Finance and Economic Growth: The Empirical Relationship Revisited

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Abstract

This paper reexamines the empirical relationship between financial development and growth for a large cross-section sample of some 100 countries from 1970 to 2002. Results from cross-sectional analysis demonstrate that the effect of financial development on growth is significantly positive as well as the initial level of financial development helps determine future economic growth since it has significantly positive connection to growth in the long run. However no significant finance-growth relation is found in dynamic panel analysis. The results are consistent with several current studies on the finance-growth nexus.

Keywords : financial development, economic growth, empirical relationship, world

Ⅰ. Introduction

The relationship between finance and growth has been an important research topic to be studied extensively for long by economists. It seems almost natural that we see higher development of the financial sector in more developed countries and vice versa. Many have argued that financial development encourages economic growth since the developed the financial sector increases investment and its efficiency altogether (Levine, 1997). Recently, empirical studies have examined this argument and most findings lend a general support to them. Many empirical researches have introduced cross-country regressions and report that financial development measured by monetary indicators and credit plays a significant role in economic growth (King and Levine, 1993; La porta et al., 1998; Levine et al., 2000; Rioja and Valev, 2004). These findings led economists to emphasize the need of the development of the financial sector, for example by way of financial liberalization, for countries to grow faster.

However, although there is a strong relationship between finance and growth in theory and empirics, it is not so easy to take the argument that finance spurs growth. Some point to possibilities that the direction runs the opposite way, that is, financial development follows

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economic growth. Several studies question the growth effect of financial development using time-series analasyses (Arestis and Demetriades, 1996; Shan et al., 2001; Graff, 2003). More recent studies, using the panel approach, have indicated that the relationship between finance and growth may be weaker than currently argued (Khan and Senhadji, 2000; Trabelsi, 2002; Favara, 2003) Thus, the debate appears not to be completely over, which calls on further efforts for empirical investigation.

Given the circumstances, we attempt to contribute to the current debate by examining the finance-growth relationship empirically, using various methods. First, we examine whether financial development spurs economic growth using standard cross-country regressions. Our study uses many indexes and covers more countries and periods than current studies to our knowledge, and also examines possible preconditions and channels. Second, we introduce recent panel methods to test the relationship between financial development and economic growth.

We do find that financial development plays an important role in economic growth in cross-country regressions and the finance-growth relationship is non linear. However, although channels such as investment and productivity are clearly promoted by financial development there is hardly evidence that commonly mentioned preconditions help finance to spur growth further. In panel regressions, we do not find evidence that financial development spurs economic growth at least in the short run.

The paper consists of 5 parts. Section II discusses current empirical studies on financial development and economic growth. We point out that most studies verify that finance leads economic growth however recent studies report mixed results. Section III presents data and specifications for our empirical research. Section IV reports results of cross-country and panel regressions following current studies. Possible precondition in which finance spurs economic growth are tested. Section V concludes.

Ⅱ. Current Empirical Studies

There have been many empirical studies to examine the relationship between finance and growth, mostly about the effect of financial development on economic growth. The most popular ones are standard cross-country growth regressions that use financial development variables as an independent variable after controlling other variables. King and Levine (1993) (henceforth KL) study growth over a 30-year horizon (1960-1989) for 77 countries and find long run significant positive relation between finance and growth. In order to address possible endogeneity problem in cross-sectional analysis, KL examine initial financial development indicators obtain highly significant results after controlling for initial conditions and several combinations of institutional indexes as well as regional dummy variables for Sub-Saharan African and Latin American countries.

In order to avoid simultaneity bias in the finance-growth relationship, recent researchers have conducted studies using instrumental variables to extract the exogenous component of

financial development. Levine (1998, 1999) and Levine, Loayza, and Beck (2000) (henceforth LLB) use the La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) (henceforth LLSV) measures of legal origin as instrumental variables and indicate the positive relationship between the exogenous component of financial development and economic growth.

In light of the problems associated with purely cross-country growth regressions, LLB use a GMM (General Method of Moment) estimator developed for panel data (Arellano and Bond, 1991, Blundell and Bond, 1998). LLB construct a panel that consists of data for 71 countries over the period 1960-95 and find a positive relationship between the financial development and economic growth, productivity growth, and capital accumulation. They find that regressions pass the standard specification tests and the estimates of coefficients of the panel regressions are very similar to those obtained using cross-country studies.

Khan and Senhadji (2000) employ both cross-section and panel regression for different samples and demonstrate strong positive impact of financial development on growth in cross-sectional analysis. The size of the effect varies with different indicators, estimation method, and functional form of the relationship, and some indicators are insignificant in panel regressions. Favara (2003) also uses both cross-section and panel analysis over 83 countries from 1960-1998 and find mixed results, though using similar variables used in KL. Although the relation between finance and growth is positive in cross-section but when financial indicators are instrumentalized by legal origin the result is opposite to LLB with the finance variable loosing its significance. Using the GMM panel, he also finds weak results in general.

Rioja and Valev (2004) examine 74 countries from 1966-95 and find financial development has greater positive impact on growth in countries with middle region, lower positive impact on high region and uncertain impact on low region of financial development, using cross-country and panel regressions. Demetriades and Law (2004) apply cross-section and panel analysis over 72 countries from 1978-2000 and find financial development has larger effects on growth within sound institutional framework.

Thus, the empirical literature to date using standard growth regressions provides a general support on the growth effect of financial development. However, some studies, in particular ones using panel regressions, find conflicting findings. Time-series empirical studies indeed point to the limit of the strong argument to support financial development presenting suspicion about the causal relationship (Young, 1996; Arestis and Demetriades,1997; Ram, 1999; Shan et al., 2000; Graff, 2003; Arestis et al., 2004). There are strengths and weaknesses associated with each methodology used to examine the relationship between finance and growth. Our study reexamines the empirical relationship a broad number of countries using cross-country and panel regressions, considering channels and conditions.

Ⅲ. Empirical Strategy and Data

3.1. Data for regressions

In this study, we take the approach of standard growth regressions including the cross-

country regressions and panel regressions. We use the dataset that is larger than that of other current studies to our knowledge and that covers longer time periods. Our data include 100 countries and the period from 1970 to 2002 from the World Development Indicators 2004 from World Bank except institutional variables.

As an index of financial development, we use commonly used three alternative financial development indicators, such as, Private Credit/GDP (=PC/GDP), Broad Money/GDP (=M2/GDP), and Liquid Liabilities/GDP (=M3/GDP). Though we try to incorporate maximum number of countries (100 countries) in our study, due to availability of M2 and M3 data for some countries included in our sample we have used 86 observations for them. Though not reported, all these variables have high correlation with the growth rate in a simple correlation matrix. We report the regression results using the index of private credit for 100 countries in our texts, while the results with other indexes are reported in the appendix.

Regarding control variables in cross-country regressions, we use the initial level of GDP, initial attainment of education, government consumption, inflation and trade openness. Besides we add GADP as the institutional variable, and regional dummies DS, DL and DE for Sub-Saharan African, Latin American and East Asian countries respectively. According to the procedure prescribed by Knack and Keefer (1995), the composite GADP (Government Anti-Diversion Policy) index is used, constructed from several different institutional by Political Risk services (PRS) group.[1)]

We are interested in not only the growth effect as such of financial development, but also in preconditions that it may work. One may argue that finance would promote growth under more developed countries and a certain level of financial development. We test this argument by using interaction terms in growth regressions. In addition, we examine which channels are relevant for financial development to exert a beneficial effect on growth.

3.2. Cross-Country Model

In a pure cross-sectional analysis we use data averaged for 100 countries over 1970-2002, such that there is one observation per country. The basic regression takes the following form :

$$G_i=\beta_0+\beta_1 FD_i+\beta_2 X_i+u_i \cdots\cdots (1)$$

Where, G is the average growth rate of per capita real GDP for the period from 1970 to 2002.[2)]; Financial Development Indicators (FD) use M2=Broad Money/GDP or, M3=Liquid Liability /GDP or, PC=Private Credit/GDP for robustness check; Control Variable(X) include IG=Log of Initial (1970) Real GDP Per Capita; ISEC=Log of Initial (1970) Secondary School Enrollment Ratio; GV=Final Government Consumption Expenditure/GDP; INF = Inflation Rate; OP=Trade Openness=(Export+Import)/GDP; GADP =Composite GADP Index; DS=Dummy for Sub-Saharan African Countries; DL=Dummy for Latin American Countries and DE=Dummy for East Asian Countries. The white noise error term is indicated by "*u*". The subscript "*i*" (with different variables) denotes a particular country.

3.3. Dynamic Panel Model

In case of panel data analysis, we use 5-year averaged unbalanced panel data consisting of 100 countries' observation over the period from 1970 to 1999. The data are averaged over non-overlapping 5-year periods, so that there could be 6 observations per country (1970-74; 1975-79; etc.). The panel regression model is as followings.

$$y_{i,t}-y_{i,t-1}=(\alpha-1)y_{i,t-1}+\beta X_{i,t}+\eta_i+\varepsilon_{i,t} \cdots\cdots (2.1)$$

Where, $y_{i,t}$ is the logarithm of real per capita GDP; $y_{i,t}-y_{i,t-1}$ is the growth rate of real per capita GDP; $X_{i,t}$ is a set of explanatory variables (other than lagged per capita real GDP) including measures of financial development, η_i captures the unobserved country-specific effects, and $\varepsilon_{i,t}$ is the error term. The subscripts (with variables) "i" and "t" represent country and time period, respectively. Also, it includes time dummies in order to account for time-specific effects which are not reported in the regression results. Now we can rewrite the above equation (2.1) as

$$y_{it}=\alpha y_{i,t-1}+\beta x_{it}+\varepsilon_{it} \cdots\cdots (2.2)$$

The standard Generalized Method of Moments (GMM) approach due to Arellano and Bond (1991) starts with first differencing equation (2.2) in order to eliminate the country-specific fixed effects. The transformed model takes the following form:

$$\Delta y_{it}=\alpha\Delta y_{i,t-1}+\beta\Delta x_{it}+\Delta\varepsilon_{it} \cdots\cdots (2.3)$$

Where, Δ is the first difference operator. Since the new error term $\Delta\varepsilon_{it}$ is by definition correlated with the lagged dependent variable, $\Delta y_{i,t-1}$, one should use instrumental variables. The GMM approach uses all available lags of the dependent and the exogenous variables to form an optimal instrumental variable matrix.

Thus dynamic panel GMM technique could address potential endogeneity in the data. Since persistent in the explanatory variables may adversely affect the small sample and asymptotic properties of the difference estimator (Blundell and Bond, 1988; Bond et al., 2001), the difference estimator is further combined with an estimator in levels to produce a system GMM estimator. For GMM estimation of both 2-Step 1st difference and system, DPD (package version 1.21) for Ox (version 3.40) is used.

Ⅳ. Cross-Country and Panel Results

4.1. Cross-country regression: growth effects of financial development, where and how?

Table 1 demonstrates the basic result of cross-country regressions using several financial development indexes. We test both average values of financial development indicators and initial values, considering that the regression using average value would be faced with more serious endogeneity problems (Arestis and Demetriades, 1996; Arestis et al., 2004). When we use

Table 1. Financial Development and Growth

Dependent Variable : G=Average Real Per Capita GDP Growth Rate (1970-2002)

Independent Variables	Financial Development Indicator : PC=Private Credit/GDP			
	Equation(1)	Equation(2)	Equation(3)	Equation(4)
IG	−0.695*** (−4.406)	−0.887*** (−5.402)	−1.194*** (−7.516)	−1.23*** (−7.99)
ISEC	0.570** (2.40)	0.981*** (3.937)	0.862*** (3.856)	0.353 (1.521)
GV		0.864 (0.610)	−1.376 (−1.027)	−0.203 (−0.161)
INF		−0.239*** (−3.606)	−0.169*** (−2.778)	−0.158*** (−2.863)
OP		0.0098 (0.051)	0.136 (0.790)	0.160 (1.036)
GADP			0.118*** (4.961)	0.139*** (6.151)
DS				−0.663*** (−3.564)
DL				0.112 (0.738)
DE				0.434* (1.806)
PC	1.49*** (5.66)	1.198*** (4.797)	0.743*** (3.091)	0.516** (2.098)
C	1.34*** (3.64)	1.446*** (4.193)	1.472*** (4.791)	2.027*** (5.032)
R^2	0.36	0.478	0.590	0.679
DW	2.07	1.813	1.759	1.819
Obs.	100	98	98	98
Tech.	OLS	OLS	OLS	OLS

Figures in parentheses ( ) are t-values significant at 1% Level (***) or, 5% Level (**) or, 10% Level (*)
IG=Log of Initial Real GDP Per Capita, ISEC=Log of initial Secondary School Enrollment Ratio, GV=Government Final Consumption/GDP, INF=Inflation, OP=Openness, GADP=Composite GADP, DS, DL and DE are the Dummy for Sub-Saharan African, Latin American and East Asian Countries respectively and PC=Private Credit/GDP[8].

average values all of our alternative financial development indicators are significant in almost all growth regressions as Table 1 shows.[3]

This result is robust even when we use initial values of all independent variables as KL report, as illustrated in Table 2. The contribution of financial development to economic growth is robust to inclusion of more control variables such as regional dummies. In general, our study demonstrates that initial financial development, causes long-run economic growth even after taking account of other factors important to growth and addressing possible endogeneity problems.

In order to address simultaneity bias in finance-growth regression, some recent researchers such as LLB use LLSV measure of legal origin as instrumental variable for financial develop-

Table 2. Initial (1970) Financial Development and Growth

Dependent Variable: G=Average Real Per Capita GDP Growth Rate (1970-2002)

Independent Variables	Financial Development Indicator: IPC=Initial (1970) Private Credit/GDP			
	Equation(1)	Equation(2)	Equation(3)	Equation(4)
IG	−0.520*** (−3.037)	−0.536*** (−3.023)	−0.818*** (−4.082)	−0.851*** (−4.391)
ISEC	0.859*** (3.302)	0.861*** (3.254)	0.774*** (3.003)	0.294 (1.145)
IGV		0.577 (0.385)	−0.220 (−0.148)	0.002 (0.001)
IINF		0.192 (0.393)	0.168 (0.356)	0.376 (0.898)
IOP		0.034 (0.153)	0.319 (1.330)	0.387* (1.813)
IGADP			0.043*** (2.716)	0.035*** (2.398)
DS				−0.969*** (−4.148)
DL				−0.417** (−2.167)
DE				0.517* (1.749)
IPC	1.15*** (2.682)	1.113** (2.566)	1.151*** (2.744)	1.104*** (2.842)
C	0.776** (1.999)	0.705* (1.666)	1.221*** (2.706)	2.308*** (4.068)
R^2	0.219	0.219	0.279	0.462
DW	2.20	2.047	2.095	2.116
Obs.	98	97	97	97
Tech.	OLS	OLS	OLS	OLS

Figures in parentheses ( ) are t-values significant at 1% Level (***) or, 5% Level (**) or, 10% Level (*)

ment. However, when we include this instrumental variable in our cross-country regression using 2SLS (Two Stage Least Square), financial variables become insignificant in Table 3. This result opposes the finding of LLB while it supports Favara's (2003) result.[4)]

Next, we test whether there is a non-linear effect of financial development on economic growth. Some may think that financial development becomes more helpful as countries develop from very poor state due to the development of institutions however the benefit grows less in highly developed countries due to a decrease of marginal benefit. Then, there might be the inverted "U" relationship between financial development and growth. Our result in Table 4 finds this relationship where we use the quadratic term of private credit as a financial development index. This result is robust to the inclusion of other control variables. When we divide samples into 3 groups according to the level of financial development based on private credit/GDP we also find that the benefit of financial development is clearer in countries with

Table 3. Financial Development and Growth (Taking Legal Origin as Instrument)

Dependent Variable : G=Average Real Per Capita GDP Growth Rate (1970-2002)

Independent Variables	Financial Development Indicator : PC=Private Credit/GDP			
	Equation(1)	Equation(2)	Equation(3)	Equation(4)
IG	−0.621** (−2.466)	−0.672** (−2.537)	−1.193*** (−5.473)	−1.318*** (−5.279)
ISEC	0.939*** (2.926)	0.909*** (2.823)	0.770*** (2.775)	0.261 (0.933)
GV		0.550 (0.352)	−1.532 (−1.021)	−0.046 (−0.031)
INF		−0.066 (−0.419)	0.076 (0.559)	0.017 (0.137)
OP		0.209 (0.922)	0.266 (1.299)	0.245 (1.262)
GADP			0.114*** (3.733)	0.133*** (4.642)
DS				−0.730*** (−3.569)
DL				0.113 (0.559)
DE				0.275 (0.814)
PC	0.818 (1.256)	0.853 (1.280)	0.954 (1.644)	0.916 (1.312)
C	0.927 (1.480)	0.899 (1.399)	1.445*** (2.798)	2.249*** (3.457)
R^2	0.321	0.335	0.480	0.589
DW	2.629	2.214	2.121	2.169
Obs.	87	86	86	86
Tech.	2SLS	2SLS	2SLS	2SLS

Figures in parentheses ( ) are t-values significant at 1% Level (***) or, 5% Level (**) or, 10% Level (*)

the middle development of finance, which is similar to the finding of Rioja and Valev (2004) using the panel method.5 Since we do not find a similar result using other indexes M2/GDP and M3/GDP there seems to be the inverted U relationship in the case of private credit only.

One may argue that the finance-growth nexus as such varies across contexts. For instance, financial development can spur economic growth more in countries where other markets are more developed or institutional quality is higher with better financial regulation. In addition, macroeconomic stability such as lower inflation and government consumption could be important conditions for financial development to stimulate growth more. We add interaction terms of the financial development index and other condition variables including the institutional variable, the level of GDP, and also inflation and government consumption so as to test this hypothesis.

The following Table 5 demonstrates results using the average value of private credit and

Table 4. Non-Linear Effect of Financial Development on Growth

Dependent Variable: G=Average Real Per Capita GDP Growth Rate (1970-2002)

Independent Variables	Financial Development Indicator: PC=Private Credit/GDP			
	Equation(1)	Equation(2)	Equation(3)	Equation(4)
IG	−0.759*** (−4.995)	−0.873*** (−5.463)	−1.175*** (−7.615)	−1.204*** (−7.798)
ISEC	0.368 (1.569)	0.758*** (2.926)	0.657*** (2.844)	0.303 (1.296)
GV		−0.0578 (−0.040)	−2.186 (−1.632)	−0.691 (−0.529)
INF		−0.222*** (−3.428)	−0.155** (−2.613)	−0.152*** (−2.750)
OP		−0.037 (−0.201)	0.089 (0.533)	0.133 (0.854)
GADP			0.116*** (5.004)	0.136*** (5.981)
DS				−0.585*** (−3.015)
DL				0.099 (0.656)
DE				0.448* (1.872)
PC	3.623*** (5.094)	2.881*** (3.962)	2.312*** (3.525)	1.331** (2.058)
PC^2	−1.433*** (−3.203)	−1.099** (−2.456)	−1.018** (−2.559)	−0.533 (−1.361)
C	1.330*** (3.780)	1.475*** (4.393)	1.499*** (5.024)	1.938*** (4.770)
R^2	0.426	0.511	0.618	0.686
DW	2.183	1.903	1.799	1.848
Obs.	100	98	98	98
Tech.	OLS	OLS	OLS	OLS

Figures in parentheses ( ) are t-values significant at 1% Level (***) or, 5% Level (**) or, 10% Level (*)

various condition variables respectively. The result appears to be opposite to conventional arguments.[6] The coefficients of interaction terms are significantly negative when the initial level of growth and educational attainment, and institutional variables are used as condition variables. This suggests that the contribution of financial development to economic growth becomes lesser in countries where institutions are more developed and education is better and the GDP is higher. It may be understandable if the growth impact of finance is larger in developing countries and lesser in already developed countries. This must be associated with our finding that the investment channel is much more significant rather than the productivity channel and investment is crucial for growth in developing countries. When we divide countries into 3 subgroups according to the income level, again we find that the benefit of finan-

Table 5. Conditionality in Financial Development and Growth

Dependent Variable : G=Average Real Per Capita GDP Growth Rate (1970-2002)

Condition variable	Financial Development Indicator : PC=Private Credit/GDP					
	Equation(1)	Equation(2)	Equation(3)	Equation(4)	Equation(5)	Equation(6)
IG	−0.721*** (−3.415)	−1.111*** (−7.047)	−1.134*** (−7.158)	−1.182*** (−7.468)	−1.203*** (−7.594)	−1.098*** (−7.189)
ISEC	0.587** (2.560)	1.090*** (4.642)	0.905*** (4.109)	0.836*** (3.745)	0.911*** (4.034)	0.585** (2.587)
GV	−1.626 (−1.271)	−1.290 (−0.991)	2.423 (1.080)	−1.729 (−1.272)	−0.777 (0.549)	−2.436* (−1.867)
INF	−0.162*** (−2.806)	−0.166*** (−2.813)	−0.162*** (−2.710)	−0.239*** (−3.012)	−0.180*** (−2.950)	−0.127** (−2.150)
OP	0.078 (0.472)	0.060 (0.356)	0.073 (0.426)	0.168 (0.971)	−0.283 (0.770)	0.090 (0.554)
GADP	0.126*** (5.526)	0.123*** (5.315)	0.115*** (4.915)	0.119*** (5.005)	0.114*** (4.777)	0.198*** (6.115)
PC	3.639*** (3.907)	3.265*** (3.203)	1.991*** (3.104)	0.731*** (3.052)	0.374 (1.001)	3.058*** (4.287)
PC*IG	−0.800*** (−3.207)					
PC*ISEC		−1.473** (−2.541)				
PC*GV			−8.322** (−2.091)			
PC*INF				0.465 (1.369)		
PC*OP					0.579 (1.288)	
PC*GADP						−0.142*** (−3.423)
C	0.281 (0.595)	0.789* (1.964)	0.791* (1.782)	1.488*** (4.864)	1.648*** (4.916)	0.632* (1.663)
R^2	0.633	0.618	0.610	0.599	0.598	0.638
DW	1.900	1.894	1.809	1.816	1.735	1.895
Obs.	98	98	98	98	98	98
Tech.	OLS	OLS	OLS	OLS	OLS	OLS

Figures in parentheses ( ) are t-values significant at 1% Level (***) or, 5% Level (**) or, 10% Level (*)

cial development is larger in less developed countries. Inflation and openness are not relevant as conditions, while more government spending seems to be bad to the growth effect of financial development.

We have also examined if the benefit financial development conditional on precondition variables shows a non-linear relationship with conditions, as Klein argues in the case of financial opening (Klein, 2003). The interaction variable of financial development and quadratic

Table 6. Financial Development and Investment

Dependent Variable : I=Investment/GDP (1970-2002)

Independent Variables	Financial Development Indicator : PC=Private Credit/GDP			
	Equation(1)	Equation(2)	Equation(3)	Equation(4)
IG	−0.017 (−1.582)	−0.029** (−2.624)	−0.033*** (2.707)	−0.027** (−2.309)
ISEC	0.033** (2.070)	0.050*** (2.956)	0.049*** (2.849)	0.015 (0.865)
GV		0.117 (1.205)	0.091 (0.876)	0.184* (1.920)
INF		−0.005 (−1.207)	−0.004 (−0.993)	−0.0031 (−0.751)
OP		0.026** (2.027)	0.028** (2.113)	0.0298** (2.526)
GADP			0.001 (0.760)	0.0022 (1.319)
DS				−0.047*** (−3.381)
DL				−0.005 (−0.510)
DE				0.059*** (3.225)
PC	0.060*** (3.347)	0.041** (2.434)	0.0365* (1.957)	0.0031 (0.1674)
C	0.202*** (8.032)	0.192*** (8.071)	0.192*** (8.064)	0.216*** (7.068)
R^2	0.256	0.340	0.344	0.507
DW	2.190	1.699	1.701	1.879
Obs.	100	98	98	98
Tech.	OLS	OLS	OLS	OLS

Figures in parentheses ( ) are t-values significant at 1% Level (***) or, 5% Level (**) or, 10% Level (*)

terms of initial GDP and institutional index is used to test this, however there is no evidence to support this, though not reported.

As to channels from financial development to economic growth, many emphasize investment and investment efficiency altogether. Financially developed countries must have higher investment since those economies can utilize more financial sources, and productivity should be higher in more financially developed countries since the capital allocation should be more efficient. We investigate this using the investment rate and productivity regressions.

First, the following Table 6 reports that financial development indicators including all 3 measures have a positive impact on the ratio of investment to GDP though we report the result using private credit only. The result is robust to inclusion of other control variables before we take account of regional differences. When we use the growth rate of capital stock

per capita from King and Levine (1993) financial indicators are still significant, which is almost similar to their result However, we do not find the non-linear relationship between financial development and the investment ratio.

In addition to the investment ratio, some may well expect that financial development promote the productivity of the whole economy. In order to test this, we use several proxies for productivity including one used by Hall and Jones (1999) though it is a level variable for one year, and the average of output-capital ratio, though this depends on data availability from Penn World table. We also test 2 alternative measures of productivity, the ratio of the change of real per capita GDP to investment and that to the change of investment, all used by King and Levine (1993)[7]. Different from the case of investment, there is no evidence that financial development promotes productivity in any case. Therefore we may conclude that the growth effect of financial development is mainly through the investment channel, and this would be one reason why the benefit of financial development is larger in developing countries that crucially need more investment for growth.

4.2. Panel regressions : ambiguous short-run effects

In this section, we establish a panel regression model using 5-year average values for each country. We use the average value of financial development for each 5-year periods and test similar specification used in the former section. Concerning the empirical method, we use both fixed effects model and General Method of Moment (GMM).

First, Table 8 reports the basic specification for economic growth using 5-year average values, using private credit. The coefficients of control variables including initial GDP, educational attainment and institutions are with correct signs and high significance. We find that the benefit of financial development is not important in general. In almost all cases, the coefficient is not significant. Only when we use the simple LSDV (least square dummy variable) method assuming fixed effects in the simplest equation the coefficient of financial development is statistically significant.. This result is same in regressions using other indexes.

Our result suggests that financial development does not have short-term benefits to economic growth, though in the long-run it may promote growth as we present in the former section. Favara (2003) reports the similar result that the panel regression does not support the hypothesis that financial development spurs economic growth. While some studies including Beck, Levine and Loayza (2004) argue that the growth effect of financial development is clear in panel estimations, other studies such as Khan and Senhadji (2000), Trabelsi (2002), demonstrate the coefficient of financial indicators in panel estimations are not statistically significant.

The commonly used 5-year average may capture the short-run relationship only, sometimes affected by economic cycles. It may take a long time for finance to exert a beneficial effect on economic growth though it is not important in long run. It is indeed interesting that we find that the coefficient of financial development changes statistically significant when we use 10-year averages. Not only using the regression using the private credit variable, but also that using M2 and M3 measure for financial development demonstrates the same result. This and the result of cross-country regression assert that there is rather a long run relationship be-

Table 7. Financial Development and Growth (5-Year Averaged Dynamic Panel Analysis : 1970-1999)

Dependent Variable : Average Real Per Capita GDP Growth Rate

Independent Variables	Baseline[9]			Extended[10]			Extended+Institutional Variable[11]		
	LSDV	1st Diff. GMM(2)	System GMM(2)	LSDV	1st Diff. GMM(2)	System GMM(2)	LSDV	1st Diff. GMM(2)	System GMM(2)
G(−1)	−0.050*** (−6.852)	−0.061*** (−4.17)	−0.003*** (−13.5)	−0.051*** (−7.256)	−0.092*** (−2.99)	−0.002*** (−25.4)	−0.069*** (−5.472)	−0.0087*** (−3.78)	−0.010*** (−29.7)
SEC	−0.006 (−1.201)	−0.057** (−2.00)	0.058* (1.75)	−0.009 (−1.514)	−0.084* (−1.87)	0.059** (2.20)	0.005 (0.552)	−0.034 (−0.788)	0.042** (2.54)
GV				0.019 (1.063)	0.005 (0.099)	−0.009* (−1.81)	0.025 (0.974)	−0.0075 (−0.126)	−0.097* (−1.91)
INF				−0.0005*** (−3.489)	−0.0009* (−1.81)	−0.0009* (−1.93)	−0.0002** (−2.003)	−0.0014** (−2.44)	−0.00067** (−2.14)
OP				0.024*** (4.979)	−0.006 (−0.156)	0.065** (1.98)	0.021*** (3.390)	−0.017 (−0.686)	0.0098 (1.32)
GADP							0.001*** (3.821)	0.0025* (1.95)	0.0022*** (2.74)
PC	0.009** (2.325)	−0.013 (−0.832)	−0.006 (−0.623)	0.004 (1.034)	−0.013 (−0.626)	−0.045 (−1.14)	−0.003 (−0.652)	−0.058** (−2.03)	−0.0078 (−0.949)
C	0.182*** (7.387)	0.0004 (0.174)	−0.059** (−2.14)		0.0022 (0.410)	−0.061*** (−2.95)	0.194*** (4.440)	0.0067 (1.45)	−0.048** (−2.55)
R^2	0.614			0.683			0.804		
Wald Test (Joint)[12]		58.97*** [0.000]	1909*** [0.000]		48.16*** [0.000]	6877*** [0.000]		62.49*** [0.000]	1.078e+004*** [0.000]
Wald Test (Dummy)[13]		24.43*** [0.000]	44.43*** [0.000]		15.33*** [0.004]	35.01*** [0.000]		4.228 [0.121]	7.957** [0.047]
Wald Test (Time)[14]		24.43*** [0.000]	34.05*** [0.000]		15.33*** [0.004]	30.79*** [0.000]		4.228 [0.121]	4.600* [0.100]
Sargan[15] Test		14.05 [0.521]	40.45** [0.046]		32.93 [0.326]	60.03 [0.266]		15.43 [0.974]	55.47 [0.382]
m1[16] Test		−0.2099 [0.834]	−2.593*** [0.010]		−0.1669 [0.867]	−2.694*** [0.007]		−1.451 [0.147]	−1.708* [0.088]
m2[17] Test		−1.926* [0.054]	−1.481 [0.139]		−1.148 [0.251]	−2.066** [0.039]		N. A[18]	N. A.
Obs.	473	374	473	440	342	439	283	185	281

Figures in parentheses ( ) & [ ]are t-values and p-values respectively, significant at 1% Level (***) or, 5% Level (**) or, 10% Level (*)
G(−1)=Log of Initial Real Per Capita GDP, SEC=Log of Secondary School Enrollment Ratio, GV=Government Final Consumption /GDP, INF=Inflation Rate, Op=Openness, GADP=Composite GADP, PC=Private Credit/GDP
"Ox version 3.40 (Windows) (C) J. A. Doornik, 1994-2004
This version may be used for academic research and teaching only"[19]

tween financial development and economic growth.

We also test whether there is an inverted-U relationship with financial development and growth in panel regressions, however we do not find it. Rioja and Valev (2004) reports that when they divide countries into 3 categories by the level of financial development they find

Table 8. Financial Development and Growth (10-Year Averaged Dynamic Panel Analysis) (1970-1999)

Dependent Variable : Average Real Per Capita GDP Growth Rate

Independent Variables	Baseline			Extended			Extended+Institutional Variable		
	OLS	LSDV	1st Diff. GMM(2)	OLS	LSDV	1st Diff. GMM(2)	OLS	LSDV	1st Diff. GMM(2)
G(−1)	−0.007*** (−3.69)	−0.06*** (−6.17)	−0.06*** (−3.43)	−0.008*** (−4.28)	−0.05*** (−6.00)	−0.05*** (−3.88)	−0.01*** (−5.84)	−0.06*** (−6.22)	−0.06*** (−3.88)
SEC	0.014*** (3.68)	0.001 (0.134)	0.001 (0.133)	0.017*** (4.74)	0.005 (0.549)	0.005 (0.602)	0.017*** (4.97)	0.006 (0.686)	0.006 (0.779)
GV				−0.005 (−0.40)	0.061** (2.435)	0.061* (1.83)	−0.018 (−1.304)	0.07*** (2.77)	0.07** (2.12)
INF				−0.001*** (−4.82)	−0.0006** (−2.57)	−0.0005*** (−3.28)	−0.0009*** (−4.12)	−0.0005** (−2.28)	−0.0004** (−2.46)
OP				0.001 (0.754)	0.011 (1.60)	0.011** (2.07)	0.001 (0.860)	0.006 (0.931)	0.006 (1.11)
GADP							0.001*** (4.23)	0.0007* (1.79)	0.0006* (1.76)
PC	0.01*** (4.52)	0.013** (2.38)	0.013** (2.52)	0.01*** (4.03)	0.010* (1.90)	0.010** (2.13)	0.007*** (2.70)	0.011** (2.073)	0.011** (2.27)
C	−0.0001 (−0.02)	0.20*** (6.03)	0.001 (0.811)	0.0001 (0.037)	0.17*** (4.80)	0.001 (0.507)	0.002 (0.534)	0.16*** (4.670)	0.0003 (0.188)
R^2	0.196	0.85		0.313	0.87		0.378	0.883	
Wald Test (Joint)			26.01*** [0.00]			96.26*** [0.00]			81.10*** [0.00]
Wald Test (Dummy)			0.6582 [0.417]			0.2569 [0.612]			0.03524 [0.851]
Obs.	187	187	89	180	180	83	180	180	83

Figures in parentheses ( ) & [ ]are t-values and p-values respectively, significant at 1% Level (***) or, 5% Level (**) or, 10% Level (*)
Insufficient Observations for running 2-Step System GMM as well as Sargan Test, m1 & m2 Test.
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growth effects of financial development on in countries with middle level of financial development using panel regressions. It is not the case of our regressions using the same method. When we either use the quadratic form or group countries into some subgroups we do not find any non-linear relationship in panel regressions.

Turning to preconditions in panel specifications, again we do not find significant results using any financial variables, though not reported. Besides, the regression for the investment rate using panel regressions does not find that financial development promotes investment in the short run. In sum, panel regressions show mixed results about the positive impact of financial development on growth.

Ⅴ. Conclusions

The empirical results in this paper using more samples and long time periods confirm that there exist the positive and statistically significant long-run relationship between average financial development and economic growth in general in the cross-sectional analysis. The same results have been found using initial values of financial development, which supports the argument that this finance-growth relationship is hardly a byproduct of endogeneity problem. However, using LLSV measures of legal origin as instrumental variable for financial development indicator, we do not find any significant relation, different from other studies.

We also find that there is an inverted "U" relationship between finance and growth when we use private credit measure for financial development. The benefit of financial development is the clearest in countries with middle financial development in comparison with financially underdeveloped and highly developed countries. Concerning preconditions, financial development promotes growth further in countries where the level of growth, institutional development and educational attainment are lower. We find that the lesser government consumption the larger the benefit of financial development. Finally, cross-country regressions exhibits that financial development spurs mainly investment but not productivity.

However, none of the financial development indicators demonstrates any significant relation with growth when the growth equations are estimated with 5-year averaged dynamic panel regressions. It is not unusual to have such results using the panel method considering that it needs time for finance to affect growth in the long-run finance-growth nexus. Indeed we find that the panel result changes significant too when we conduct 10-year averaged panel regressions. Therefore, the major assertion of this paper is that the relationship between financial development and economic growth is not a short-run episode rather it is a long-run phenomenon as evident from cross-sectional as well as 10-year panel analysis.

In conclusion, our empirical evidence suggests a strong long-run positive relationship between financial development and economic growth. Besides, the relationship is stronger in countries with the middle level of financial development. This supports the common argument for the benefit of financial development for economic growth and the policy proposal that in particular middle income countries should promote the financial sector. However, such positive impact of could disappear in panel regressions, suggesting that the benefit of financial development to growth is not being felt in the short run.

Note:

1) We construct a new GADP index, different from that used in many studies up to now, because the category of protection for investment has been changed after the late 1990s. We use an equally weighted average of the index for corruption, law and order, bureaucratic quality, and investment risk.

2) It is calculated as (Log of real per capita GDP in 2002-Log of real per capita GDP in 1970)/32.

3) Only private creidt/GDP is reported here. The results using other financial indicators, M2/GDP and M3/GDP will be provided on request to authors.

4) The results using M2/GDP and M3/GDP produce similar results but not reported.

5) The result for each group of countries is provided on request.

6) The result is almost same when we use other financial development indicators such as M2/GDP and M3/GDP.

7) This is the contribution of productivity to economic growth after subtracting that of investment, calculated by the growth rate of real GDP per capita minus 0.3* (the growth rate per capita capital stock). See King and Levine (1993).

8) Rationale for using control variables are-initial level of per capita real GDP controls for the convergence effect; initial secondary school enrollment ratio is an educational variable which controls for the level of human capital development; government consumption, inflation and openness control for policy issues and GADP controls for institutional development in the country.

9) For Baseline Equation, 2 Step 1st diff. GMM instruments are : Time dummies (not reported), G(−3), SEC(−3), PC(−3) and all of their next lags; Again for system GMM, additional instruments used for level equations are ΔG(−1), ΔSEC & ΔPC.

10) For Extended Equation, Time dummies (not reported), G(−3), SEC(−3), GV(−3), INF(−3), OP(−3), PC(−3) and all of their next lags are the instruments for 2 Step 1st difference; in addition that, ΔG(−1), ΔSEC, ΔGV, ΔINF, ΔOP & ΔPC for 2 Step system GMM.

11) For Institutions, Time dummies (not reported), G(−3), SEC(−3), GV(−3), INF(−3), OP(−3), GADP(−3), PC(−3) and all of their next lags are the instruments for 2 Step 1st difference; in addition that, ΔG(−1), ΔSEC, ΔGV, ΔINF, ΔOP, ΔGADP & ΔPC for 2 Step system GMM.

12) The Wald (Joint) test is a test of joint significance of the estimated coefficients asymptotically distributed as Chi-Square under the null hypothesis of "No Relationship".

13) The Wald (Dummy) test is a test of joint significance of sector dummy variables asymptotically distributed as Chi-Square under the null hypothesis of "No Relationship".

14) The Wald (Time) test is a test of joint significance of time dummy variables asymptotically distributed as Chi-Square under the null hypothesis of "No Relationship".

15) The Sargan test of over-identifying restrictions is asymptotically distributed as Chi-Square under the null hypothesis of instrument validity i. e. "the instruments used in the model are not correlated with the residuals".

16) The m1 test is the test for first order autocorrelation of residuals distributed as N(0,1).

17) The m2 test is a test for second order autocorrelation of residuals distributed as N(0,1), where the null hypothesis is that the residuals or error terms in the 1st differenced regression exhibit no second order serial correlation.

18) N. A. indicates not available, due to insufficient observations (as GADP variable has small number of observations) m2 test for serial correlation is not available in the last category of the above mentioned GMM estimation.

19) As a precondition to use DPD package in Ox for estimating GMM, the reference of Ox is needed to be cited.

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