.3	147.3	55.5	35.5	63.7
Jordan*	2.60	-0.42	55.3	68.3	60.7	14.4	9.3	55.7
Kenya*	-0.66	-0.45	21.7	28.7	27.9	3.8	0.6	14.6
Korea	9.07	3.28	50.4	37.0	86.8	135.7	47.5	26.4
Malaysia*	6.16	2.33	87.2	91.3	88.5	30.5	44.3	107.5
Mauritius	4.20	2.68	47.4	69.2	47.4	5.4	1.6	29.5
Mexico*	1.87	0.60	17.8	21.8	18.2	43.9	5.9	15.7
Nepal*	3.88	0.68	21.2	28.5	21.5	4.7	0.4	7.4
Netherlands	1.38	1.13	100.5	85.1	133.1	76.5	47.0	59.1
New Zealand	1.58	1.13	68.6	59.9	75.1	30.3	10.0	41.2
Norway	1.54	2.05	54.1	48.3	88.4	67.7	15.6	23.0
Pakistan*	1.90	1.78	22.9	28.2	22.9	108.4	14.2	10.4
Panama*	3.71	1.20	67.2	59.7	67.2	4.0	0.5	16.6
Paraguay*	0.05	-0.73	23.5	20.6	23.5	5.6	0.1	2.6
Peru*	-0.69	-0.13	13.1	15.1	14.7	16.8	2.0	12.3
Philippines*	1.86	0.74	27.6	30.6	33.7	26.3	7.6	26.9
Portugal	3.65	1.19	81.0	83.6	81.0	26.9	8.4	15.9
Singapore	3.39	2.94	83.1	71.7	99.6	50.9	49.4	134.9
South Africa*	0.55	0.93	52.5	48.6	83.8	18.6	19.8	120.8
Spain	2.93	1.10	78.2	65.1	78.2	97.8	37.7	31.3

Sri Lanka*	2.04	3.11	21.0	26.4	21.0	11.5	1.6	12.0
Sweden	1.30	1.20	47.7	42.8	96.7	58.0	36.5	52.4
Switzerland	1.42	0.38	139.0	106.3	139.0	78.0	136.3	111.2
Thailand*	5.21	3.06	78.5	64.3	78.5	78.7	22.4	28.1
Trinidad & Tob.	-0.40	3.65	30.6	40.2	47.3	7.6	1.6	33.1
Tunisia*	0.06	2.92	52.3	40.4	59.0	9.0	1.0	10.0
Turkey*	3.77	0.88	15.5	24.6	15.5	80.6	19.1	14.1
UK	2.40	1.38	82.5	62.5	82.5	54.5	49.3	91.0
United States	2.82	1.30	51.7	65.3	121.4	98.9	77.5	77.4
Uruguay	0.74	0.73	34.5	38.8	34.5	2.6	0.0	0.9
Venezuela*	-1.15	-0.12	18.3	23.4	31.4	10.7	1.1	6.8
Zimbabwe*	-0.09	-1.11	13.9	17.9	21.1	11.2	2.9	26.9

Notes: Countries with a "*" are those in the Low Income group. The remainder countries are in High Income group.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Capital Growth	2.19	2.62	-3.01	13.73
Productivity Growth	1.33	1.86	-6.38	11.77
Bank Credit	51.90	37.17	2.07	207.22
Bank Deposits	51.80	33.83	4.15	229.76
Private Credit	58.80	41.41	4.35	264.89
Turnover Ratio	38.96	44.76	0.34	371.58
Value Traded	19.52	36.61	0.00	233.24
Market Capitalization	38.63	46.92	0.02	372.08
Initial Capital	26445	22989	813	95011
Initial Income	12075	8302	1166	34757
Schooling	6.50	2.60	1.03	12.25
Government Size	19.11	7.79	5.50	67.43
Inflation	33.88	154.41	-2.28	1667.21
Openness	67.13	52.84	8.48	403.80

Table 2: Correlations

	Cap. Growth	Prod. Growth	Bank Credits	Bank Deps.	Private Credit	Turn over Ratio	Value Traded	Market Capit.	Initial Capital	Initial Income	Schooling	Gov. Size	Inflation	Openness
Cap. Growth	1.00													
Prod. Growth	0.30	1.00												
Bank Credit	0.18	0.02	1.00											
Bank Dep.	0.13	0.05	0.89	1.00										
Private Credit	0.18	0.06	0.92	0.82	1.00									
Turnover	0.22	0.13	0.27	0.20	0.33	1.00								
Value Traded	0.13	0.08	0.60	0.54	0.65	0.60	1.00							
Market Cap.	0.11	0.10	0.62	0.61	0.64	0.24	0.75	1.00						
Initial Capital	0.02	0.03	0.67	0.57	0.70	0.34	0.55	0.46	1.00					
Initial Income	0.04	0.06	0.65	0.57	0.71	0.31	0.54	0.49	0.95	1.00				
Schooling	-0.03	0.04	0.49	0.41	0.60	0.25	0.44	0.44	0.76	0.83	1.00			
Gov. Size	-0.05	-0.10	-0.22	-0.19	-0.21	-0.13	-0.25	-0.17	-0.26	-0.26	-0.18	1.00		
Inflation	-0.18	-0.11	-0.16	-0.18	-0.19	-0.02	-0.08	-0.12	-0.12	-0.13	-0.09	0.05	1.00	
Openness	0.15	0.17	0.34	0.36	0.32	-0.03	0.30	0.54	0.23	0.22	0.11	-0.09	-0.16	1.00

Table 3: The Effects of Banks and Stock Markets on Capital Accumulation

Dependent variable is the growth rate of capital accumulation. The results below show the coefficient estimates for each bank measure and stock market measure combination obtained from two-step, robust GMM estimations. Each regression was run with the simple control set and with time dummies; those coefficients are not reported. P-values are in parenthesis. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

Panel A: All countries

		Stock Market		
		Turnover Ratio	Value Traded	Capitalization
Banks				
Bank Credit	*Bank measure*	4.165	4.182	4.111
		(0.000)***	(0.000)***	(0.001)***
	St. mkt measure	0.624	0.580	0.521
		(0.160)	(0.068)*	(0.533)
Bank Deposits	*Bank measure*	7.031	5.961	5.384
		(0.000)***	(0.000)***	(0.000)***
	St. mkt measure	0.645	0.385	0.803
		(0.288)	(0.134)	(0.369)
Private Credit	*Bank measure*	4.450	4.706	4.225
		(0.000)***	(0.000)***	(0.002)***
	St. mkt measure	0.725	0.494	0.348
		(0.217)	(0.151)	(0.656)

Panel B: High income countries

		Stock Market		
		Turnover Ratio	Value Traded	Capitalization
Banks				
Bank Credit	*Bank measure*	4.023	4.149	3.671
		(0.001)***	(0.003)***	(0.016)**
	St. mkt measure	1.612	1.260	2.865
		(0.007)***	(0.001)***	(0.042)**
Bank Deposits	*Bank measure*	5.522	4.542	4.208
		(0.007)***	(0.057)*	(0.329)
	St. mkt measure	1.766	1.258	3.129
		(0.094)*	(0.068)*	(0.214)
Private Credit	*Bank measure*	4.133	4.356	3.330
		(0.000)***	(0.000)***	(0.041)***
	St. mkt measure	1.383	0.954	2.519
		(0.001)***	(0.007)***	(0.041)**

(continued)

Table 3 (continued)
The Effects of Banks and Stock Markets on Capital Accumulation

Panel C: Low income countries				
		Stock Market		
Banks		Turnover Ratio	Value Traded	Capitalization
Bank Credit	*Bank measure*	5.365	5.700	6.973
		(0.000)***	(0.001)***	(0.000)***
	St. mkt measure	0.528	0.557	0.663
		(0.336)	(0.354)	(0.598)
Bank Deposits	*Bank measure*	4.853	6.364	8.754
		(0.020)**	(0.001)***	(0.002)***
	St. mkt measure	0.409	0.022	-2.031
		(0.510)	(0.969)	(0.211)
Private Credit	*Bank measure*	3.819	3.782	6.367
		(0.000)***	(0.000)***	(0.000)***
	St. mkt measure	0.405	0.250	-1.569
		(0.473)	(0.582)	(0.109)

Table 4: The Effects of Banks and Stock Markets on Capital Accumulation: Robustness

Dependent variable is the growth rate of capital accumulation. The results below show the coefficient estimates from two-step, robust GMM estimations for the all-countries sample. Each regression was run with time dummies which are not reported for conciseness. P-values are in parenthesis. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)
Bank Credit	4.182	4.114	4.612	2.024
	(0.000)***	(0.000)***	(0.000)***	(0.089)*
Value Traded	0.580	0.782	0.486	0.730
	(0.068)*	(0.030)**	(0.093)*	(0.061)*
Initial capital	1.434	-2.060	-1.388	0.398
	(0.365)	(0.258)	(0.213)	(0.833)
Schooling	0.520	0.462	-1.902	-3.365
	0.839	0.854	0.352	0.338
Govt. Spending		-4.907		
		(0.066)*		
Inflation			0.062	
			(0.917)	
Openness				6.338
				(0.023)**
Constant	21.33	38.87	23.51	-19.76
	(0.090)*	(0.032)*	(0.013)**	(0.219)
Number Obs.	293	293	293	293
Countries	61	61	61	61
Wald test joint sig. *(p-value)*	(0.000)***	(0.000)***	(0.000)***	(0.060)**
AR(2) test (p-value)	0.07	0.24	0.04	0.17
Hansen J test (p-value)	0.36	0.53	0.22	0.10
# instruments	30	36	36	36

Table 5: The Effects of Banks and Stock Markets on Productivity

Dependent variable is the growth rate of productivity. The results below show the coefficient estimates for each bank measure and stock market measure combination obtained from two-step, robust GMM estimations. Each regression was run with the simple control set and with time dummies; those coefficients are not reported. P-values are in parenthesis. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

Panel A: All countries

		Stock Market		
		Turnover Ratio	Value Traded	Capitalization
Banks				
Bank Credit	*Bank measure*	1.733	0.493	0.402
		(0.084)*	(0.561)	(0.644)
	St. mkt measure	0.209	0.359	0.894
		(0.488)	(0.031)**	(0.031)**
Bank Deposits	*Bank measure*	3.650	1.599	1.465
		(0.000)***	(0.071)*	(0.284)
	St. mkt measure	0.284	0.291	0.707
		(0.265)	(0.060)*	(0.074)*
Private Credit	*Bank measure*	0.813	0.664	0.567
		(0.600)	(0.501)	(0.624)
	St. mkt measure	0.271	0.242	0.658
		(0.420)	(0.185)	(0.131)

Panel B: High income countries

		Stock Market		
		Turnover Ratio	Value Traded	Capitalization
Banks				
Bank Credit	*Bank measure*	0.986	-1.215	-1.098
		(0.4470	(0.101)	(0.467)
	St. mkt measure	0.717	0.800	2.036
		(0.272)	(0.003)***	(0.044)**
Bank Deposits	*Bank measure*	-0.051	-0.248	-0.887
		(0.984)	(0.895)	(0.712)
	St. mkt measure	0.938	0.754	1.897
		(0.047)**	(0.004)***	(0.101)
Private Credit	*Bank measure*	1.850	-0.354	-0.596
		(0.222)	(0.651)	(0.640)
	St. mkt measure	0.545	0.800	2.290
		(0.192)	(0.012)**	(0.004)***

(continued)

Table 5 (continued)
The Effects of Banks and Stock Markets on Productivity

Panel C: Low income countries				
		Stock Market		
Banks		Turnover Ratio	Value Traded	Capitalization
Bank Credit	*Bank measure*	2.002	2.807	2.853
		(0.137)	(0.004)***	(0.005)***
	St. mkt measure	0.119	0.177	0.505
		(0.797)	(0.540)	(0.405)
Bank Deposits	*Bank measure*	2.077	2.979	3.958
		(0.124)	(0.005)***	(0.000)***
	Stock market measure	-0.002	-0.068	-0.723
		(0.996)	(0.805)	(0.168)
Private Credit	*Bank measure*	0.738	2.246	1.711
		(0.528)	(0.065)*	(0.215)
	Stock market measure	0.008	-0.248	-0.652
		(0.984)	(0.483)	(0.269)

Table 6: The Effects of Banks and Stock Markets on Productivity: Robustness

Dependent variable is the growth rate of productivity. The results below show the coefficient estimates from two-step, robust GMM estimations for the all-countries sample. Each regression was run with time dummies which are not reported for conciseness. P-values are in parenthesis. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)
Bank Credit	0.493	-0.020	0.023	0.041
	(0.561)	(0.984)	(0.980)	(0.963)
Value Traded	0.359	0.450	0.255	0.473
	(0.031)**	(0.072)*	(0.074)*	(0.016)**
Initial income	1.206	0.537	1.511	0.948
	(0.299)	(0.737)	(0.164)	(0.463)
Schooling	-3.716	-0.725	-3.555	-3.804
	(0.021)**	(0.732)	(0.022)**	(0.029)**
Govt. Spending		-8.019		
		(0.002)***		
Inflation			-1.071	
			(0.003)***	
Openness				2.494
				(0.013)**
Constant	-1.621	31.10	-5.194	-9.513
	(0.857)	(0.065)*	(0.520)	(0.358)
Number Obs.	293	293	293	293
Countries	61	61	61	61
Wald test joint sig. *(p-value)*	(0.060)*	(0.160)	(0.150)	(0.043)**
AR(2) test (p-value)	0.74	0.83	0.75	0.90
Hansen J test (p-value)	0.23	0.72	0.20	0.39
# instruments	30	36	36	36

Table 7: Summary of empirical results

"+" indicates a positive and statistically significant effect and "0" indicates that the effect is not statistically significant.

	All countries		Developed countries		Developing countries	
	Capital	Productivity	Capital	Productivity	Capital	Productivity
Stock markets	0	+	+	+	0	0
Banks	+	0	+	0	+	+