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Does one size fit all?: a reexamination of the finance and growth relationship

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Abstract

Recent research has found a strong positive effect of a country's financial development on economic growth. We propose that this relationship may vary according to the level of financial development (divided in three regions). In the low region (countries with very low levels of financial development), additional improvements in financial markets have an uncertain effect on growth. In the intermediate region, financial development has a large, positive effect on growth. Finally, in the high region, the effect is positive, but smaller. We examine a panel of 74 countries using generalized method of moments (GMM) dynamic panel techniques and find support for the different regions.

JEL classification: O40; G10
Keywords: Financial development; Growth

1. Introduction

The relationship between financial development and economic growth has received a lot of attention in the economic literature in the last 10 years. The predominant view is that the increased availability of financial instruments and institutions reduces transaction and information costs in an economy. Well-developed financial markets help economic agents hedge, trade, and pool risk raising investment and economic growth. While many economic thinkers (e.g., Schumpeter, 1912; Robinson, 1952; Hicks, 1969; McKinnon, 1973; Fry, 1995) had discussed the relationship between financial development and growth, advances in computing power and the availability of economic data for a large number of countries in the late 1980s launched the large-scale empirical literature on the subject. Specifically, a

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series of empirical articles by King and Levine (1993a,b,c) brought the discussion to the forefront of economic literature in the 1990s.[1] The general conclusion from this literature is that financial development exerts a strong positive effect on economic growth.

This relationship has been further explored by Demetriades and Hussein (1996), Rioja and Valev (2004), De Gregorio and Guidotti (1995), and Odedokun (1996) who find that finance may have a different effect on growth in different countries, time periods or stages of development. For example, Levine et al. (2000) and De Gregorio and Guidotti (1995) show that the effect declines as the level of financial development increases.[2] De Gregorio and Guidotti (1995) even present evidence of a negative effect on growth in a sample of 12 Latin American countries during 1950–1985. Our goal in this paper is to examine whether variations in the finance–growth relationship observed by other authors have a systematic component. We develop a structure that explicitly allows the effect of finance on growth to differ and show that differences can, at least partially, be attributed to scale and diminishing returns effects in the development of financial sectors.

Using a broad sample of 74 countries during the 1960–1995 period, we find that the effect of finance on growth is not uniformly positive and even when positive its size differs. Our results suggest that financial development exerts a strong positive effect on economic growth *only* once it has reached a certain size threshold, i.e., in what we call the "middle" region. In the "low" region (below this threshold), the effect is uncertain as different empirical measures of bank-based financial development suggest a zero effect or a positive effect. At the other end, in the "high" region, the growth effect of financial development declines once it reaches very high levels.

There are several theoretical justifications for the three regions that we propose. Concerning the low region, a number of arguments point to the importance of economies of scale in the process of allocating savings to projects with higher rates of return. One argument is based on the assumption that projects with higher rates of return are indivisible and have minimum size requirements (Acemoglu and Zilibotti, 1997). In that environment, the financial sector has to develop to a certain minimum size before sufficient funds can be pooled together to finance larger projects.[3] Another framework that studies potential structural breaks in this relationship points to the importance of pooling risk and the liquidity services provided by financial intermediaries. For example, in Saint-Paul (1992), agents choose between a more liquid investment project with a lower rate of return and a less liquid project with a higher rate of return. In that model, as in Bencivenga and Smith (1991), financial intermediaries allow agents to mitigate idiosyncratic risk by holding diversified portfolios. The resulting shift towards more high-return projects contributes to economic growth. In that setting, the scale of risk diversification and the resulting positive effect on growth increase as the size of the financial system grows from low to high levels.

[1] Other empirical work in this vein includes Gelb (1989), Roubini and Sala-I-Martin (1992), Pagano (1993), Levine (1997, 1998), Levine et al. (2000), and Beck et al. (2000).

[2] This is done implicitly in Levine et al. (2000) as their key explanatory variable is the natural logarithm of financial development.

[3] The existence of scale effects suggests the possibility of "poverty traps," an equilibrium condition of low financial development and low economic development. Lee (1996) and Berthelemy and Varoudakis (1996) study this problem theoretically and empirically. Saint-Paul (1992) similarly proposes a low and a high equilibrium.

Several authors have also emphasized the importance of financial intermediaries in reducing the cost of collecting and analyzing information on investment projects. In Greenwood and Jovanovic (1990), financial intermediaries arise endogenously to perform that function. Since the organization of financial intermediaries is costly, however, as the economy grows, financial depth increases with a strong feedback effect on growth.

Other arguments relate to learning-by-doing effects. Lee (1996), for example, models lending decisions as a process of learning-by-doing where lenders acquire project-specific information by making investment decisions. Also, the experiences of many countries have shown that expansion in the financial sector produces sound results only if the regulatory and supervisory authorities have enough expertise to manage that expansion.[4] Since financial sector "expertise" is accumulated in a learning-by-doing manner, the financial sector may have to develop to a certain size before the rules of its functioning are sophisticated and regulators are more effective. Finally, Rousseau and Wachtel (2002) have shown that the effect of finance on growth is significantly reduced in high inflation environments, which may be more common in lower income countries with less developed financial markets.

Concerning the high region, the theoretical literature guides us to expect that the effect of finance on growth will decline with further improvements because of diminishing returns (Greenwood and Jovanovic, 1990). In addition, the structure of financial markets changes as a country becomes more developed. Some studies have shown that market-based external financing becomes increasingly important as the financial system evolves (e.g., Levine and Zervos, 1998; De Gregorio and Guidotti, 1995). That effect, however, is not readily captured using standard bank-based measures for financial development.

In summary, a number of theoretical results point to the possibility of nonlinear effects of financial development on economic growth. The empirical analysis presented here explicitly tests for structural breaks in terms of the level of financial development. However, we do not distinguish between the various channels through which the nonlinearities occur, e.g., through indivisibility of investment, improved risk pooling and liquidity services or through learning-by-doing.

In order to identify and test for these potential regions, we use recent generalized method of moments (GMM) dynamic panel data techniques, which can deal with the possible simultaneity between financial development and economic growth, so as to concentrate on the causal effect of the exogenous component of financial development on economic growth. Using panel data also allows us to control for country-specific effects and to incorporate information from individual countries over time. The paper proceeds as follows. Section 2 describes some observations from the data to motivate the analysis. Then, Section 3 presents the methodology; Section 4 describes the results; and Section 5 concludes.

2. Some observations from the data

To begin our discussion, we present several observations that point to the need for a more detailed examination of the standard hypothesis of a positive effect of finance on

[4] See Diaz-Alejandro (1985) and Sundararajan and Balino (1991) for a review of experiences with banking crises.

growth across the board. Appendix A presents real per capita GDP growth rates and financial development data for 74 countries during the 1966–1995 period. Three measures of bank-based financial development are shown in Appendix A and are later used in the empirical section. These measures of financial development have been commonly used in the literature as data are available as far back as 1960 for a large number of countries. However, at this stage we only discuss the Private Credit measure, which is defined as credit issued by deposit money banks and other financial institutions to the private sector as percent of GDP. Private Credit is a commonly used measure in the literature (e.g., Levine et al., 2000).

First, consider countries that had low Private Credit in 1966–1970 and did not raise it much by 1991–1995; e.g., Haiti. Private Credit in Haiti was 0.02 in the earlier period and 0.11 in the latter period. Notice also that Haiti grew −1.46% per year over 1966–1995. Similarly, Private Credit in Senegal went from 0.15 to 0.22. Senegal's average growth over 1966–1995 was also negative at −0.48% per year. In general, we observe that most countries that had low Private Credit, and did not increase it much, had a poor growth performance. These countries would fall in our hypothesized low region.

Second, consider Thailand where Private Credit was a low 0.15 in 1966–1970, but increased to 1.01 by 1991–1995. Thailand grew a very high 5.18% per year over the 1966–1995 period. Similarly, Cyprus increased its Private Credit from 0.43 to 1.00 and grew 5.87% per year. In general, countries that started with moderate levels of Private Credit and increased it significantly grew the most. These countries would fall under our hypothesized middle region.

Third, consider countries like Switzerland that had an already high level of Private Credit, 1.16, in 1966–1970. While Switzerland's Private Credit rose from 1.16 to 2.04, its growth performance was only average: 1.47% per year. The United States also displays a similar pattern as Private Credit increased from 0.98 to 1.48, but the country grew only an average of 1.84% per year.

While clearly these are only casual observations from the data, they do provide motivation to studying potential structural breaks in the financial development–growth relationship. We now turn to describing the methodology and data for formally testing our hypothesis.

3. Methodology and data

Following Levine et al. (2000) and Beck et al. (2000), we use recently developed dynamic panel generalized method of moments (GMM) techniques to address potential endogeneity in the data.[5] Let y_{it} be the logarithm of real per capita GDP in country i at time t. We are interested in the following equation:

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

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

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

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

and take first differences to eliminate the country-specific effect:

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

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

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

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

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 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:

$$E[y_{i,t+p}\eta_i]=E[y_{i,t+q}\eta_i] \text{ and } E[X_{i,t+p}\eta_i]=E[X_{i,t+q}\eta_i] \text{ for all } p \text{ and } q. \tag{6}$$

The additional moment conditions for the regression in levels are:

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

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

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

Recall that three hypothesized stages of financial development are the essence of this paper. In order to capture these, we first create the dummy variables low region (LR) and high region (HR) such that LR is equal to 1 if financial development is below a

Table 1
Descriptive statistics, 1961–1995, 74 countries

Variable	GDP growth	Initial income per capita	Average years of secondary schooling	Private credit	Commercial–Central bank	Liquid liabilities	Government size	Openness to trade	Inflation rate	Black market premium
Mean	0.017	3883	1.12	0.37	0.76	0.41	0.14	0.55	0.16	0.6
Maximum	0.13	20,134	5.15	2.05	1.00	1.91	0.45	2.00	3.44	109.9
Minimum	− 0.10	107	0.00	0.003	0.12	0.05	0.04	0.09	− 0.03	− 0.05
Standard deviation	0.03	4792	0.94	0.23	0.20	0.25	0.06	0.30	0.32	5.52
Correlations										
GDP growth	1.00									
Initial income per capita	0.10	1.00								
Average years of secondary schooling	0.15	0.69	1.00							
Private credit	0.07	0.76	0.61	1.00						
Commercial–central bank	0.28	0.51	0.32	0.58	1.00					
Liquid liabilities	0.21	0.62	0.50	0.84	0.49	1.00				
Government size	− 0.01	0.44	0.26	0.23	0.25	0.23	1.00			
Openness to trade	0.07	0.01	0.03	0.05	0.18	0.10	0.19	1.00		
Inflation rate	− 0.27	− 0.15	− 0.05	− 0.21	− 0.24	− 0.21	0.03	− 0.19	1.00	
Black market premium	− 0.18	− 0.07	− 0.05	− 0.07	− 0.10	− 0.02	0.09	− 0.08	0.53	1.00

certain lower threshold and zero otherwise. Similarly, HR equals 1 if financial development is greater than a certain upper threshold, zero otherwise. Next, the LR and HR dummies are interacted with the financial development (FD) variable as follows: $\beta_0 FD_{it} + \beta_1 FD_{it} \times LR_{it} + \beta_2 FD_{it} \times HR_{it}$. With this specification, the effect of financial development on growth in the low region is $\beta_0 + \beta_1$; in the middle region it is β_0; and in the high region it is $\beta_0 + \beta_2$. The estimated effects for each region are reported in Results.

Of course, where exactly the thresholds are (if they exist) is not known a priori. Hence, we estimate the model repeatedly varying the location of both thresholds over a wide range of the distribution of each financial development measure.[6] We use three financial development measures, which are commonly adopted in the literature: Private Credit (already described above), Liquid Liabilities, and Commercial vs. Central Bank. Liquid Liabilities is defined as currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries as percent of GDP. This is a size or "financial depth" measure that has been used in the literature by Goldsmith (1969) and King and Levine (1993b) among others. Commercial vs. Central Bank is defined as commercial bank assets divided by commercial bank plus central bank assets. This measures the relative importance of commercial banks vs. central banks in allocating savings. Presumably, commercial banks are better at evaluating the potential returns and risks of various projects.

The data set consists of a panel of observations for 74 countries for the period 1961–1995. This is the same data set used by Levine et al. (2000).[7] The data are averaged over 5-year intervals: 1961–1965, 1966–1970,..., 1991–1995, so there are seven observations per country when available. Table 1 presents descriptive statistics for all the variables. The control variables are: initial income per capita; average years of schooling; government size (government spending/GDP), openness to trade ((exports + imports)/GDP); the average inflation rate; and the black market premium. This is a list of control variables commonly used in this literature (e.g., Beck et al., 2000; Levine et al., 2000).[8] We also include time dummies to capture period-specific effects.

4. Results

In order to ascertain the existence and location of the proposed low and high thresholds, the model is estimated repeatedly varying the thresholds over a wide range. The low

[6] This strategy has also been used by Chong and Zanforlin (1999).

[7] Levine et al. (2000) use the natural logarithm of the financial development measures in their estimation. Conversely, we do not use logs of the financial development variables since this would smooth out the potential structural breaks in the financial development–growth relationship.

[8] The rationale for including these control variables is as follows. First, the initial level of real per capita GDP controls for the convergence effect implied in the standard Solow–Swan growth theory. Second, average years of secondary schooling is a measure of educational attainment which controls for the level of human capital in the country. Third, government size, the inflation rate, and openness to trade are all controls for policy in the country. Large government sectors and high inflation are presumed to affect growth adversely, while more openness to trade is presumed to affect growth positively.

Table 2a
Financial development and growth: dynamic panel regression, system estimator

Regressors	(1)	(2)
Low Region (Private Credit <0.14)	–	−0.045 (0.364)
Private Credit	0.037 (0.001)	0.061 (0.001)
High Region (Private Credit >0.30)	–	0.041 (0.001)
Initial income per capita[a]	−0.015 (0.001)	−0.018 (0.001)
Government size	−0.034 (0.181)	0.010 (0.701)
Openness to trade	−0.039 (0.001)	−0.036 (0.001)
Inflation[b]	−0.009 (0.250)	−0.009 (0.423)
Average years of secondary school	0.009 (0.013)	0.008 (0.024)
Black market premium[b]	−0.025 (0.001)	−0.026 (0.001)
Dummy 66–70	0.004 (0.067)	0.002 (0.438)
Dummy 71–75	−0.002 (0.368)	−0.004 (0.093)
Dummy 76–80	−0.003 (0.162)	−0.007 (0.013)
Dummy 81–85	−0.023 (0.001)	−0.025 (0.001)
Dummy 86–90	−0.013 (0.001)	−0.016 (0.001)
Dummy 91–95	−0.019 (0.001)	−0.022 (0.001)
Constant	0.147 (0.001)	0.164 (0.001)
Number of observations	456	456
Sargan test[c] (*p*-value)	0.37	0.38
Serial correlation test[d] (*p*-value)	0.61	0.75

Dependent variable: growth rate of real per capita GDP. Numbers in parenthesis are *p*-values.

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

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

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

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

threshold is alternatively placed at the 10th, 15th, 20th, 25th, 30th, 35th, 40th, and 45th percentiles of the distribution of each financial development measure. Similarly, the high threshold is placed at the 55th, 60th, 65th,. . ., and 90th percentiles. Each low threshold is paired with every possible high threshold, so a total of 64 regressions are run for each of our three measures.

For each of the three financial development variables, we present two tables of results. The first table shows estimates without regions (monotonic relationship) and with regions (non-monotonic relationship) for comparison purposes. The estimated coefficients for the control variables are also presented in the first table. In the second table, we only present coefficient estimates for the financial development variables using several different thresholds for the high and low regions. We choose to report nine sets of results for each financial development variable where we see strongest evidence of all three regions.[9] These estimates are obtained using the same control variables as in the first table. Results using Private Credit are reported in Tables 2a and 2b; Liquid Liabilities in Tables 3a and 3b; and Commercial–Central Bank in Tables 4a and 4b.

[9] Results of all 192 (64 × 3) regressions are not reported for brevity, but are available from the authors on request.

Table 2b
Financial development growth effects with regions: Private Credit (PC)

	High Region PC >0.28 (55th percentile)	High Region PC >0.30 (60th percentile)	High Region PC >0.37 (65th percentile)
Low Region	− 0.085 (0.080)	− 0.127 (0.009)	− 0.030 (0.560)
PC < 0.12	0.095 (0.001)	0.057 (0.001)	0.105 (0.001)
(20th percentile)	0.050 (0.001)	0.044 (0.001)	0.055 (0.001)
Low Region	− 0.016 (0.760)	− 0.045 (0.364)	0.009 (0.870)
PC < 0.14	0.100 (0.001)	0.061 (0.001)	0.102 (0.001)
(25th percentile)	0.048 (0.001)	0.041 (0.001)	0.051 (0.001)
Low Region	0.041 (0.316)	0.023 (0.576)	0.064 (0.254)
PC < 0.16	0.112 (0.001)	0.078 (0.001)	0.111 (0.001)
(30th percentile)	0.055 (0.001)	0.051 (0.001)	0.053 (0.001)

Estimates are for low, middle, and high regions, respectively. Numbers in parenthesis are *p*-values.

4.1. Private Credit

In general, Private Credit appears not to have a statistically significant effect on growth in the low region, while it has a positive, significant effect in the middle and high regions.

Table 3a
Financial development and growth: dynamic panel regression, system estimator

Regressors	(1)	(2)
Low Region (LL < 0.21)	–	0.020 (0.261)
Liquid Liabilities (LL)	0.022 (0.001)	0.050 (0.001)
High Region (LL>0.50)	–	0.030 (0.001)
Initial income per capita[a]	− 0.004 (0.042)	− 0.004 (0.049)
Government size	− 0.038 (0.031)	− 0.065 (0.002)
Openness to trade	− 0.015 (0.001)	− 0.011 (0.002)
Inflation[b]	− 0.007 (0.215)	0.002 (0.757)
Average years of secondary school	− 0.003 (0.324)	− 0.002 (0.463)
Black market premium[b]	− 0.024 (0.001)	− 0.026 (0.001)
Dummy 66 – 70	− 0.002 (0.293)	− 0.001 (0.431)
Dummy 71 – 75	− 0.008 (0.001)	− 0.008 (0.001)
Dummy 76 – 80	− 0.007 (0.001)	− 0.008 (0.001)
Dummy 81 – 85	− 0.023 (0.001)	− 0.025 (0.001)
Dummy 86 – 90	− 0.012 (0.001)	− 0.014 (0.001)
Dummy 91 – 95	− 0.017 (0.001)	− 0.020 (0.001)
Constant	0.068 (0.001)	0.065 (0.001)
Number of observations	456	456
Sargan test[c] (*p*-value)	0.31	0.21
Serial correlation test[d] (*p*-value)	0.50	0.47

Dependent variable: growth rate of real per capita GDP. Numbers in parenthesis are *p*-values.

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

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

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

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

Table 3b
Financial development growth effects with regions: Liquid Liabilities (LL)

	High Region LL>0.47 (65th percentile)	High Region LL>0.50 (70th percentile)	High Region LL>0.55 (75th percentile)
Low Region LL < 0.20	0.057 (0.001)	0.037 (0.079)	0.059 (0.100)
(20th percentile)	0.075 (0.001)	0.053 (0.001)	0.065 (0.001)
	0.035 (0.001)	0.029 (0.001)	0.034 (0.001)
Low Region LL < 0.21	0.024 (0.211)	0.020 (0.261)	0.043 (0.290)
(25th percentile)	0.066 (0.001)	0.050 (0.001)	0.061 (0.001)
	0.032 (0.001)	0.030 (0.001)	0.034 (0.001)
Low Region LL < 0.23	− 0.018 (0.261)	− 0.014 (0.470)	− 0.011 (0.690)
(30th percentile)	0.047 (0.001)	0.044 (0.001)	0.047 (0.001)
	0.021 (0.001)	0.026 (0.001)	0.026 (0.001)

Estimates are for low, middle, and high regions, respectively. Numbers in parenthesis are *p*-values.

In addition, we observe that the positive effect in the middle region is larger than in the high region.

Consider the estimates in Table 2a where the low threshold is placed at the 25th percentile (Private Credit < 0.14) and the high threshold at the 60th percentile (Private

Table 4a
Financial development and growth: dynamic panel regression, system estimator

Regressors	(1)	(2)
Low Region (CCB < 0.65)	–	0.037 (0.001)
Comm. vs. Central Bank (CCB)	0.029 (0.001)	0.038 (0.001)
High Region (CCB>0.95)	–	0.023 (0.001)
Initial income per capita[a]	− 0.017 (0.001)	− 0.014 (0.001)
Government size	− 0.061 (0.001)	− 0.072 (0.001)
Openness to trade	− 0.015 (0.019)	− 0.009 (0.118)
Inflation[b]	− 0.025 (0.001)	− 0.024 (0.001)
Average years of secondary school	0.021 (0.001)	0.018 (0.001)
Black market premium[b]	− 0.019 (0.001)	− 0.020 (0.001)
Dummy 66–70	0.010 (0.001)	0.008 (0.001)
Dummy 71–75	0.006 (0.013)	0.004 (0.046)
Dummy 76–80	0.003 (0.106)	0.001 (0.837)
Dummy 81–85	− 0.015 (0.001)	− 0.018 (0.001)
Dummy 86–90	− 0.009 (0.001)	− 0.009 (0.001)
Dummy 91–95	− 0.016 (0.001)	− 0.015 (0.001)
Constant	0.131 (0.001)	0.105 (0.001)
Number of observations	475	475
Sargan test[c] (*p*-value)	0.60	0.65
Serial correlation test[d] (*p*-value)	0.38	0.38

Dependent variable: growth rate of real per capita GDP. Numbers in parenthesis are *p*-values.

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

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

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

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

Table 4b
Financial development growth effects with regions: Commercial Central Bank (CCB)

	High Region CCB>0.94 (75th percentile)	High Region CCB>0.95 (80th percentile)	High Region CCB>0.96 (85th percentile)
Low Region CCB < 0.60 (20th percentile)	0.032 (0.009)	0.053 (0.001)	0.050 (0.001)
	0.030 (0.001)	0.046 (0.001)	0.044 (0.001)
	0.024 (0.009)	0.030 (0.001)	0.024 (0.220)
Low Region CCB < 0.65 (25th percentile)	0.024 (0.001)	0.037 (0.001)	0.034 (0.001)
	0.027 (0.001)	0.038 (0.001)	0.035 (0.001)
	0.020 (0.004)	0.023 (0.001)	0.015 (0.057)
Low Region CCB < 0.69 (30th percentile)	0.020 (0.001)	0.027 (0.001)	0.022 (0.008)
	0.025 (0.001)	0.035 (0.001)	0.030 (0.001)
	0.021 (0.001)	0.019 (0.004)	0.010 (0.193)

Estimates are for low, middle, and high regions, respectively. Numbers in parenthesis are *p*-values.

Credit >0.30). The reported coefficients are those for the regions, so we report $\beta_0 + \beta_1$ (low); β_0 (middle); $\beta_0 + \beta_2$ (high), and the *p*-values associated with significance tests for the sum of coefficients when appropriate.[10] In the low region, the estimated coefficient is -0.045 but it is not statistically significant. In the middle region ($0.14 \leq$ Private Credit ≤ 0.30) the coefficient is 0.061, so a 0.10-point increase in Private Credit would lead to a 0.61 percentage points increase in the growth rate. Finally, the coefficient for the high region is 0.041, which is only about two-thirds as large of that in middle region (0.061).[11]

In comparison, without regions we obtain a positive, statistically significant and monotonic relationship. As regression (1) shows, the estimated coefficient for Private Credit is 0.037, i.e., a 0.10-point increase in Private Credit raises growth by 0.37 percentage points regardless of the position of the country.

While the results discussed above use low and high thresholds at 25th and 60th percentiles, varying these to 20th and 30th percentiles for low and 55th and 65th percentiles for high yield very similar results (Table 2b). Once the thresholds are moved much past these values, some of the regions start to merge together and become not statistically significant.

In summarizing these results, perhaps the most striking finding is the zero effect in the low region. It is interesting to see how many countries fall in the low region. As data in Appendix A show, in 1966–1970, 16 countries out of 65 for which we have data were in

[10] For example, as Wooldridge (2002) describes, the null hypothesis of $\beta_0 + \beta_1 = 0$ can be tested with a simple *t*-test where $t = (\hat{\beta}_0 + \hat{\beta}_1)/se(\hat{\beta}_0 + \hat{\beta}_1) \sim t(n-k)$.

[11] Note that Table 2a also presents the estimated coefficients for the control variables. Most of these are statistically significant and of the expected sign, with the exception of openness to trade which was expected to have a positive effect. The Sargan tests are consistent with the instruments being correlated with the residuals. The serial correlation test rejects the null that the errors in the first-difference regression exhibit no serial correlation.

the low region (defined as Private Credit <0.14). By 1991–1995, there were 13 countries out of 73.[12]

4.2. Liquid liabilities

The results using the Liquid Liabilities measure (presented in Tables 3a and 3b) are very similar to those above. Consider, for example, the low threshold placed at the 25th percentile (Liquid Liabilities <0.21) and the high threshold at the 70th percentile (Liquid Liabilities >0.50). The full results of this specification are presented in Table 3a, regression (2). The coefficient in the low region is 0.020, but is not statistically different from zero. Consequently, raising Liquid Liabilities in this low region appears not to help growth. As Appendix A shows, 21 countries out of 65 for which we have data fell in this low region in 1966–1970. In 1991–1995, there were 10 countries out of 72 in this region.

Conversely, the effect in the middle region is significantly positive, 0.050. A 0.10-point increase in Liquid Liabilities would lead to a 0.50 percentage points increase in the growth rate. As before, the coefficient for the high region (0.030) is significant, positive, and smaller than that of the middle region.

4.3. Commercial vs. Central bank

Finally, consider the results using the Commercial vs. Central Bank (CCB) measure presented in Tables 4a and 4b. The striking result is that, in the low region (25th percentile), the effect is statistically significant, positive, and economically large. The estimate is 0.037, which implies that a 0.10 increase in CCB leads to a 0.37 percentage points increase in the growth rate. In 1991–1995, 13 countries out of 74 were in this low region as Appendix A shows. This is very different from the low region results found for the other two measures which yielded not significant coefficients.[13]

Concerning the other two regions, Table 4a shows that CCB has a statistically significant and positive effect. As before, the high region's (80th percentile) coefficient (0.023) is lower than the middle region's (0.038). The effects in the low and middle region are approximately of equal size.

4.4. Discussion of results

We find evidence of differential effects of financial development on growth depending on the position of a country. For every financial development measured used, we find that

[12] Using the 1991–1995 data on Private Credit, the countries that fall in the low region are the Central African Republic, Gambia, Ghana, Guatemala, Haiti, Malawi, Niger, Peru Rwanda, Sierra Leone, Sudan, Syria, and Zaire. The middle region includes Algeria, Argentina, Brazil, Cameroon, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Honduras, India, Iran, Jamaica, Kenya, Lesotho, Pakistan, Papua New Guinea, Paraguay, Philippines, Senegal, Sri Lanka, Togo, Uruguay, Venezuela, and Zimbabwe. The remaining countries were in the high region. Note, however, that this grouping is only illustrative as groups change depending on the sample period.

[13] Note from Table 4b that a positive, significant estimate is found for this low region even when changing the low threshold to the 20th and 30th percentiles, so it is pretty robust.

there is indeed a large positive effect in a middle region. Also, the effect remains positive, but diminishes as countries reach the high region.

The results for the low region, however, are not uniform for the different financial development measures. The effect is zero using Private Credit and Liquid Liabilities, and positive when using Commercial vs. Central Bank. This has important implications for developing countries with still low financial development levels. One explanation may be that these financial sector proxies measures somewhat different things. For instance, Liquid Liabilities and Private are size measures, which may not entirely reflect the effectiveness of the financial sector. In developing countries, sometimes cheap and abundant credit has been issued by government directive or by official banks without many questions about the expected productivity of the project. As many of these projects later fail, the increase in Liquid Liabilities or Private may not lead to higher growth rates.

The Commercial vs. Central Bank (CCB) measure is somewhat of an improvement as it measures the importance of commercial bank assets with respect to central bank assets. A larger share of the country's savings being allocated by commercial banks is presumed to be more efficiently allocated. This argument seems to fit the result that increases in CCB have large positive effects on growth in the low region. Consequently, the growth rate rises in countries where commercial banks are becoming more important (i.e., CCB is increasing) relative to the central bank.

4.5. Stock markets and non-banks

One possible explanation for the declining effect of bank-based financial development on economic growth may be that market-based external financing becomes increasingly important at higher levels of financial development, while bank-based financing dezclines in importance. Several recent papers (e.g., Levine and Zervos, 1998; Demirguc-Kunt and Maksimovic, 2002) have explored the relative importance of bank-based vs. market-based financing using detailed data on the establishment of new firms and the expansion of existing firms. These papers generally find that while the overall effect of financial development (captured by joint significance of bank and stock market measures) on growth is positive, there is no clear evidence that a bank- or a market-based financial system produces stronger effects. In that sense, it is a priori not clear whether or not the diminishing effects of the bank-based measures we use can be attributed to the growing importance of stock markets.

To explore this possibility, we use stock market and non-bank financial institution data from Demirguc-Kunt and Levine (2001). Unfortunately, these data are only available for about 40 countries and start in 1976. This means that our sample would be reduced significantly from 456 observations to 164. More importantly, most countries in our low region and many countries in our middle region would be eliminated from the estimation since data on them are not available. To avoid losing so many observations and still be able to study three regions, we construct dummy variables for the non-bank measures in the following way. For stock market variables, for instance, the dummy variable equals 1 if the country's stock market variable is larger than the observed median value in the data set and 0 otherwise. By doing so, we attempt to pick up countries and time periods where stock markets are an ''important'' part of the financial system. We recognize that this

Table 5
The effect of non-bank measures of financial development and high inflation

	(1)	(2)	(3)	(4)	(5)	(6)
Private Credit, Low Region	− 0.045 (0.940)	− 0.038 (0.460)	− 0.087 (0.950)	− 0.044 (0.360)	− 0.027 (0.600)	− 0.076 (0.140)
Private Credit, Middle Region	0.061 (0.001)	0.065 (0.001)	0.046 (0.008)	0.056 (0.004)	0.077 (0.001)	0.058 (0.004)
Private Credit, High region	0.041 (0.001)	0.044 (0.001)	0.029 (0.006)	0.046 (0.001)	0.036 (0.003)	0.039 (0.001)
Turnover dummy		− 0.005 (0.189)				
Trade Volume Dummy			0.005 (0.081)			
Banklike Assets Dummy				− 0.007 (0.112)		
Banklike Credit Dummy					0.014 (0.041)	
Inflation Dummy × Private Credit						− 0.028 (0.043)
No. of observations	456	456	456	456	456	451
Sargan test (p-value)	0.38	0.40	0.61	0.46	0.30	0.37
Serial correlation test (p-value)	0.75	0.73	0.72	0.81	0.71	0.96

Dependent variable: growth rate of real per capita GDP. Numbers in parenthesis are p-values.

approach has limitations as ideally we would like to use stock market data for all countries and periods in our original sample.[14]

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

Table 5 presents the results of including the dummy variables in our basic regression with the Private Credit measure. The benchmark results from Table 2a are placed in the first column for comparison. We find that the Turnover Ratio dummy enters insignificantly, while the Trade Volume dummy has a significant positive effect albeit only at the 10% level. More importantly, the coefficients from the middle and high regions of Private Credit are still different, while the low region remains not significant as in the benchmark. The middle region's coefficient is still larger than the high region's.

We also use two variables for banklike institutions: Banklike Assets (% of GDP) and Banklike Credit (% of GDP). These include for instance savings banks, cooperative banks, mortgage banks and building societies, and finance companies. These variables are obtained

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

from the Beck et al. (1999) data set. Again due to data limitations, we use the dummy variable approach described above. Results in Table 5 show that the Banklike Assets dummy is not significant, while the Banklike Credit dummy is positive and significant at the 5% level. While the coefficient estimates for the regions vary somewhat, they are still significantly different from one another and the effect in the middle region is the largest.

4.6. The effect of high inflation

A common feature in several of the countries classified in the low region in our data is a relatively high level of inflation. As Boyd et al. (2001) and Rousseau and Wachtel (2002) have shown, high inflation leads to underdeveloped financial systems and, more importantly for our purposes, to a breakdown of the finance–growth nexus. It is possible, then, that the statistically not significant effect of finance on growth in the low region may be attributed to high inflation. While we control for the rate of inflation in all our regressions, it is important to note that it is inflation *beyond* a certain threshold than has been shown to alter the effect of financial development on growth.

To investigate that hypothesis, we construct a dummy variable for ''very high'' inflation rates and interact it with Private Credit. The inflation threshold we use is 25% which is in the range identified empirically by Boyd et al. (2001) and Rousseau and Wachtel (2002). The results, shown in the last column of Table 5, suggest that indeed the effect of Private Credit on growth is lessened in the presence of very high inflation. However, the estimated coefficients for the three regions are still significantly different from one another.

5. Conclusion

This paper finds evidence for a differential effect of finance on growth in three distinct regions, which have been suggested in the theoretical literature, but have not been previously tested systematically. The existence and location of such regions are tested using a large panel data set and state-of-the-art econometric procedures (which control for country-specific effects and endogeneity). Our findings do support economically significant positive effects in the middle and high regions. However, it is not clear what the effect is in countries in the low region. Increasing some measures of financial development in these countries may have negligible effects on economic growth. In this sense, the results suggest caution in forecasting the economic growth effects of financial sector expansion.

While precise measures of these effects are important to the academic literature, they are also essential for the policy arena. Financial market reform is high on many countries' agenda and is frequently addressed in policy prescription packages by the IMF and the World Bank. It is important to know how financial development policies will affect growth. In fact, one of the reasons why financial sector development is interesting as a determinant of growth is that there is much a government can do to foster or restrain it.

There are a number of developing countries in what we identify as the low region where a robust positive effect of finance on growth cannot be established. In light of our results, an important policy question is how a country moves to the middle region where the payoff from financial development appears more certain. The threshold to reach a middle

region seems fairly low (e.g., about 0.14 for Private Credit; 0.21 for Liquid Liabilities) suggesting that the effect of finance on growth does kick in fairly early. Nevertheless, papers that study poverty traps (e.g., Saint-Paul, 1992) show that sustained improvements in financial development can be difficult to engineer especially starting from very low levels.

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Appendix A. Financial development variables, 1966–1970 and 1991–1995, 74 countries

Country	Real per capital GDP growth rate 1966–1995 average	Private sector credit/GDP 1966–1970 average	Private sector credit/GDP 1991–1995 average	Liquid Liabilities/ GDP 1966–1970 average	Liquid Liabilities/ GDP 1991–1995 average	Commercial bank/Central bank loans 1966–1970 average	Commercial bank/Central bank loans 1991–1995 average
Algeria	0.52		0.14		0.46	0.70	0.70
Argentina	0.95	0.15	0.14	0.22	0.14	0.69	0.83
Australia	2.11	0.31	0.79	0.48	0.60	0.91	0.96
Austria	2.84	0.45	0.92	0.52	0.89	0.96	0.99
Belgium	2.70	0.15	0.57	0.45	0.69	0.89	0.99
Bolivia	0.73	0.06	0.36	0.14	0.34	0.25	0.61
Brazil	2.66	0.11	0.26	0.17	0.22	0.59	0.69
Cameroon	0.36	0.14	0.16	0.15	0.19		0.67
Canada	2.31	0.45	0.80	0.48	0.76	0.86	0.94
Central Afr. Rep.	−0.50		0.05		0.18	0.90	0.48
Chile	1.86	0.07	0.54	0.12	0.35	0.46	0.69
Colombia	2.35	0.17	0.30	0.19	0.30	0.70	0.89
Costa Rica	1.70	0.25	0.14	0.19	0.36	0.78	0.67
Cyprus	5.87	0.43	1.00	0.55	1.25	0.99	0.87
Denmark	2.36	0.44	0.39	0.46	0.60	0.86	0.96
Dominican	2.21	0.08	0.21	0.15	0.23	0.60	0.89
Ecuador	2.28	0.17	0.18	0.18	0.22	0.60	0.62
Egypt	2.98	0.17	0.27	0.35	0.82	0.63	0.65
El Salvador	0.21	0.21	0.23	0.21	0.34	0.79	0.70
Finland	2.67	0.38	0.83	0.41	0.60	0.95	0.98
France	2.52	0.59	0.91	0.58	0.61	0.93	0.98
Gambia, The	1.00	0.19	0.11	0.22	0.26	0.94	0.68
Germany	2.36	0.63	0.96	0.53	0.65	0.96	0.99
Ghana	−0.49	0.08	0.04	0.19	0.16	0.46	0.24
Greece	3.43	0.29	0.31	0.39	0.58	0.77	0.65
Guatemala	1.07	0.13	0.13	0.17	0.22	0.78	0.97

Appendix A (*continued*)

Country	Real per capital GDP growth rate 1966–1995 average	Private sector credit/GDP 1966–1970 average	Private sector credit/GDP 1991–1995 average	Liquid Liabilities/ GDP 1966–1970 average	Liquid Liabilities/ GDP 1991–1995 average	Commercial bank/Central bank loans 1966–1970 average	Commercial bank/Central bank loans 1991–1995 average
Haiti	−1.46	0.02	0.11	0.09	0.35	0.14	0.35
Honduras	0.71	0.18	0.24	0.17	0.28	0.83	0.79
India	1.97	0.12	0.24	0.23	0.44	0.57	0.73
Indonesia	4.38		0.46	0.07	0.41		0.96
Iran	−1.96	0.22	0.26	0.26	0.42	0.62	0.48
Ireland	3.64	0.30	0.70	0.59	0.50	0.94	0.97
Israel	3.07	0.24	0.57	0.43	0.65	0.76	0.94
Italy	3.01	0.67	0.54	0.84	0.66	0.95	0.87
Jamaica	0.89	0.20	0.26	0.28	0.42	0.97	0.84
Japan	4.57	0.73	2.05	0.72	1.91	0.96	0.96
Kenya	1.44	0.12	0.30	0.24	0.46	0.95	0.69
Korea, South	6.77		1.06		0.62	0.82	0.98
Lesotho	3.68		0.19		0.38		0.70
Malawi	1.04		0.13		0.20	0.89	0.56
Malaysia	4.23	0.16	0.99	0.32	0.96	0.95	0.98
Mauritius	5.05	0.19	0.38	0.36	0.68	0.89	0.94
Mexico	1.73	0.28	0.33	0.28	0.27	0.75	0.97
Netherlands	2.29	0.57	1.40	0.58	0.83	0.95	0.99
New Zealand	1.26	0.27	0.82	0.55	0.74	0.75	0.96
Nicaragua	−1.31					0.88	0.22
Niger	−2.62	0.10	0.09	0.08	0.17	0.70	0.66
Norway	3.13	0.70	0.92	0.54	0.57	0.84	0.97
Pakistan	2.69	0.21	0.22	0.38	0.40	0.67	0.72
Panama	2.39	0.20	0.54	0.21	0.53	0.71	0.75
Papua New G.	1.73		0.25		0.32		0.78
Paraguay	1.98	0.14	0.20	0.15	0.25	0.49	0.71
Peru	0.60	0.16	0.08	0.20	0.13	0.78	0.97
Philippine	1.17	0.24	0.28	0.24	0.42	0.82	0.77
Portugal	3.77	0.56	0.49	0.80	0.74	0.97	0.97
Rwanda	−1.29	0.01	0.08	0.06	0.16	0.36	0.43
Senegal	−0.48	0.15	0.22	0.14	0.22	0.99	0.68
Sierra Leo	−0.86	0.05	0.02	0.13	0.11	0.81	0.22
South Africa	0.51	0.66	1.16	0.58	0.45	0.94	0.95
Spain	3.34	0.56	0.74	0.64	0.77	0.92	0.96
Sri Lanka	2.79	0.10	0.27	0.24	0.36	0.47	0.76
Sudan	0.06	0.11	0.06	0.18	0.27	0.93	0.25
Sweden	1.99	0.77	1.35	0.57	0.46	0.89	0.88
Switzerland	1.47	1.16	2.04	1.06	1.42	0.98	0.99
Syria	2.47	0.12	0.09	0.30	0.56	0.43	0.52
Thailand	5.18	0.15	1.01	0.28	0.76	0.82	0.98
Togo	0.53		0.23		0.32	0.99	0.71
Trinidad and T.	1.30	0.14	0.46	0.24	0.51	0.91	0.81
United Kingdom	1.94	0.19	1.11	0.34	0.93	0.60	0.97

Appendix A (*continued*)

Country	Real per capital GDP growth rate 1966–1995 average	Private sector credit/GDP 1966–1970 average	Private sector credit/GDP 1991–1995 average	Liquid Liabilities/ GDP 1966–1970 average	Liquid Liabilities/ GDP 1991–1995 average	Commercial bank/Central bank loans 1966–1970 average	Commercial bank/Central bank loans 1991–1995 average
United States	1.84	0.98	1.48	0.61	0.60	0.91	0.93
Uruguay	1.24	0.07	0.22	0.18	0.36	0.41	0.66
Venezuela	−0.63	0.24	0.18	0.24	0.31	0.93	0.71
Zaire	−2.25	0.03	0.01	0.21	0.04	0.27	0.21
Zimbabwe	0.61		0.27		0.43		0.70

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