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Financial Development and Economic Growth: Panel Data and Trilateral Analysis

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Abstract

A large body of literatures links financial development to economic growth, yet the channels through which inflation and economic development affect this relationship have been less thoroughly explored. This research takes econometric and trilateral graphic approaches to examine these channels using 99 developing and developed countries during the years 1960-2009. Findings prove that respectively there is a positive, negative and neutral relationship between financial development and economic growth in low, high and very high level of inflation. The effect of countries development situation on finance-growth nexus shows that among the financial development indexes only the effect of M3 is different through developed and developing countries.

Keywords: *Financial development, Economic growth, Inflation, Economic development, Trilateral analysis.*

JEL Classification: *C12, C23*

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1. Introduction

Finance is a key to economic growth. The relation between the two has, however, received much attention in the recent finance literature on endogenous growth (Haber, 2008). The previous studies showed that the depth of financial sector development and greater provision of financial intermediary services are associated with economic growth. However, research so far has not asked whether there are economic conditions and economic situations that are associated with a stronger or weaker finance–growth relationship. In this paper we examine such relationships—the ways in which the finance–growth relationship varies with the inflation rate and economic development. The effect of inflation occurs through a wide variety of direct and indirect channels. Inflation increases transactions and information costs which directly inhibit economic development. For example, firms and individuals will be reluctant to enter contracts when inflation is imperfectly predicted. The reluctance to enter contracts over time will inhibit investment and entrepreneurship, which will affect economic growth. Inflation will inhibit the development of the financial sector and result in financial repression. Thus, in an inflationary environment intermediaries will be less eager to provide long-term financing for capital formation and growth; both lenders and borrowers will also be less willing to enter long-term nominal contracts. Moreover, inflation will have contemporaneous effects on the finance ratios that are used to measure financial sector development (Rousseau and Wachtel, 2002).

Does the finance-growth link work whatever the level of development of countries? One position is to look at the historical experiences around the developing countries over the last 25 years. There are economies with high growth rates but weak financial and intermediation systems. Ethiopia is a typical example. Other countries have had sluggish growth but buoyant stock exchange and credit markets. A typical example is South Africa. In other cases, the developments of financial markets and banking activities have

been accompanied by a resurgence of sustained economic growth. Some Asian and Latin American countries may be classified in this third category. Finally, some countries combine low growth rates and under-developed banking sectors. This concerns many low-income countries. All in all, it may prove difficult to conclude in favor or against a significant finance-growth nexus given the diversity of the situations, since empirical studies usually measure average effects. A second position is to claim that some variables measuring financial development or intermediation have an ambiguous status. The literature has pointed out those variables, such as the banking depth, or credit to the private sector, the size of the financial sector while also being good predictors of banking crises. In this respect, we are not surprised to find a non-significant or even negative influence of these variables on growth. A third position leads to say that, in the light of the overwhelming empirical evidence of a significant link between financial intermediation or development and growth, the results obtained by Favara (2003) and other papers that may find a non-significant link rely on a questionable use of econometric methodologies (Dufrénot et al., 2008).

The last decade saw an explosion in research interest in economic growth and its determinants. There is now a large literature that uses panel data to examine differences in growth rates among countries over long periods of time. One of the outstanding findings in this literature is a robust empirical relationship between financial sector development and economic growth (Wachtel, 2001). Rousseau and Wachtel (2003) using five-year averages of standard measures of financial development, inflation, growth for 84 countries from 1960 to 1995, and a series of rolling panel regressions found that there is an inflation threshold for the finance–growth relationship that lies between 13 and 25 percent. Christopoulos and Tsionas (2003)'s study for 10 developing countries, provided clear support for the hypothesis that there is a single equilibrium relation between financial depth, growth

and ancillary variables, and that the only co-integrating relation implies unidirectional causality from financial depth to growth. Dufrénot et al, (2008) run a comparative regression analysis and found that financial intermediation is a positive determinant of growth in developed countries, while it acts negatively on the economic growth of developing countries. Rousseau and Yilmazkuday (2009) found that higher levels of financial development, combined with low inflation, are related to higher rates of economic growth, especially in lower-income countries, but that financial development loses much of its explanatory power in the presence of high inflation. Pradhan (2011) concluded that stock market development is an integral part of economic growth, which is, in turn, associated with financial development in the Indian economy.

2. Data and Methodology

- **Baseline regression estimates**

An almost standard empirical framework has emerged since Barro (1996) and Levine and Renelt (1992) introduced cross-section regressions for the study of growth among countries. The base line growth equations include a standard set of explanatory variables that provide robust proxies for growth determinants. King and Levine (1993) extend the framework to include measures of financial depth in this robust set. Furthermore, the use of data averaged over a number of years has become a standard approach for analyzing long-term determinants of growth. This research's empirical framework draws on this decade-old tradition. Our data set is constructed as a panel of country observations from the World Bank's "World Development Indicators', and includes 99 countries. Since our interest is the longer-term determinants of economic growth, we use five-year average data as the frequency of observation. Data is thus available for 10 time series observations for each country. Accordingly, we start with the average rate of growth in real per capita output averaged for 1960-2009 as the dependent

variable (Y) and then condition on combinations of the following explanatory variables:

- LGDP: The log of Initial real GDP has an expected negative sign due to real convergence.
- LSEC: The log of the initial secondary school enrollment rate (called SEC) is used as a proxy for human capital investment and enters with an expected positive sign.
- G: Total government expenditure as percentages of GDP which is suspected that large public expenditures would tend to crowd out potentially more productive private investments.
- OP: Openness to trade which would have a positive effect on growth.
- INF: The inflation rate measured as the average annual growth rate of the consumer price.
- F: One of five measures of financial sector depth— M3: the ratio of liquid debts to GDP, CRDIT: private sector bank credits to GDP, CAP: size of stock market (listed domestic stock values to GDP), SV: value traded (traded stocks values to GDP) and TR: turnover ratio (traded stocks total value to present average value of stocks) is included.

3. Panel Data model

It is evident that the crucial source of the bias is a result of failure to applying the OLS methods to deal with the heterogeneity (Baltagi, 2005). Accordingly, the solution which we apply in this research to control heterogeneity is the use of Panel Data procedure. One way to take into account the individuality of each two countries or each cross section unit is to let the intercept vary for each country but assume that the slope coefficients in the model are constant across countries. In the literature, this

kind of model is known as the Fixed Effect Model (FEM). The fixed effect model can be expensive in terms of degrees of freedom if we have several cross section units. And so instead of treating intercepts as fixed, we can assume that there are random variables. This method is called Error Component Model (ECM) or Random Effect Model (REM). The challenge facing a researcher is to select between panel and pooling methods and if the panel approach has been selected, we should choose FEC or REM. We will implement this through F-Leamer's test and choose between pooling and panel. By using restricted residual sum of squares (RRSS) obtained from estimation, the pooling model by OLS and unrestricted residual sum of squares (URSS) obtained from inter-group regression; we can extract the F-Leamer's test:

$$F = \frac{(RRSS - URSS)/(N-1)}{(URSS)/(NT - N - K)} \approx F_{(N-1,N(T-1)-K)} \quad (1)$$

Indeed, there is a formal test that will help us to choose between FEM and REM, which is called Hausman test. Hausman test is based on this assumption $H_0 = Cov(\mu_i, X_{it}) = 0$. In technical words, H statistic test for the null hypothesis that explanatory variables and individual effects can be uncorrelated. The FEM estimates are consistent with both null and alternative hypotheses, where the REM estimates are only compatible with the null hypothesis. Therefore, REM model is preferred if the null hypothesis holds, otherwise FEM can be applicable (Baltagi, 2005, Cheng and Wall, 2005). The relation between considered variable through panel data model has been illustrated in equation 2:

$$Y_{i,t} = Log\,(GDP)_{i,t} + Log(SEC)_{i,t} + G_{i,t} + OP_{i,t} + INF_{i,t} + F_{i,t} + \varepsilon_{i,t} \quad (2)$$

4. Results and Discussions

- **Inflation and finance-growth nexus; panel data and trilateral approach**

Estimation is by instrumental variables with initial values of financial depth, inflation, government expenditure and trade for each five-year period serving as instruments in the first stage. We include fixed effects for the five-year periods because Husman test confirmed the usage of FEM model. The results have been represented in table1:

Table 1: Baseline instrumental variables growth regressions (1960-2009)

Variables (1)	(1)	(2)	(3)	(4)	(5)
LGDP	-1.212 (0.000)*	-1.247 (0.013)**	-1.962 (0.000)*	-1.270 (0.001)*	-1.132 (0.001)*
LSEC	1.306 (0.042)**	2.332 (0.000)**	2.649 (0.000)**	2.220 (0.000)**	1.953 (0.001)**
INF (%)	0.011 (0.074)***	0.007 (0.211)	-0.004 (0.063)***	0.007 (0.176)	0.007 (0.11)
M3 (% of GDP)	0.033 (0.004)*				
CAP (% of GDP)		-0.0002 (0.988)			
CRDIT (% of GDP)			0.021 (0.193)		
SV (% of GDP)				0.0004 (0.967)	
TR (%)					0.003 (0.680)
G (% of GDP)	0.030 (0.352)	-0.009 (0.855)	0.001 (0.961)	0.008 (0.883)	0.011 (0.809)
OP (% of GDP)	-0.004 (0.385)	-0.001 (0.797)	-0.006 (0.229)	-0.001 (0.782)	-0.0008 (0.893)
R- sqd.	0.08	0.058	-0.09	0.057	0.08

Source: Author's calculations

Notes: Probability errors are in parentheses. Growth rates are five-year averages. Estimation is by two-stage least squares. The initial values of government, openness, inflation, M3, and credit in each five-year period are used as instruments for the corresponding five-year averages. *, ** and *** indicate significance at the 1%, 5% and 10% levels, respectively.

According to the above table, the coefficient for initial GDP is negative and statistically significant in all models including one of the five financial indexes and thus consistent with the theory of conditional convergence. In other words, the countries with lower initial GDP have the lower economic growth rate. Also, the coefficient of initial secondary enrollment (SEC) is positive and statistically significant throughout. Indeed the coefficients of all five financial development indexes are positive but not statistically significant except the M3. The coefficient of M3 indicates that 1% increase in M3 to GDP, real GDP per capita will increase 0.033%. The coefficient of INF in the model includes M3 which is statistically significant at 10% significant level and states that there is a positive relation between inflation rate and economic growth. Finally, total government expenditure as percentages of GDP (G) and openness to trade (OP) are not statistically significant. For better interpretation of inflation and finance-growth nexus in this study we build upon Rousseau and Wachtel (2002) by illustrating the trilateral relation using a series of three-dimensional graphs that offer an appealing visual interpretation. The method allows us to quantify directly the growth rates that might be achieved along the continuum of possible combinations of financial development and inflation, providing intuitive answers to questions of how to interpret sets of coefficients from linear regressions and more complex non-linear ones (Rousseau and Yilmazkuday, 2009). Figure 1 and 2 illustrate the trilateral analysis of relation between inflation, economic growth and M3 as the financial development index:

Fig 1: Inflation and finance-grow trilateral analysis

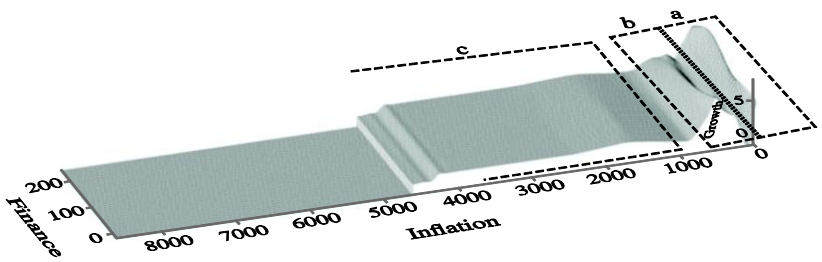
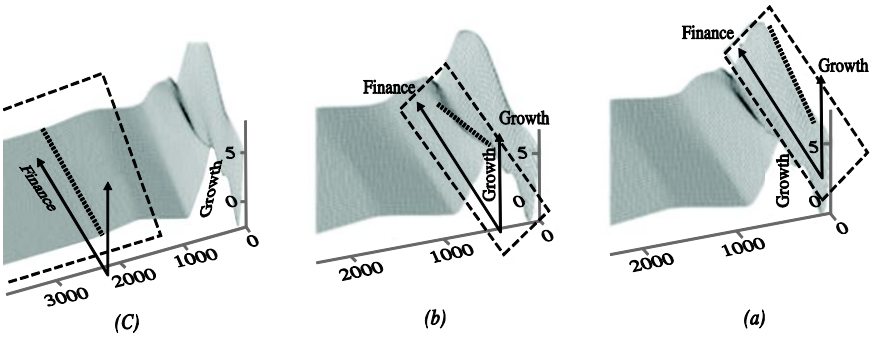


Fig 2 (a-b-c): Inflation and finance-grow trilateral analysis through the inflation levels



Figures 2-a, 2-b and 2-c represent that in low, high and very high levels of inflation rates, the economic growth shows the increasing, decreasing and neutral behavior, respectively. It is because of the deficiency of financial system in meeting its missions caused by high inflation rates and consequently led to dropping the economic growth rapidly. Also, very high levels of inflation rates encounter the financial system with tribulation and consequently no effect will treat the economic growth.

For better understanding the effect of inflation rate on finance-growth nexus between countries with various levels of inflation rate, we divided the considered countries in two categories: high and low inflation rate countries. For this purpose, we use the dummy variable (D=0 for countries with high level of inflation rate and D=1 for countries with low level of inflation rate) and time it to each financial development index and then enter the obtained variable (DF) to every considered model. The results have been shown in table 2:

Table 2: Growth regressions for high and low inflation rate countries (1960-2009)

Variables (1)	(1)	(2)	(3)	(4)	(5)
LGDP	-2.368	-0.965	-1.494	-0.604	-0.509
	(0.001)*	(0.012)**	(0.001)*	(0.204)	(0.228)
LSEC	3.547	2.117	1.801	1.474	1.301
	(0.000)*	(0.001)*	(0.010)*	(0.029)**	(0.055)***
M3 (% of GDP)	-0.064				
	(0.07)***				
CAP (% of GDP)		0.043			
		(0.031)**			
CRDIT (% of GDP)			-0.093		
			(0.003)*		
SV (% of GDP)				0.026	
				(0.196)	
TR (%)					0.009
					(0.081)***
DF	0.065	-0.042	0.101	-0.032	-0.019
	(0.046)**	(0.042)**	(0.001)*	(0.174)	(0.095)***
G (% of GDP)	0.062	-0.043	0.063	-0.054	-0.022
	(0.168)	(0.441)	(0.143)	(0.394)	(0.664)
OP (% of GDP)	-0.011	0.003	-0.007	0.004	0.002
	(0.155)	(0.629)	(0.256)	(0.384)	(0.661)
R- sqd.	-0.30	0.02	-0.55	0.11	0.08

Source: Author's calculations

Notes: Probability errors are in parentheses. Growth rates are five-year averages. Estimation is by two-stage least squares. The initial values of government, openness, inflation, M3, and credit in each five-year period are used as instruments for the corresponding five-year averages. *, ** and *** indicate significance at the 1%, 5% and 10% levels, respectively.

According to the theory we expect that the effect of financial development index on economic growth will be respectively high, and low in high and low inflation rate countries. Therefore, the coefficient of DF must be positive in every considered model. Obviously the results of table 2 indicate that the coefficient of DF is positive and statistically significant in all regressed models except No. 4. Table 3 illustrates the effect of financial

development indexes on economic growth of countries with high and low inflation rate levels:

Table 3: Effect of financial development on economic growth for various inflation rate countries

Countries	Banking system indexes		Stock market indexes		
	M3/GDP	CRDIT	CAP	TR	SV
Low inflation rate	0.001	0.008	0.001	-0.010	0.000
High inflation rate	-0.064	-0.093	0.043	0.009	0.000

Source: Research findings

According to the above table, the effect of financial development indexes related to banking system for low inflation rate countries, are more than that one's for high inflation rate countries. Thus, the results of inflation and finance-growth nexus trilateral analysis are confirmed. Meanwhile, the effect of financial development indexes related to stock market for high inflation rate countries are more than that one's for low inflation rate countries.

- **Economic development and finance-growth nexus; panel data approach**

Various nations in developing states have different regulatory structures and make different public sector policies. These various policy and regulatory structures assess the type of financial structure. In other words, different types of financial services are in response of economic environment and regulatory structure of nations. Therefore, economic development can affect the finance-growth nexus. Thus, in order to study the effect of economic

development factor on finance-growth nexus, we categorized the considered countries in two categories: developed and developing countries. For this purpose we used the dummy ((D=0 for developing and D=1 for developed countries) and time it to each financial development index and then entered the obtained variable (DF) to every considered model. The results have been illustrated in table 4:

Table 4: Growth regressions for developed and developing countries (1960-2009)

Variables	(1)	(2)	(3)	(4)	(5)
LGDP	-1.723 (0.000)*	-0.895 (0.037)**	-1.915 (0.024)**	-0.872 (0.104)	-0.366 (0.535)
LSEC	1.627 (0.034)**	1.731 (0.002)*	1.597 (0.313)	1.380 (0.044)**	0.902 (0.166)
INF (%)	0.012 (0.110)	0.006 (0.187)	-0.003 (0.421)	0.006 (0.202)	0.004 (0.429)
M3 (% of GDP)	-0.040 (0.048)**				
CAP (% of GDP)		0.017 (0.083)***			
CRDIT (% of GDP)			-0.040 (0.358)		
SV (% of GDP)				0.009 (0.660)	
TR (%)					0.008 (0.148)
DF	0.063 (0.014)**	-0.020 (0.188)	0.070 (0.425)	-0.017 (0.668)	-0.027 (0.275)
G (% of GDP)	0.066 (0.132)	-0.001 (0.980)	0.028 (0.668)	-0.008 (0.912)	-0.006 (0.911)
OP (% of GDP)	0.009 (0.166)	-0.008 (0.167)	0.017 (0.521)	-0.002 (0.969)	-0.002 (0.699)
R- sqd.	-0.18	0.18	-0.39	0.16	0.12

Source: Author's calculations

Notes: Probability errors are in parentheses. Growth rates are five-year averages. Estimation is by two-stage least squares. The initial values of government, openness, inflation, M3, and credit in each five-year period are used as instruments for the corresponding five-year averages. *, ** and *** indicate significance at the 1%, 5% and 10% levels, respectively.

According to the above table, the coefficient of the logarithm form of initial per capita GDP (LGP) is negative and statistically significant in models 1, 2 and 3 which confirm the exception and correspond with conditional integration. The coefficient of LSEC is positive and statistically significant in these models which indicate the positive effect of human development index on economic growth. On the other hand, the coefficient of inflation rate is not statistically significant in every model. Also, the coefficients of financial development indexes are not statistically significant except M3 and CAP which are statistically significant at 5% and 10%, respectively. The coefficient of DF is positive and statistically significant only in model 1 which indicates that among the financial development indexes only the effect of M3 is different through developed and developing countries and has more effect on developed countries, while the effect of other financial development indexes is not different through developed and developing countries. The coefficients effect of financial development indexes on economic growth through developed and developing countries are shown in table 5:

Table 5: Effect of financial development on economic growth for developed and developing countries

Countries	**Banking system indexes**		**Stock market indexes**		
	M3/GDP	**CRDIT**	**CAP**	**TR**	**SV**
Low inflation rate	0.023	0.000	0.017	0.000	0.000
High inflation rate	-0.040	0.000	0.017	0.000	0.000

Source: Research findings

Obviously, 1% increase in M3 will increase the LGDP in developed and developing countries about 0.02% and 0.04%, respectively. Also, the CAP is positive and statistically significant at 10% level which indicates that 1% increase in CAP will increase the LGDP 0.017% through developed and developing countries.

5. Summary and Conclusion

We take a panel data and trilateral graphical approaches to analyze the relation between inflation and finance- growth, and economic development and finance-growth. The panel data analysis of inflation and finance-growth nexus shows that there is a positive relation between inflation rate and economic growth only in model including M3. But the trilateral analysis of inflation and finance-growth nexus shows that in low, high and very high levels of inflation rates, the economic growth have the increasing, decreasing and neutral behavior, respectively. Also, the analysis of inflation finance-growth nexus through countries with various rates of inflation shows that the effect of financial development indexes related to banking system for low inflation rate countries, are more than that one's for high inflation rate countries. While, the effect of financial development indexes related to stock market for high inflation rate countries, are more than that one's for low inflation rate countries. Finally the effect of developing situation on finance-growth nexus shows that among the financial development indexes only the effect of M3 is different through developed and developing countries and has more effect on developed countries while the effect of other financial development indexes is not different through developed and developing countries.

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