J Econ Finan
DOI 10.1007/s12197-011-9218-3

Stock markets, banks and the sources of economic growth in low and high income countries

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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 that includes high- and low-income countries. Results show that, in low-income countries, banks have a sizable positive effect on capital accumulation. We find that stock markets, however, have not contributed to capital accumulation or productivity growth in these countries. Given the emphasis that has been placed in developing equity markets in developing countries, these findings are somewhat surprising. Conversely, in high-income countries, stock markets are found to have sizable positive effects on both productivity and capital growth, while banks only affect capital accumulation.

Keywords Financial Development · Capital Growth · Productivity · Stock Markets · Banking · Low-income Countries · High-income Countries

JEL Classification G1 · O4

1 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

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

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Published online: 29 November 2011

both greater physical capital accumulation and greater productivity growth. The literature also shows that stock markets and banks both enhance economic growth (e.g., Beck and Levine 2004). 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. And in particular whether these effects vary between high- and low-income countries. In a widely discussed article in *The Economist* (July 11, 2009), the Chief Economist of the World Bank, Justin Lin, proposed that sophisticated financial institutions "are not appropriate in low-income markets." Further, Lin suggests that "small local banks are the best entities for providing financial services" in these countries.

In this paper, 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 the sources of growth in low-income countries?
- Do stock markets have a stronger effect on the sources of growth in high-income economies?

Our motivation for this analysis is twofold. First, as described in Acemoglu et al. (2006) 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, advanced 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 of growth and in particular the role that different components of the financial markets play. Furthermore, Aghion et al. (2005) and Rioja and Valev (2004) have shown that the effects of finance on growth may vary according to the country's income level. Lin et al. (2009) show theoretically that the structure of the financial system depends on the country's stage of development. 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.

The theoretical literature proposes that 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

[2] Some empirical papers have confirmed that the engines of growth vary for different countries (e.g., Young (1995) and Christensen et al. (1981)).

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, Gerschenkron (1962) argues that banks can exert pressure on firms to service their debts. Therefore they finance capital investments even in weak institutional environments. 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 these hypotheses. 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 capital accumulation. However, neither stock markets nor banks seem to affect productivity 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 with data ending in 1993). Both credit markets and stock markets have developed significantly since the mid 1990's. We use data for 62 countries covering the period of 1980–2009. 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 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.

However, Rioja and Valev (2004) focus on the effects of private credit and do not study in detail how the effects of stock markets vary according to income levels.

The remainder of the paper is organized as follows. Section 2 describes the data and the measures used. Section 3 describes the methodology and Section 4 discusses the results. Section 5 concludes.

2 Data and measures

The data set consists of a panel of observations for 62 countries for which we have stock market data for the period 1980–2009. We take advantage of the wider availability of data to expand on the previous work of Levine and Zervos (47 countries, up to 1993) and Beck and Levine (2004) which study 40 countries up to the year 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 are computed from the Penn World Tables 7.0 (Heston et al. 2011). As standard in this literature, the data are averaged over five-year intervals: 1980–1984, 1985–1989, 1990–1994, 1995–1999, 2000–2004, and 2005–2009, so there are six observations per country when available.

2.1 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.[5] 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,

$$\ln(A) = \ln(y) - \alpha \ln(k), \tag{1}$$

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 et al. (2000) and Rioja and Valev (2004).

Summary statistics are presented in Table 1. The average capital growth rate over all countries was 2.3% per year. The maximum capital growth was 11.24% per year observed in Korea in 1990–1994, and the minimum of −3.37% was observed in Zimbabwe in the 2005–2009 period. For productivity, the average growth was 1.29% with a minimum of −13.1% in Zimbabwe (2000–2004) and a maximum of

[5] The farther in the past the initial observation of investment is, the more accurate the capital series will be. Penn World Tables (PWT) data start in 1950 and provide fairly uniform measures across countries. Alternatively, the World Development Indicators (WDI) data could have been used; however, these data do not go back in time as early as PWT and have sparser coverage of the earlier years. Hence, we chose to use PWT data.

Table 1 Summary statistics

Variable	Mean	Std. Dev.	Min	Max
Full Sample				
Capital Growth	2.30	2.37	−3.37	11.24
Productivity Growth	1.29	2.03	−13.06	8.51
Bank Credit	56.95	42.15	2.07	234.12
Bank Deposits	55.62	37.00	4.15	262.40
Private Credit	63.27	44.85	4.35	264.89
Turnover Ratio	44.26	49.70	0.06	371.58
Value Traded	27.12	45.84	0.00	258.82
Market Capitalization	47.98	57.90	0.10	527.94
Initial Capital	35901	30375	672	129738
Initial Income	14959	12018	155	50096
Schooling	6.74	2.60	1.03	12.25
Government Size	8.75	3.49	2.66	21.46
Inflation	55.67	490.57	−2.28	8603.28
Openness	72.90	58.47	10.57	432.08
Low Income countries (34)				
Capital Growth	2.10	2.75	−3.37	10.91
Productivity Growth	1.21	2.24	−13.06	5.48
Bank Credit	33.95	24.81	2.07	145.31
Bank Deposits	38.45	23.18	4.15	120.49
Private Credit	36.87	27.51	4.35	145.31
Turnover Ratio	27.81	43.59	0.06	371.58
Value Traded	10.35	23.51	0.00	187.28
Market Capitalization	30.26	41.04	0.10	220.32
Initial Capital	11930	7453	672	33294
Initial Income	5100	2982	155	12292
Schooling	5.01	1.69	1.03	8.49
Government Size	7.96	3.73	2.66	21.46
Inflation	100.09	673.54	0.66	8603.28
Openness	65.65	39.19	10.57	206.80
High Income countries (28)				
Capital Growth	2.53	1.84	−2.41	11.24
Productivity Growth	1.37	1.76	−2.79	8.51
Bank Credit	82.14	42.89	17.90	234.12
Bank Deposits	74.42	40.11	23.10	262.40
Private Credit	92.70	42.08	23.45	264.89
Turnover Ratio	64.58	49.39	1.26	293.05
Value Traded	45.99	56.41	0.01	258.82
Market Capitalization	68.21	67.13	0.45	527.94
Initial Capital	62887	22834	12845	129738
Initial Income	26059	7997	5975	50096
Schooling	8.76	1.93	3.27	12.25
Government Size	9.64	2.96	2.98	19.53
Inflation	6.23	15.53	−2.28	177.53
Openness	81.05	73.73	12.15	432.08

8.5% in Trinidad and Tobago (2005–2009).We further separate countries into two groups, Low Income and High Income, according to their World Bank classification system.[6] Table 1 also presents summary statistics for each income group.

2.2 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 55% 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 (1985–1989) and Ghana (1990–1994).

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 44% (65% in High Income countries and 28% in Low Income countries), while the *Value Traded* is about 27% of the economy (46% in High Income countries and 10% in Low Income countries), and the average size of the stock market is about 48% 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 1980s with *Value Traded* less than 1% of GDP.[7]

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.

[6] We attempted to have an approximately balanced number of countries in the two groups. Countries classified by the World Bank as "High Income OECD" and "High Income non-OECD" comprise our High Income group. Countries classified as "Low Income"; "Lower Middle Income"; and "Upper Middle Income" comprise our Low Income group.

[7] Clearly, we only use countries in our data set that have stock markets given that we attempt to study their effects.

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 Simple 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 sample correlations.

3 Methodology

We use dynamic panel generalized-method-of-moments (GMM) techniques to address potential endogeneity in the data.[8] 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). The technique can be briefly described as follows.

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:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta' \mathrm{X}_{\mathrm{i,t}} + \eta_{\mathrm{i}} + \varepsilon_{\mathrm{i,t}} \tag{2}$$

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 Eq. (2) as:

$$y_{i,t} = \alpha y_{i,t-1} + \beta' \mathrm{X}_{\mathrm{i,t}} + \eta_{\mathrm{i}} + \varepsilon_{\mathrm{i,t}}, \tag{3}$$

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:

$$y_{i,t} - y_{i,t-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta'\left(\mathrm{X}_{\mathrm{i,t}} - \mathrm{X}_{\mathrm{i,t-1}}\right) + \left(\varepsilon_{\mathrm{i,t}} - \varepsilon_{\mathrm{i,t-1}}\right). \tag{4}$$

By construction, in Eq. (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

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

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	0.32	1.00												
Bank Credit	0.16	−0.07	1.00											
Bank Dep.	0.10	0.00	0.82	1.00										
Private Credit	0.15	−0.04	0.91	0.78	1.00									
Turnover	0.17	0.01	0.38	0.26	0.42	1.00								
Value Traded	0.13	0.02	0.61	0.58	0.65	0.66	1.00							
Market Cap.	0.12	0.05	0.58	0.67	0.61	0.27	0.76	1.00						
Initial Capital	0.05	−0.04	0.69	0.61	0.72	0.42	0.58	0.52	1.00					
Initial Income	0.07	−0.02	0.66	0.54	0.71	0.43	0.55	0.47	0.96	1.00				
Schooling	0.00	0.01	0.52	0.43	0.63	0.30	0.46	0.43	0.73	0.81	1.00			
Gov. Size	−0.06	−0.05	−0.01	−0.01	−0.01	0.07	−0.09	−0.12	0.14	0.18	0.09	1.00		
Inflation	−0.18	−0.16	−0.15	−0.17	−0.18	−0.05	−0.05	−0.02	−0.10	−0.10	−0.07	−0.02	1.00	
Openness	0.12	0.17	0.30	0.40	0.28	−0.04	0.28	0.54	0.31	0.20	0.10	0.00	−0.03	1.00

future error terms). Then the following moment conditions are used to calculate the difference estimator:

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

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

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:

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

The additional moment conditions for the regression in levels are:

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

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

In summary, the GMM *system* estimator is obtained using the moment conditions in Es. (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. We also attempt to keep the number of instruments below the number of cross sectional units by "collapsing" the instrument matrix as suggested by Roodman (2007).

4 Results

4.1 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 (3×3).[9] The results for the full sample are

[9] Each equation estimated also included the Simple Control Set (i.e., initial capital and schooling) and time dummies. These coefficients are not reported on Table 3 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." For all regressions on Table 3, 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.

Table 3 The effects of banks and stock markets on capital accumulation

Banks		Stock Market		
		Turnover Ratio	Value Traded	Capitalization
Panel A: All countries				
Bank Credit	*Bank measure*	5.753***	3.938***	4.404***
		(0.000)	(0.002)	(0.004)
	St. mkt measure	0.0904	0.687*	1.820*
		(0.869)	(0.0813)	(0.0868)
Bank Deposits	*Bank measure*	9.037***	5.100	4.348
		(0.009)	(0.117)	(0.211)
	St. mkt measure	−0.304	0.446	1.228*
		(0.688)	(0.223)	(0.0837)
Private Credit	*Bank measure*	3.991***	2.814**	2.095
		(0.008)	(0.035)	(0.134)
	St. mkt measure	0.155	0.478	1.625*
		(0.733)	(0.226)	(0.068)
Panel B: Low income countries				
Bank Credit	*Bank measure*	4.696*	4.868***	6.384***
		(0.086)	(0.001)	(0.000)
	St. mkt measure	0.386	0.398	−0.514
		(0.691)	(0.520)	(0.715)
Bank Deposits	*Bank measure*	6.435	5.939**	8.302**
		(0.131)	(0.038)	(0.011)
	St. mkt measure	0.294	0.285	−1.110
		(0.751)	(0.690)	(0.387)
Private Credit	*Bank measure*	3.776*	4.191**	3.939
		(0.076)	(0.048)	(0.135)
	St. mkt measure	0.265	0.140	−0.858
		(0.812)	(0.839)	(0.590)
Panel C: High income countries				
Bank Credit	*Bank measure*	2.440**	3.053***	3.052***
		(0.026)	(0.001)	(0.002)
	St. mkt measure	2.095*	0.831**	1.801**
		(0.093)	(0.032)	(0.048)
Bank Deposits	*Bank measure*	−0.349	2.714	3.473
		(0.912)	(0.137)	(0.151)
	St. mkt measure	2.208**	1.008*	2.018**
		(0.034)	(0.062)	(0.028)
Private Credit	*Bank measure*	3.279***	3.353**	2.725**
		(0.004)	(0.011)	(0.037)
	St. mkt measure	1.282	0.620	1.718**
		(0.173)	(0.186)	(0.014)

The 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

described in Panel A. The banking measures are generally statistically significant. 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.[10]

As described in the introduction, we split the sample into two groups of countries based on the World Bank classification system. The High Income group is composed of 28 countries, and the Low Income group has 34 countries. The Appendix lists which counties fall in which group. Panel B in Table 3 presents the results from re-running all the specifications only for the Low Income countries.[11] Overall, the results show that banks are significant determinants of capital growth, while stock market measures are not. It is useful to interpret the economic significance of the coefficients. Consider the regression that uses the *Bank Credit* and *Value Traded* measures (the second cell on the first row). The coefficient of *Bank Credit* is 4.868. With a *Bank Credit* at about 22% of GDP, the country of Pakistan was at the 33 percentile among Low Income countries in the 2000–04 period. Increasing banking system development in Pakistan to the median of 26% of GDP (Costa Rica), would raise the capital growth rate in Pakistan by about 0.88% per year. This is a sizable effect.[12]

Regarding the coefficient estimates for the stock market variables, they are generally not statistically significant for Low Income countries as Panel B shows. This is somewhat of a surprising finding given that stock market development in Low Income countries has received lots of attention in the last 15–20 years. Furthermore, these results would agree with Lin (2009) that developing counties need banks and not more sophisticated financial institutions like stock markets. There may be several explanations for this finding. While stock markets have been established 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. Indeed, as shown on Table 1, Value Traded averages only 10% of GDP in Low Income countries, while it is 46% of GDP in our High Income group. 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

[10] In addition, 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.

[11] As an initial step, we interacted the bank and stock market measures with income and ran regressions using the all-countries group. The results were as expected with diminishing effects of bank measures as income increased. However, those regressions make the strong assumption of holding constant the coefficients for all other variables for all countries. We believe it is more appropriate to separate them in two groups and study each group separately as we do here.

[12] 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 −1.51 to −1.33=0.18. Hence, 4.868 (coeff) x 0.18=0.88.

markets account for a strong preference by firms to keep borrowing from banks rather than issue equity.[13]

Compare the results above with those from High Income countries shown in Panel C. Both banks and stock markets are statistically significant in some of the regressions, though the results are mixed. The bank measures *Bank Credit* and *Private Credit* are statistically significant in every regression, as is the stock market measure *Market Capitalization*. Again, it is useful to interpret and compare the coefficients to those for Low Income countries. We focus on the regression that uses the *Bank Credit* and *Value Traded* measures to be consistent. The coefficient of *Bank Credit* in High Income countries is 3.053 vs. 4.868 in Low Income countries. Hence, expanding bank credit has a larger positive effect on capital growth in Low Income countries. On the other hand, the *Value Traded* coefficient is 0.831 and statistically significant at the 5% level in High Income countries, while not significant for Low Income countries. Among High Income countries, Israel is at the 33rd percentile with a *Value Traded* of 35% in the period 2000–04. If the stock market activity increased to the median level of 51% (Italy), the capital growth rate would rise by 0.31%.[14]

While the regressions of Table 3 include the Simple Control set and time dummies, 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. The results are consistent with those from Table 3. In Low Income countries, *Bank Credit* is positive and statistically significant at the 1% significance level in every regression, while *Value Traded* is not. In High Income countries, *Value Traded* is statistically significant in 3 of 4 regressions, while *Bank Credit* is only statistically significant in two regressions. Of the three controls added, only *Government Size* is statistically significant and shows the expected sign.

4.2 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 generally not significant. Only *Market Capitalization* is significant in all regressions. The picture becomes more clear looking at the two income groups separately. For the Low Income countries neither bank measures nor stock market measures are statistically significant. This is further confirmed in Table 6 when we add other controls for robustness. In sum, we find no

[13] Countries with large banking sectors often have large stock markets and vice versa, so some degree of collinearity is expected. We conduct a robustness test in which we run regressions with either bank or stock market measure without the other. Then we compare the coefficients to those obtained from a regression that includes both types of financial markets. We find similar results in terms of statistical significance. However, the size of the coefficients is larger in the regressions that only include one of the measures. This would indicate that indeed it is appropriate to test the effects of banks and stock markets by including both in each regression as we do in our results. These robustness regressions are available from the authors.

[14] Since the bank and stock market measures enter the regressions in logarithms, the exact calculations are as follows. For *Value Traded* the increase is from −1.04 to −0.67=0.37. Then, 0.831 (coeff) x 0.37=0.31.

Table 4 The effects of banks and stock markets on capital accumulation: robustness

	Low income				High Income			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank Credit	4.868***	4.791***	4.406***	3.428**	3.053***	1.337	1.186	1.648**
	(0.001)	(0.007)	(0.006)	(0.016)	(0.001)	(0.263)	(0.288)	(0.043)
Value Traded	0.398	0.345	0.226	0.794*	0.831**	0.584**	0.504	0.617***
	(0.520)	(0.625)	(0.511)	(0.072)	(0.032)	(0.022)	(0.126)	(0.006)
Initial capital	4.430	3.743	−1.914	−1.573	−7.353***	−4.679	−6.111	−7.230***
	(0.417)	(0.359)	(0.545)	(0.564)	(0.009)	(0.259)	(0.141)	(0.001)
Schooling	−8.320	−6.441	−0.053	−1.926	−5.852	5.732	4.726	0.312
	(0.266)	(0.310)	(0.990)	(0.539)	(0.143)	(0.406)	(0.403)	(0.894)
Govt. Spending		0.182	−0.934	−3.753		−13.39***	−12.47***	−7.512**
		(0.981)	(0.773)	(0.297)		(0.007)	(0.001)	(0.021)
Inflation			−0.724	−0.109			4.287	3.135
			(0.629)	(0.891)			(0.580)	(0.697)
Openness				3.855**				−1.620
				(0.027)				(0.298)
Constant	−17.25	−13.58	28.93	18.53	99.23***	72.11*	88.59**	107.1***
	(0.730)	(0.745)	(0.289)	(0.497)	(0.002)	(0.069)	(0.036)	(0.000)
Observations	172	172	171	171	151	151	151	151
Number of countries	34	34	34	34	28	28	28	28
AR(2) test(p-value)	0.33	0.37	0.26	0.49	0.68	0.09	0.07	0.26
Hansen J test(p-value)	0.68	0.93	1.00	0.99	0.81	0.90	0.99	1.00

The 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

Table 5 The effects of banks and stock markets on productivity

Banks		Stock Market		
		Turnover Ratio	Value Traded	Capitalization
Panel A: All countries				
Bank Credit	*Bank measure*	−0.284	−1.100	−1.276
		(0.825)	(0.224)	(0.328)
	St. mkt measure	0.00232	0.371*	1.362**
		(0.993)	(0.085)	(0.035)
Bank Deposits	*Bank measure*	2.200	0.816	0.715
		(0.146)	(0.495)	(0.652)
	St. mkt measure	−0.217	0.248	1.275**
		(0.438)	(0.215)	(0.025)
Private Credit	*Bank measure*	−1.324	−1.166	−2.446*
		(0.285)	(0.214)	(0.052)
	St. mkt measure	−0.0647	0.241	1.164**
		(0.814)	(0.183)	(0.025)
Panel B: Low income countries				
Bank Credit	*Bank measure*	1.184	1.249	0.609
		(1.140)	(0.374)	(0.593)
	St. mkt measure	0.193	0.110	−0.00163
		(0.550)	(0.683)	(0.998)
Bank Deposits	*Bank measure*	2.252	3.250*	3.555
		(0.262)	(0.096)	(0.116)
	St. mkt measure	−0.108	−0.0986	−0.666
		(0.803)	(0.779)	(0.286)
Private Credit	*Bank measure*	0.709	1.158	0.899
		(0.657)	(0.467)	(0.600)
	St. mkt measure	0.0949	−0.0905	−0.611
		(0.862)	(0.660)	(0.590)
Panel C: High income countries				
Bank Credit	*Bank measure*	−1.284	−1.015	−0.543
		(1.977)	(0.329)	(0.692)
	St. mkt measure	−1.541	0.666**	1.941
		(1.115)	(0.0328)	(0.103)
Bank Deposits	*Bank measure*	−3.604	−2.899**	−1.965
		(0.136)	(0.039)	(0.157)
	St. mkt measure	−0.454	0.774*	1.462**
		(0.753)	(0.076)	(0.037)
Private Credit	*Bank measure*	−1.258	−0.0496	0.0187
		(0.609)	(0.965)	(0.989)
	St. mkt measure	−0.893	0.687*	2.185*
		(0.422)	(0.091)	(0.086)

The 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

Table 6 The effects of banks and stock markets on productivity: robustness

VARIABLES	Low income				High Income			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank Credit	−0.276	0.0867	−0.673	−1.020	−0.533	−1.858*	−2.000*	−1.315*
	(0.769)	(0.915)	(0.451)	(0.297)	(0.476)	(0.058)	(0.065)	(0.075)
Value Traded	0.0268	−0.0290	−0.0323	−0.0873	0.545***	0.417**	0.630***	0.452**
	(0.897)	(0.913)	(0.917)	(0.763)	(0.007)	(0.045)	(0.007)	(0.017)
Initial capital	4.218**	3.687*	2.968	0.717	−0.232	1.723	1.330	−3.294
	(0.013)	(0.0600)	(0.274)	(0.597)	(0.937)	(0.464)	(0.627)	(0.401)
Schooling	−5.556***	−4.420*	−3.164	−2.951	−3.353**	−0.690	2.473	−0.958
	(0.009)	(0.0635)	(0.237)	(0.195)	(0.043)	(0.733)	(0.418)	(0.683)
Govt. Spending		2.908	2.794	1.938		−5.314*	−6.944*	−5.849
		(0.306)	(0.326)	(0.148)		(0.066)	(0.064)	(0.117)
Inflation			−1.202*	−1.147**			−15.27	−3.524
			(0.051)	(0.010)			(0.109)	(0.545)
Openness				−0.364				1.612
				(0.859)				(0.474)
Constant	−25.37**	−27.86*	−24.36	−3.318	10.38	−4.191	−3.106	45.62
	(0.029)	(0.0944)	(0.306)	(0.838)	(0.725)	(0.853)	(0.908)	(0.292)
Observations	172	172	171	171	151	151	151	151
Number of countries	34	34	34	34	28	28	28	28
AR(2) test(p-value)	0.51	0.56	0.44	0.43	0.96	0.74	0.10	0.37
Hansen J test(p-value)	0.56	0.89	0.96	1.00	0.81	0.95	0.99	1.00

The 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

evidence that productivity growth in Low Income countries has been affected by banks or stock markets.

For High Income countries, on the other hand, Panel C of Table 5 shows that stock markets are significant in a couple of regressions. When using the *Bank Credit* and *Value Traded* measures and adding other controls on Table 6, *Value Traded* is significant and positive in every regression, while *Bank Credit* is not. Let's consider, for example, the coefficient estimate for *Value Traded* in regression (2) which is 0.417. Continuing with the example of Israel which ranks at the 33 percentile for *Value Traded* in the High Income group, an increase is stock market activity to the median Value Traded would result in productivity growing 0.15% faster. This is a fairly sizable increase considering that productivity grows at 1.3% per year in these advanced countries. In sum, stock markets generally boost productivity growth in High Income countries.

5 Conclusions

This paper studies the effects of stock markets and banks on capital accumulation and productivity growth. Our results are succinctly summarized in Table 7. Studying panel data for a world sample, we find that bank credit primarily affects capital accumulation across all countries as predicted by Gerschenkron (1962) and Stulz (2001). We also 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). Our all-countries-sample findings are generally consistent with Levine and Zervos (1998) while extending the number of countries and time observations as well addressing potential endogeneity concerns by using dynamic panel GMM-IV estimators.

Our main contribution arises when we study Low and High Income countries separately. In Low Income countries, banks are essential as they have a sizable positive effect on capital accumulation. We find that stock markets, however, have not contributed to capital accumulation or productivity growth in these 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.

Table 7 Summary of empirical results

	All countries		High Income countries		Low Income countries	
	Capital	Productivity	Capital	Productivity	Capital	Productivity
Stock markets	0	0	+	+	0	0
Banks	+	0	+	0	+	0

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

Nevertheless, given the emphasis that has been placed in developing equity markets in developing countries, these findings are somewhat surprising. These results seem to provide support for Lin's (2009) argument that financial markets in developing countries should be focused on banks.

Conversely, in high-income countries, stock markets are generally found to have sizable positive effects on both productivity and capital growth, while banks only affect capital accumulation. This agrees with theoretical work by Allen and Gale (1999) as stock markets are important in funding innovations which lead to productivity 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.

Acknowledgements We are grateful to Gustavo Canavire-Bacarreza, Fernando Rios-Avila, and Tatyana Zelenskaya for research assistance. Comments from Federico Mandelman and seminar participants at the Federal Reserve Bank of Atlanta, Auburn University, and the University of Georgia are gratefully acknowledged.

Appendix

Table 8 Country averages, 1980–2009

	Capital Growth	Prod. Growth	Bank Credit	Bank Deposits	Private Credit	Turnover Ratio	Value Traded	Market Capit.
Argentina*	0.51	1.05	15.35	16.90	15.73	24.41	3.49	21.56
Australia	2.94	1.32	66.07	54.25	64.51	57.56	37.86	66.28
Austria	2.34	1.07	90.62	78.32	90.12	53.24	6.30	14.43
Bangladesh*	4.39	0.97	24.45	33.92	24.00	24.83	0.74	2.56
Barbados	0.85	−0.08	45.18	66.23	53.05	3.29	3.48	88.87
Belgium	2.31	1.02	56.94	64.68	55.40	25.63	11.72	59.80
Bolivia*	0.85	1.38	46.29	40.82	47.97	0.89	0.10	14.64
Botswana*	6.59	0.73	14.86	25.15	14.88	5.62	0.66	15.82
Brazil*	0.88	0.41	33.60	37.31	28.69	49.07	10.61	23.10
Canada	2.69	0.66	85.62	88.09	109.55	53.11	38.42	72.58
Chile*	3.45	2.17	52.18	35.24	58.31	10.04	7.06	65.80
Colombia*	2.83	1.26	18.07	16.31	25.47	8.80	1.49	12.75
Costa Rica*	2.38	0.28	20.31	28.69	20.18	9.13	0.51	7.32
Cyprus	0.36	1.50	86.33	90.04	121.78	32.68	15.97	31.60
Denmark	2.65	0.74	75.63	48.37	71.78	59.99	23.86	37.96
Ecuador*	0.10	1.27	22.74	19.97	22.86	5.10	0.37	7.44
Egypt*	2.47	2.82	34.08	63.95	39.84	19.23	6.79	22.24
Finland	1.85	1.45	64.35	47.25	63.47	67.46	54.25	64.43

Table 8 (continued)

	Capital Growth	Prod. Growth	Bank Credit	Bank Deposits	Private Credit	Turnover Ratio	Value Traded	Market Capit.
France	1.80	0.78	83.98	62.05	82.80	67.55	32.09	45.95
Ghana*	0.83	1.82	9.25	15.85	9.00	3.35	0.42	15.16
Greece	1.48	1.06	47.61	60.45	46.77	34.27	18.65	33.77
Hong Kong	4.62	2.24	143.50	202.88	145.27	51.64	122.92	250.52
Iceland	2.38	0.84	110.23	44.89	101.32	62.35	39.54	78.92
India*	4.56	2.70	27.40	38.71	26.51	87.19	27.21	26.20
Indonesia*	4.37	2.13	27.71	31.47	27.55	34.99	6.65	14.69
Iran*	2.08	2.64	22.68	33.36	29.11	16.21	2.40	16.72
Ireland	3.75	2.69	99.94	67.76	97.58	49.75	23.58	56.68
Israel	1.63	1.22	64.06	66.88	64.07	58.03	24.43	46.58
Italy	2.30	0.59	63.87	56.27	62.59	89.11	24.79	26.50
Jamaica*	1.25	0.64	23.32	39.40	23.14	6.72	2.52	49.91
Japan	2.62	0.73	144.14	182.43	144.24	72.19	51.69	74.57
Jordan*	1.23	0.32	64.29	79.54	67.36	22.74	40.34	88.21
Kenya*	0.72	−0.07	21.96	29.40	27.12	5.33	1.12	17.68
Korea	7.44	2.93	61.85	43.82	101.18	156.48	71.91	36.88
Malaysia*	4.77	2.18	98.92	100.45	101.40	34.07	49.97	128.03
Mauritius*	3.49	2.56	53.51	76.57	53.69	5.77	1.82	32.14
Mexico*	1.92	0.45	16.92	21.38	17.38	44.44	6.85	19.36
Nepal*	4.33	0.49	27.25	35.28	21.46	4.50	0.33	8.55
Netherlands	1.85	1.11	121.89	95.01	148.55	95.89	66.19	74.24
New Zealand	1.84	1.06	79.97	65.05	83.33	33.18	11.00	40.70
Norway	1.92	1.78	58.08	48.50	90.14	79.78	23.98	28.59
Pakistan*	1.36	1.43	23.61	29.31	23.57	126.82	32.96	14.29
Panama*	3.93	2.20	69.81	63.95	69.03	3.48	0.47	19.34
Paraguay*	0.06	−0.29	21.84	19.85	21.72	3.95	0.10	2.70
Peru*	0.64	1.04	14.09	16.61	15.34	15.13	2.37	16.14
Philippines*	0.74	0.90	27.65	35.64	33.64	25.25	8.20	31.23
Portugal	3.66	1.14	94.43	88.14	92.01	44.16	11.94	22.30
Singapore	3.99	3.24	88.70	81.95	106.43	61.87	64.37	139.64
South Africa*	0.67	0.83	57.00	49.51	95.67	24.53	33.15	145.19
Spain	2.79	1.18	92.29	72.92	87.42	111.22	60.63	42.88
Sri Lanka*	2.48	2.85	22.85	27.78	22.72	12.33	2.24	13.61
Sweden	1.64	1.09	60.15	43.06	100.80	76.76	58.10	69.58
Switzerland	1.35	0.72	150.62	115.04	149.74	91.79	164.71	145.22
Thailand*	4.61	2.77	87.06	74.40	88.03	67.52	29.90	38.79
Trinidad &Tob.	0.76	4.53	30.20	39.22	44.62	6.61	2.08	47.58
Tunisia*	0.52	2.50	53.54	42.22	59.89	9.87	1.13	9.94
Turkey*	3.27	1.07	17.26	26.99	16.94	87.16	25.18	17.72
UK	2.46	1.10	106.26	80.46	103.71	68.90	79.33	107.42
United States	2.64	0.83	52.49	66.55	137.88	118.35	104.84	93.22
Uruguay*	1.01	0.89	34.47	38.79	34.47	2.58	0.03	0.88
Venezuela*	−0.90	−0.03	16.69	22.32	25.58	11.29	1.13	6.57
Zimbabwe*	−0.57	−2.12	13.88	18.21	21.40	11.19	4.34	33.07

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

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