Financial Development and Economic Growth

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I. Introduction[1]

International evidence persistently reveals striking difference in developing patterns among nations. Some countries enjoy sustainable high economic growth; While others grow at acceptable rates, others still stagnate in low level of economic development for long years. Illuminating insights, theoretical as well as empirical, to apprehend these phenomena have been recently provided by ever-increasing literature of endogenous growth models. However, alternative research agenda on this topic remain rather unexploited to this date; The role of evolution of financial intermediaries for economic developments is focused in this study.

A strong consensus among economists would be that countries with healthier financial systems can generally grow faster. Robust positive correlations between financial development and economic growth have been extensively documented since the pioneering work of Goldsmith (1969). Though early developments also include important theoretical studies such as Gurley and Show (1960), and Mckinnon (1973), these investigations may lack strict analytical foundations. However, recent developments of endogenous growth models offered a more in-depth theoretical framework for analyzing essential interaction between financial development and economic growth. Several studies have already articulated various theoretical mechanisms through which financial intermediation can improve the allocation of financial resources and thereby accelerate the rate of economic development. The role of financial institutions on solving an asymmetric information problem was particularly emphasized. Furthermore, based on this new theoretical framework, a few empirical studies, such as King and Levine (1993a, 1993b), were already carried out. We will further extend this line of research in this paper.

Although serious attentions were paid for the question of non-convergent economic growth paths, an academic consensus for this problem is not achieved at this stage. To comprehend these phenomena further, in the first part of this study, we will focus on an alternative possibility of explanations, threshold effects associated with financial developments. This aspect is highlighted in the theoretical works such as Saint-Paul (1992) and Berthelemy and Varoudakis (1996b). Moreover, Berthelemy and Varoudakis (1995, 1996b) proposed a new statistical procedure, called convergence club method, to examine financial threshold effects empirically. So, in this paper, by applying their method, we will further examine the threshold effects related with financial development. Furthermore, another different empirical procedure, direct non-linear estimation of the financial threshold effects will be adopted as well.

The convergence club analysis and non-linear estimation analysis are all concerned with the quantitative

developments of the financial sector of the economy. However, a stimulating paper, Keefer and Knack (1997) focused empirical relevance of the institutional quality upon economic growth of the economy. It is evident that financial institutions have critical effects upon the institutional quality of the economy. Thus, we rather highlight institutional aspects of financial developments in the final part of the study.

The structures of this paper are the followings; In next section, endogenous growth models with financial intermediaries and related empirical analyses are briefly summarized. Theoretical works revealing threshold effects of the financial development are reviewed, then, empirical investigations using convergence club method are presented in section three. The possibility of the direct non-linear estimation of the financial threshold effects is illustrated in section four. In section five, an empirical approach featuring institutional aspects of financial development is presented. Last section concludes.

II. Financial Intermediation and Economic Growth

II. 1 Financial Intermediation and Endogenous Growth Model

The role of the financial intermediation was specially emphasized and extensively investigated by the thorough classical study of Gurley and Shaw (1960). Moreover, in an exhaustive study of the developed and the underdeveloped countries over the period 1860 - 1963, Goldsmith (1969) provided ample evidence for a positive association between the ratio of the financial assets to GNP and economic developments. In his words, "periods of more rapid economic growth have been accompanied, though not without exception, by an above-average rate of financial development" (p.48). However, note that he also stressed the issue of the causality[2]. Establishing the direction of the causal mechanism between financial development and long-run economic growth is difficult. Financial factors could be responsible for the development of economic sectors or they could simply reflect the accelerating economic growth. Patrick (1966) was quite impressive in this context. He advocated supply-leading hypothesis; the development of financial intermediaries precedes economic development. This issue of two-way causality is focused in this study.

Though in these studies, importance of financial deepening was featured, McKinnon (1973) emphasized critical importance of the price variables as the more relevant financial conditioning variables. Accordingly, well-known financial repression in the form of below-equilibrium interest rate may retard real development of the economy.

These early developments in the finance and development literature provided numerous insights regarding the intimate connection of the financial development and economic growth. It is not, however, a general equilibrium model in which financial intermediaries can affect rates of economic growth.

In the last decade, we saw two strands of prominent economic research. The first literature of endogenous economic growth, originated with the works of Romer (1986) and Lucas (1988), constructs theoretical models where economic agents make decisions that will determine the economy's steady growth rates. This literature

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[2]For example, he mentioned, " there is no possibility, however, of establishing with confidence the direction of causal mechanism, i.e., of deciding whether financial factors were responsible for the acceleration of economic development or whether financial development reflected economic growth whose mainsprings must be sought elsewhere"(p. 48).

uncovered various factors of critical importance. The list of newly highlighted elements may include the human capital accumulation, trade consideration, political elements, social infrastructure, income distribution, industrial organization and so on[3]. Nevertheless, financial aspects were not particularly stressed in the early stage of the theoretical developments and its empirical counterparts[4].

Another important area of theoretical developments in the last decade is the financial contract literature; Townsend (1979), Diamond (1984), Williamson (1986) analyze theoretical mechanisms where financial contracts emerge as optimal responses of economic agents, facing asymmetric information problems. Combining these two strands of research, it became possible to construct a dynamic general equilibrium model where the interaction of the financial development and long run economic growth can be explicitly formulated.

Informational role of financial intermediation is first analyzed in Greenwood and Jovanovic (1990), based on earlier work, Townsend (1983). In their theoretical framework, capital can be invested in a safe, low-yield technology or a risky, high-yield technology. Returns to risky technology consist of two random shocks: aggregate shock and project-specific shock. Financial intermediaries can choose the most appropriate technology because they have a large portfolio so that they can identify aggregate productivity shock component. We should also stress that development of the financial intermediaries (or financial networks in their words) is endogenously determined with real economic activity in their model.

Another important role of the financial intermediation, the reduction of the liquidity costs, was analyzed in Bencivenga and Smith (1991). In the absence of banks, individuals can avoid idiosyncratic liquidity shocks only by investing in liquid productive assets, thus frequently forgoing more productive but more illiquid investment. With the presence of the banks, liquidity risks of individuals can be pooled and more of the financial resources can be invested in more illiquid but more productive projects. This theoretical framework, originally put forward in Diamond and Dybvig (1983), was incorporated into an endogenous growth model by Bencivenga and Smith (1991). They show that the productivity of the investment in the economy can be increased due to two factors; allocation of the funds toward illiquid, high-yield projects and the reduction of premature liquidation of the investment funds.

The monitoring of the competence of entrepreneurs and the return on risky investment is another essential functioning of the financial intermediaries. This aspect is theoretically focused in King and Levine (1993a). Monitoring the various available projects involves serious assessment, incurring a large sum of fixed costs. If those fixed costs are sufficiently high, private investigators can be discouraged from carrying out necessary research for themselves. However, financial intermediaries can spread such fixed costs among the investors; More evaluation can be made, making investment projects more productive[5].

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[3]See, for example, recent issue of the journal of the economic dynamics and control (1997, Vol.21).

[4]For example, a detailed empirical analyses on the empirical determinant for the long-run economic growth, Barro and Lee (1994), have included many variables to explain long run economic growth. However, no financial variables are included.

[5]For a through and excellent survey on the theoretical and empirical literature on the endogenous growth model with financial intermediation, see, Berthelemy and Varoudakis (1996a).

II. 2 Empirical Studies

As succinctly summarized in chapter 8 of Fry (1995), there already existed a wide range of empirical studies assessing the effects of various financial development on the growth path of the economy[6].   Theoretical developments in the last section, however, resulted in a new strand of investigations such as Roubini and Salai-Martin (1992), De Gregorio and Guidotti (1995).

Among the recent studies, however, the most well known studies on this topic would be King and Levine (1993 a, 1993b). In those papers, they used several proxies for the financial services as well as for the structure of the financial markets. First, as for the level of the economic activity, they chose growth rate of real per capita GDP, growth rate of the real per capita physical capital stock, growth rate of the technology, and the ratio of gross domestic investment to GDP as the indicators of real economic activity.

As for financial indicators, they chose four proxies as well. First, they use a measure of the overall size of the formal financial intermediary sector; the ratio of liquid liability[7] to GDP, called DEPTH in King and Levine (1993 b). Second financial development indicator, called BANK, is the ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets. Idea here is that, since banks seem more likely to provide the types of financial services as in the theoretical modeling than central bank, higher value of BANK should correspond to higher levels of financial development. Third and fourth financial indicators are to measure to whom the financial system is allocating credit. PRIVATE equals a ratio of credit to nonfinancial private sectors to domestic credit. PRIV/Y equals credit issued to private enterprises divided by GDP. Higher value of PRIVATE reflects a redistribution of credit from public enterprises and government to private firms. Higher value of PRIV/Y indicates more credit to the private sector as a share of GDP.

After the discussion of these proxies, they first looked at correlations of these financial indicators and growth indicators. They persistently found a significant correlation between these proxies and the long-run economic growth. Then with other conditioning variables such as initial secondary school enrollment, and initial level of real per capita income, they estimated three stage least squares regression. This method is used because of the possible simultaneity bias that could arise from an aforementioned reverse causality between financial development and growth. Initial values of financial variables and other control variables were simply used as instrument variables there. The significant effects of financial indicators on long run economic growth are not, however, so robust.

However, some objections against their methodology of using initial financial conditions to control for its endogeneity have been raised. For example, in comments on King and Levine (1993c), Gertler and Roubini both questioned validity of initial financial development as appropriate instrumental variables in the estimation procedure. Gertler argued that initial financial development could simply reflect anticipated future growth. Furthermore he pointed out that omitted factors could drive both financial development and economic growth. Levine (1997a) also suggested difference in political systems, legal tradition, institutions as such causal factors.

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[6]Odedokun (1996) offers a useful review of the empirical literature as well.

[7]This liquid liability measure equals M3 or line 551 from the Financial statistics or when 551 is not available, line 34 plus 35, which is M2, is used.

Nevertheless we may refer to empirical studies such as Gupta (1984) and Jung (1986), investigating the causal relationship between financial development and economic growth. For example, Jung (1986) employed the technique of Granger causality to approach this issue. His results basically supported exogenous nature of the financial development, especially at its early stage of economic development[8]. Since the results of these studies can be interpreted as still inconclusive, following studies are of our interest. First, Roubini and Salai-Martin (1992) is quite interesting in this respect; They used the bank reserve ratio as a proxy for financial (under) development or financial repression for that matter. As pointed out by Pagano (1993), this sort of policy variable can be valid instruments for financial development because it is not likely to be affected by economic development. Secondly, Lanyi and Saracoglu (1983) divided 21 developing countries into three groups. Countries with positive real interest rates, countries with "not punitively negative" real interest rate, and countries with severe negative real interest rate were differentiated in the empirical investigations. Because this classification relates to the degree of financial repression, we may utilize this information to identify the causal nature of the financial system at question. Thirdly Levine (1997b) used indexes for legal and regulatory determinants of financial development as valid instruments for the financial indicators, strengthening the former results in King and Levine (1993a,b). However, it is not surprising that mere empirical investigations may not unambiguously resolve the issue of causality. To motivate our study further, we may quote from a recent survey on this literature, Levine (1997a) where he argues, " Nevertheless, the body of evidence would tend to push many skeptics toward the view that the finance-growth link is a first-order relationship" (p.709).

III. Threshold Effects of the Financial Development

III. 1 Theoretical Developments

As explained in the section 2, the possibility of multiple equilibrium or existence of threshold level can be of critical importance for explaining convergence or nonconvergence of the growth path in the world economy. From this perspective, two additional studies, Saint-Paul (1992) and Berthelemy and Varoudakis (1996b) deserve serious attention.

As we mentioned in the introduction, we take two way causality between financial development and economic growth seriously. Let us briefly review the argument of Patrick (1966). He put forward the hypothesis that supply -leading financial development dominates the early stages of economic developments since it makes financing of productive investments possible. The supply-leading financial development mobilizes financial resources trapped in traditional sector and transfer those resources to the modern sector of the economy. Therefore, financial development can have autonomous effect on long run growth of the economy. Once the financial development reaches at certain mature stage, then demand-following movement will take over its course. Nevertheless, it is also well known that economic growth is required to setup a sophisticated financial system. Hence the reciprocal interactions between financial development and economic growth can be of simultaneous nature, not of sequential

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[8]This finding is quite interesting in itself because it is consistent with aforementioned Patrick's hypothesis.

nature alleged by Patrick's hypothesis.

However, in Greenwood and Jovanovic (1990), the developments of the financial intermediation are simultaneously determined with the development of the real economy. In their model, the establishment of the financial intermediation (financial network) is surely costly. Therefore whether financial networks will be established in the economy depends on the benefits of the formation of the financial networks. However, those benefits are in turn decided by the level of economic development of the economy (or more concretely the level of the average capital stock). This fixed cost nature of the establishment or development of the financial sector of the economy implies that the reciprocal relationship between financial development and economic growth can give a rise to threshold effects on the economy; Economies will only select a particular type of financial system when they have passed a certain threshold because only then the benefits of establishing highly sophisticated financial system can be realized. Existence of multiple equilibrium in theoretical model may lead to endogenous determination of the such thresholds for the economic development and financial development.

Saint-Paul (1992) was among the first to examine such multiple equilibrium in an endogenous growth model with financial markets. His model focuses the interrelationship between the financial intermediation and technological choice of the economy. More productive investments imply more specialized technology. However, without the presence of the financial markets, profitability shock, coming from unforeseen product demand variability, can be avoided only by choosing less specialized, less productive, technologies. Thus developing financial systems can have positive effects on economic growth by making more specialized, but more productive investment feasible. In this economy, there exist two types of equilibrium; One is a low equilibrium where the underdevelopment of the financial system results in an inefficient productive structure of the economy that in turn justifies the absence of financial development. Another high equilibrium is the economy where developed financial system encourages adoption of the highly specialized technologies which in turn stimulates further development of financial system despite of its high establishment cost. Economy would realize one of these two equilibriums, depending on the certain parameters of the structure of technology and costs of establishment of the financial market.

Another inspiring theoretical model with multiple equilibrium and related threshold effect is recently presented in Berthelemy and Varoudakis (1996b). In their economy, the real sector is modeled to have endogenous growth properties based learning-by-doing externalities as in Romer (1986). Consumers hold claims on financial intermediaries. Utility maximization results in usual Keynes-Ramsey condition. The difference between bank's creditor rate and the marginal productivity of capital is the counterpart of the intermediation services provided by the banks. The opportunity cost of financial intermediation services is measured in terms of labor services used by the financial intermediaries. At the individual bank level, the rate of transformation of savings into capital depends on its labor input. However, it is assumed that the rate of transformation is independent of the volume of savings. This characteristic implies an externality provided by the real sector on the financial intermediary activity of the economy; An increase of the savings generated by the real sector improves the efficiency of banks by raising their productivity. Furthermore, these economies of scale in the banking sector may result in a standard monopolistic competition framework. Hence, the margins of the financial intermediation depend inversely on the

number of banks in the market. This provides another link between real economic activity and financial sectors of the economy.

In this economy, it is possible to show that this economy can result in three equilibrium, high equilibrium, threshold equilibrium, and low equilibrium. High equilibrium and Low equilibrium are both stable equilibrium, while intermediate threshold equilibrium is unstable one. This unstable equilibrium signifies threshold effects of financial development on economic growth. Beyond this critical level of financial development, the economy converges to the high-growth equilibrium. While below that level, it would be trapped into the low equilibrium. In underdeveloped equilibrium, financial sector is rather underdeveloped. This surely results in weak competition in the banking sector with a high financial intermediation margin. This, in turn, would result in a low net interest rate to the household sector, being consistent with low steady state growth in the long run according to the Keynes -Ramsey condition. Low return on saving reduces the flow of the household saving to the banks. In turn, small size of the banking sector implies low marginal productivity of the banking sector, justifying low level of employment and therefore the underdevelopment of the banking sector. Henceforth, the economy is trapped in a low equilibrium with insufficient financial development and low economic growth. However, in high equilibrium, high development of the banking sector induces severe competition in the banking sector. This results in low intermediation margins and a high net interest rate paid to the household. A high growth rate, a strong incentive to save, a large financial sector is consistent with this high equilibrium.

These models illustrate possibilities of multiple equilibrium and associated threshold effects of the development of the financial sector of the economy. We believe that this possibility provokes another venture in understanding the issue of the underdevelopment trap in the economic development.

III. 2 Quantile Regressions

To start our empirical investigations focusing threshold effects associated with financial development, in line with King and Levine (1993b), we adopt following three financial indicators, DEPTH, BANK, and PRIV/Y as proxies for the financial development of the economy. In keeping with the previous studies in this area, our

$$GYP_i = a_0 + a_1 LY_{i,1960} + a_2 LSEC_{i,1960} + a_3 GOV_i + a_4 REVC_i + a_5 OIL_t + a_6 OPEN_t + a_7 FI_i \qquad (1)$$

specification for the growth regression is the following,
where

> GYP_i= average annual real per capita income growth, 1960 to 1989 for country i.
>
> $LY_{i,1960}$= log of initial real per capita income.
>
> $LSEC_{i,1960}$= log of initial secondary school enrollment rate.
>
> GOV_i= average ratio of government expenditures to GDP.
>
> $REVC_i$= an indicator of political instability which equals average number of coups
> d'etat and revolutions per year.
>
> OIL_i= a dummy variable for the positive effects of oil production.

$OPEN_i$= average ratio of imports plus exports to GDP.

FI_i= proxies for financial developments; either $DEPTH_i$, $BANK_i$, $PRIV/Y_i$,

all of these financial indicators are average values over the sample period, 1960-1989,

or the possible longest period available.

This specification is essentially the same as those of King and Levine (1993a, 1993b), except three additional control variables, REVC, OIL, and OPEN; These factors are included here to make results comparable with those in Berthelemy and Varoudakis (1995, 1996b) since we will adopt their convergence club method at next section [9].

As reviewed in section III.1, existence of multiple equilibrium, suggested by the theoretical arguments in Saint -Paul, and Berthemeley and Varoudakis, give a rise to threshold effects in long run economic growth. With multiple endogenous growth equilibria the relationship between the financial development and the steady state growth rate is not necessarily linear. Hence, long run economic growth rate can be very different, depending on whether economy is on the transitional path for low equilibrium or high equilibrium. Therefore, the growth regressions can be unstable across the entire sample of countries, making the search for global convergence particularly inappropriate.

Durlauf and Johnson (1995) point out that Azariadis-Drazen (1990) type of physical and human capital threshold can generate multiple steady-state equilibrium associated with highly non-linear law of motion for the respective countries. Moreover, Bernard and Johnston (1996) show that a negative initial output coefficient, i. e. conditional converegnce of grwoth rates, can mistakenly observed with the presence of human and/or physical capital accumulation threshold. Thus, a first step in the analysis of the financial threshold effects would naturally be to examine the stability of the growth equation in details.

Before we engage in empirical stability analyses, let us focus Quah (1993) again. After harsh methodological criticism for "Barro Regressions", he proposed a rather innovative statistical method, fractile Markov chain model, to analyze growth path of the world economy. He unveiled several important empirical findings to this field. First, his method revealed extreme immobility over the period, 1962-1984. The richest countries remain so with probability at least 98 per cent. The poorest will have to stay there with the probability of at least 95 per cent. However, very stimulating findings for us are transitional probabilities of interior diagonals. Middle countries are less likely to remain where they were. Those middle countries encounter about equal probability of rising or falling.

For the stability analyses of the growth regressions, we use level of real per capita GDP as a conditioning variable, as in Durlauf and Johnson (1995). However, based on the Quah's finding, we combine the second and third quantile group countries into a single subgroup sharing same law of motion.

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[9] Our specification of growth regression is, in fact, a hybrid specification. It also differs from the specification of Berthelemy and Varoudakis. Dependent variable is the log difference of the real per capita income level and its initial value in 1960. Moreover, their sample period is from 1960 to 1985.

Table 1 Quantile Regression: DEPTH 1960-1989			
Independent Variables	(1) 0.25 Quantile	(2) 0.5 and 0.75 Quantile	(3) 1.0 Quantile
Constant	0.019＊＊＊	0.035＊＊＊	0.005
	(0.0038)	(0.0069)	(0.013)
LY60		-0.10＊＊	-0.018＊＊
		(0.0048)	(0.086)
LSEC60		0.01＊＊＊	
		(0.0023)	
DEPTH		0.030＊＊＊	0.025＊＊＊
		(0.0074)	(0.0089)
OIL	0.17＊＊		
	(0.0082)		
REVC	-0.033＊＊＊		
	(0.011)		
GOV			0.187＊＊＊
			(0.047)
R2	0.356	0.58	0.53
NOB	23	49	23

Dependent Variable: GYP - Real Income Per Capita GDP Growth, 1960-89, standard erros in parentheses, ＊significant at 10% level, ＊＊significant at 5 %level＊＊＊significant at 1 %level LY60 = log of initial real per capita GDP in 1960, LSEC60 =log of secondary school ebrollment rate in 1960, OIL=Dummy variable for OECD countries, REVC=Number of revolution and coups per year, GOV=Governemnt consumption share of GDP, DEPTH=Ratio of Liquid Liabilities to GDP.

Table 2 Quantile Regression: PRIV/Y 1960-1989			
Independent Variables	(1) 0.25 Quantile	(2) 0.5 and 0.75 Quantile	(3) 1.0 Quantile
Constant	0.026＊＊＊	0.035＊＊＊	0.021＊
	(0.0051)	(0.0081)	(0.012)
LY60		-0.0081	-0.015＊＊
		(0.0062)	(0.0064)
LSEC60		0.011＊＊＊	0.0038＊
		(0.0027)	(0.0024)
DEPTH		0.049＊＊＊	0.017＊
		(0.0015)	(0.0088)
OIL			
REVC	-0.045＊＊＊		
	(0.016)		
GOV			0.116＊＊＊
			(0.037)
R2	0.36	0.58	0.50
NOB	25	49	25

Dependent Variable: GYP - Real Income Per Capita GDP Growth, 1960-89, standard erros in parentheses, ＊significant at 10% level, ＊＊significant at 5 %level ＊＊＊significant at 1`f%level LY60 = log of initial real per capita GDP in 1960, LSEC60 =log of secondary school ebrollment rate in 1960, OIL=Dummy variable for OECD countries, REVC=Number of revolution and coups per year, GOV=Governemnt consumption share of GDP, PRIV/Y= Gross Claims to on the private sector to GDP.

Table 3 Quantile Regression: BANK 1960-1989			
Independent Variables	(1) 0.25 Quantile	(2) 0.5 and 0.75 Quantile	(3) 1.0 Quantile
Constant	0.046 * * *	0.022 *	0.043 * *
	(0.0011)	(0.011)	(0.015)
LY60			-0.0231 * * *
			(0.0071)
LSEC60	0.0071 * * *	0.011 * * *	0.0016 * * *
	(0.0027)	(0.0027)	(0.0044)
BANK		0.038 * * *	0.031 *
		(0.0013)	(0.016)
OIL			
REVC	-0.025 * *		'
	(0.012)		
GOV			
R2	0.407	0.53	0.39
NOB	23	43	22

Dependent Variable: GYP - Real Income Per Capita GDP Growth, 1960-89, standard erros in parentheses, *significant at 10%level, * *significant at 5 %level * * *significant at 1 % level LY60 = log of initial real per capita GDP in 1960, LSEC60 =log of secondary school enrollment rate in 1960, OIL=Dummy variable for OECD countries, REVC=Number of revolution and coups per year, GOV=Government consumption share of GDP, BANK= Deposit bank dometsic credit divided by deposit bank domestic credit plus central bank domestic credit.

Estimated results for each financial indicator and quantile group are summarized in Table 1-3. Though the results in those tables are puzzling in some aspects, several interesting observations can be made; First, it is surprising to see that the political stability proxy variable, REVC is persistently significant for the 0.25 quantile countries regardless of the financial proxies. On the other hand, economic conditioning variables turned out to be irrelevant for most of the cases for this group. This definitely exposes absence of any economic growth dynamics. Secondly, the conditional convergence hypothesis can not be applicable for 0.25 quantile countries because the negative correlation between growth rate and the initial income level is not detected. Third, it is astonishing to observe that financial indicators, despite of specific forms chosen, are consistently significant at the 1 per cent level for middle income group countries. This finding shows that the development of financial sector of the country as well as human capital accumulation have been equally indispensable for the development of the economy. Fourth, for developed countries, government expenditures became the most significant determinant for their long-run economic growth in DEPTH and PRIV/Y cases.

These results are in favor of instabilities of the growth regressions in each subgroup. However, this type of stability analysis, thought insightful in many aspects, can not resolve the issue of endogenous identification of subgroup of economies. In other words, in this type of analysis exogenous data splits are simply assumed, not endogenously determined[10]. Hence, to attack this problem, in the next section, we will proceed to the analysis

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[10]Another problem, pointed out in Durlauf and Johnson (1995) is that this method will very quickly eliminates degrees of freedom.

of threshold effects associated with financial development, using convergence club method.

III. 3 Convergence Club with Financial Development

Durlauf and Johnson (1995) applied an inspiring statistical procedure, called convergence club method, to endogenously identify subgroups of countries which share same law of motion. They were concerned about the empirical investigation of the physical as well as human capital threshold effects.

Berthelemy and Varoudakis (1995, 1996b), however, applied convergence club method to analyze financial threshold effects. To investigate the stability of the growth regressions on the basis of the financial development, first, an entire sample of countries can be sorted out in decreasing order according the values of financial indicators. Then, for example, recursive Chow test can be carried out to find sample break points. However, this simple procedure could lead to serious specification error; The threshold effect due to the accumulation of human capital, as Azariadas and Drazen (1990) and others suggested, is equally likely. Because of possible correlation between financial development and the level of education, the break point found can be strongly influenced by the threshold effects of human capital accumulation.

Then the subtle issue is how to combine these two threshold effects. Here, Berthelemy and Varoudakis (1995) argues that "because of the virtual importance of human capital the threshold effect associated with human capital development has priority" (p.71); The development of financial sector may initiate growth process only after human capital accumulation has passed a certain threshold.

In view of these observations, the whole sample is first ordered according to the values of SEC. Assuming a single break point within a sample, the sum of the squares of the regression, $\delta^2 j$, is re-estimated over the subsample. The quasi log-likelihood of the data for this break point, $QL = -\Sigma n_j \ln(\delta^2 j)$, where n_j is the size of each sub-sample, is used for identifying a break point. This test was carried out for all points where chow test rejects structural stability hypothesis of the growth regression equation at the 5 per cent level, as well as points in their neighborhood.

In order to examine the possibility of financial threshold, the data for each subgroup is re-ranked according to the values of financial indicators[11]. Then the existence of a split with respect to financial development was examined by the same procedure used for locating an educational threshold. Let us review the estimated results for each financial indicator.

(i) DEPTH

For this financial indicator, the econometric procedure described above resulted in a convergence-tree diagram in Figure 1. This convergence tree defines group of countries which share same growth behavior[12]. Re-estimated

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[11] It is evident that we ignored the possibility of multiple break points arising from the educational attainment.

[12] Stability test according to the financial development indicator did not result in any sensible dual splitting for this variable. In fact, for group A countries, the stability test by DEPTH variable statistically suggested a possible structural break. However, according to this split, re-estimated growth regressions are not sensible; no explanatory variables are significant. Hence, we did not adopt this.

results of growth regressions for each group of countries are shown in Table 4. The comparative economic performances are summarized in Table 5.

For group A, increasing the size of financial sector is irrelevant for growth perspectives. This result is not inconsistent with the financial threshold effect hypothesis. The average value of DEPTH for group A is only 0. 220, almost half of the value for group B; If the development of financial sector is not sufficient, it does not lead to significant improvements in efficient capital utilization until certain threshold level is passed. For the rest of the countries, group B, financial development in the form of DEPTH variable significantly improves growth performances, indicating again a threshold effect. In this context, the slight significance of educational development for group A countries are worthy of attention.

In terms of macroeconomic performances of the countries, the split with respect to average growth rate was evident between group A and group B according to Table 5. Group B is clearly a convergence club, made up of countries that were on a high growth path over the sample period. They have been well equipped with satisfactory initial human capital and experienced adequate financial development, enjoying higher rate of long-run economic growth. On the other hand, group A apparently forms a convergence club around a poverty trap. This group is characterized rather as a group of countries with low financial development and insufficient human capital.

(ii) PRIV/Y

For this financial indicator, a convergence-tree diagram is shown in Figure 2. Re-estimated growth regression results are given in Table 6 with corresponding macroeconomic performances in Table 7. For group C, financial indicator as well as educational attainment variable are highly significant, being consistent with the threshold hypothesis. There are striking differences of the human capital variable and financial development between group C and other groups in Table 10. It would be certain that group C countries have been located to the right of the

Table 4 Growth Regression with Convegence Club Method: DEPTH 1960-1989		
Country Group	A	B
Constant	0.024 $*$ $*$ $*$	0.038 $*$ $*$ $*$
	(0.0082)	(0.0068)
LY60		-0.013 $*$ $*$ $*$
		(0.00026)
LSEC60	0.0041 $*$	0.011 $*$ $*$ $*$
	(0.0021)	(0.0034)
DEPTH		0.028 $*$ $*$ $*$
		(0.0056)
R2	0.07	0.48
NOB	40	55

Dependent Variable: GYP - Real Income Per Capita GDP Growth, 1960-89, standard errors in parenthese, $*$ siginificant at 10% level, $*$ $*$ significant at 5 % level $*$ $*$ $*$ significant at 1 % level LY60 = log of initial real per capita GDP in 1960, LSEC60 =log of secondary school ebrollment rate in 1960, DEPTH=Ratio of Liquid Liability to GDP

Table 5 Comparative Performance of Groups Couontries				
Group	SEC	DEPTH	Growth Rates	Real Per Capita GDP
	1960	1960-1989	1960-1989	1960
A				
Average	0.035	0.220	0.009	0.699
Max	0.11	0.624	0.037	3.635
Min	0.003	0.105	-0.012	0.208
B				
Average	0.347	0.475	0.027	2.768
Max	0.860	1.504	0.066	7.380
Min	0.11	0.118	-0.004	0.496

Figure 1 Convergence Tree Diagram with DEPTH

$SEC_{i,1960}$ → > 11%   55 countries   (B)

$SEC_{i,1960}$ → < 11%   40 countries   (A)
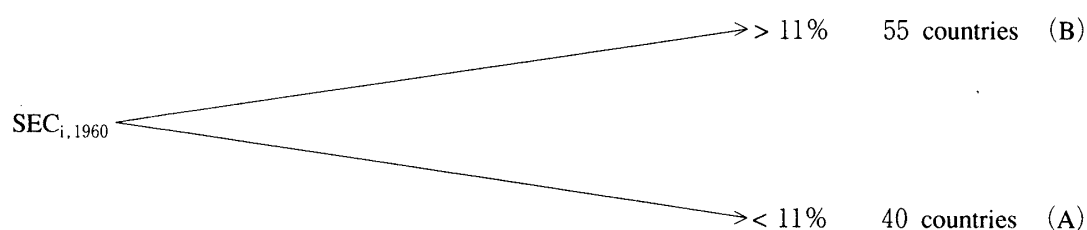
threshold values for educational attainment and financial development. Clearly group C forms a convergence club with eminent economic growth rate.
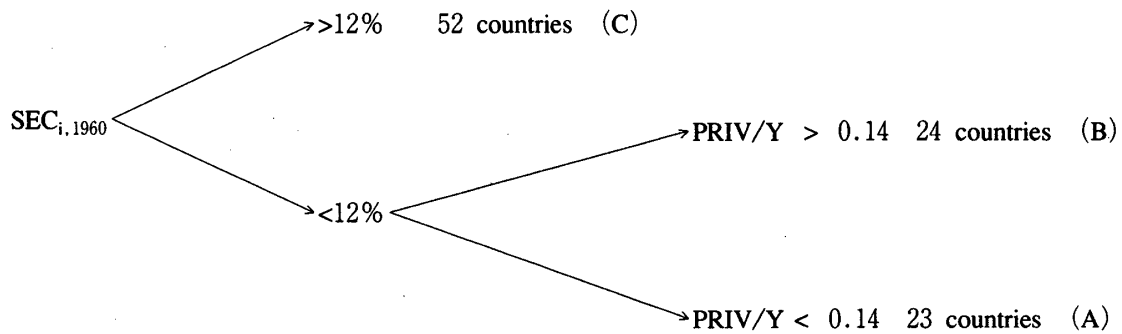
However, the growth path of group A and B countries is more difficult to describe. The most significant difference between these groups is the value of PRIV/Y; Group B countries have been equipped with well-developed financial sector than group A countries. Nevertheless, levels of educational attainment are virtually the same. The reason that the educational variable is significant only for group B could be that the return for human capital accumulation can not be realized without reasonable degree of development of financial sector. In terms of macroeconomic performances, both group A and B obviously constitute poverty traps. However, we do not have a sensible dynamics between these two groups at this stage.

Table 6 Growth Regression with Convegence Club Method: PRIV/Y 1960-1989			
Country Group	A	B	C
Constant	-0.014	0.036 * * *	0.0414 * * *
	(0.011)	(0.0092)	(0.0075)
LY60		-0.015 * * *	-0.016 * * *
		(0.0069)	(0.003)
LSEC60		0.0086 * *	0.01 * *
		(0.0028)	(0.0039)
PRIV/Y	0.296 * *		0.038 * * *
	(0.122)		(0.0091)
R2	0.18	0.25	0.41
NOB	23	24	52

Dependent Variable: GYP - Real Income Per Capita GDP Growth, 1960-89, standard errors in parenthese, * significant at 10% level, * * significant at 5 % level * * * significant at 1 % level LY60 = log of initial real per capita GDP in 1960, LSEC60 =log of secondary school ebrollment rate in 1960, PRIV/Y= Gross Claims on the Private Sector to GDP.

Table 7 Comparative Performance of Groups Couontries				
Group	SEC	PRIV/Y	Growth Rates	Real Per Capita GDP
	1960	1960-1989	1960-1989	1960
A				
Average	0.04	0.087	0.013	0.711
Max	0.12	0.141	0.07	1.588
Min	0.003	0.037	-0.011	0.396
B				
Average	0.04	0.2	0.012	2.768
Max	0.11	0.409	0.032	7.38
Min	0.004	0.143	-0.011	0.496
C				
Average	0.36	0.34	0.029	2.854
Max	0.86	1.119	0.067	7.38
Min	0.12	0.089	-0.004	0.496

Figure 2 Convergence Tree Diagram with PRIV/Y

$SEC_{i,1960}$

>12%   52 countries (C)

<12%

PRIV/Y > 0.14   24 countries (B)

PRIV/Y < 0.14   23 countries (A)

(iii) BANK

Resulting convergence tree is shown in Figure 3[13]. The regression results are summarized in Table 8. Macroeconomic performances of group of countries are presented in Table 9.

Note that, unlike former cases, educational variable and financial indicators are both significant in group A as well as in group B. Moreover, it is somewhat peculiar that the average values of BANK for group A and B roughly coincide. Though, the level of human capital accumulation is remarkably different, both groups are characterized, at least on average, with same level of financial development. Evidently group B is a convergence club with a prominent long-run economic growth. On the other hand, group A forms a convergence club around a poverty trap. Taken into account of same average value of PRIV/Y for two groups, group B countries could be sized in poverty trap simply because of its low educational development.

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[13]Like the case of DEPTH, stability test according to the financial development indicator did not result in any sensible dual splitting for this variable. In fact, for group B countries, the stability test by BANK variable statistically suggested a possible structural break. However, according to this split, re-estimated growth regressions are not sound; though the conditional convergence was observed, no explanation is possible for this. Hence, this splitting was not accepted.

Table 8 Growth Regression with Convegence Club Method: BANK 1960-1989		
Country Group	A	B
Constant	0.0049	0.032 * * *
	(0.011)	(0.0012)
LY60	-0.0059	-0.014 * * *
	(0.0048)	(0.0031)
LSEC60	0.0061 * *	0.011 * * *
	(0.0025)	(0.0037)
BANK	0.037 * * *	0.026 * *
	(0.012)	(0.12)
R2	0.22	0.29
NOB	37	50

Dependent Variable: GYP - Real Income Per Capita GDP Growth, 1960-89 standard errors in parenthese, * * significant at 5 % level * * * significant at 0.01 level LY60 = log of initial real per capita GDP in 1960, LSEC60 = log of secondary school ebrollment rate in 1960, BANK= Deposit bank credit divided by deposit bank dosmestic credit plus central bank domestic credit.

Table 9 Comparative Performance of Groups Couontries				
Group	SEC	DEPTH	Growth Rates	Real Per Capita GDP
	1960	1960-1989	1960-1989	1960
A				
Average	0.032	0.628	0.009	0.587
Max	0.08	0.937	0.037	1.588
Min	0.003	0.235	-0.012	0.208
B				
Average	0.339	0.775	0.019	2.712
Max	0.86	0.979	0.027	7.380
Min	0.11	0.423	-0.04	0.496

Figure 3 Convergence Tree Diagram with BANK

SEC$_{i,1960}$ → 11% > 50 countries (B)

SEC$_{i,1960}$ → 11% < 37 counries (A)
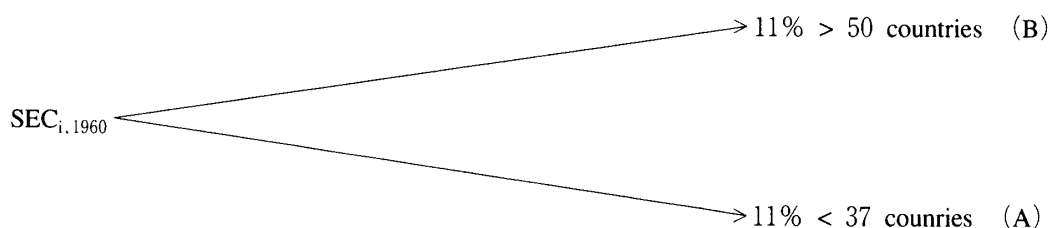
IV. Non-Linear Estimation of the Effects of the Financial Development

We focused so far stability of the growth regressions to identify the potential threshold effects due to human and financial capital accumulation in the last section. However the effects of the threshold level of financial development may be approached from rather different perspective.

In Greenwood and Jovanovic model (1990), the threshold effects of financial development can be related to fixed setting up costs for the financial intermediation network. Because of those fixed costs, individuals join

financial network only after their income reach some minimum level. Thus, small economies may not possess financial intermediation sector. When the financial intermediation opens up, however, as the size of financial market grows, the cost of the intermediation falls, increasing the productivity of capital. Moreover, Levine (1993) extends the idea by introducing increasing setting up costs for more sophisticated financial services. In this setting, the financial services which an economy can enjoy would change with the size of the financial sector.

Moreover, in Greenwood and Jovanovic model financial intermediaries can reduce project risks by observing a large number of productivity investments thereby differentiating "macro' shock from individual shocks. In King and Levine (1993a) model, the financial intermediaries can reduce investment risks gathering information on such intrinsic quality of the projects and/or the skills of the entrepreneurs associated with the projects. It is understood that the efficiency of the financial sector upon these activities would surely depend on the size of the financial sector of the economy.

These complicated threshold effects and the economy of scape effects associated with the financial sector would imply non-linear effects of the financial development upon the growth path of the economy; In other words, the effects of developments of financial sector upon economic development will alter as the size of financial sector changes in a complicated manner. Thus, an alternative approach to measure the effects of financial development might be to estimate non-linear effects directly.

As a first step, to focus on the non-linear effects of the developments of financial sector, we have removed the effects of the initial output level and human capital accumulation. We have done so simply by running a simple linear regression with dependent variable being DEPTH[14]. The residuals from the first stage regression are named growth rates unexplained, or abbreviated as GRU hereafter. For this GRU variable, we specify non-linear regression in a following Weibull-type,

$$GRU = G\ (DEPTH) = \alpha - (\alpha - \beta)\exp\{-(K \cdot \text{DEPTH})^{\delta}\} \tag{2}$$

This functional form is capable of having an inflection point. Moreover, the effect of the developments of financial sector upon economic growth is,

$$\frac{dG\ (\text{DEPTH})}{d\text{DEPTH}} = \delta\ K\ |\ \alpha - G\ (DEPTH)|\ *\ \left\{\log\ \frac{\alpha - G\ (0)}{\alpha - G\ (\text{DEPTH})}\right\}^{1-\frac{1}{\delta}} \tag{3}$$

Thus effects of financial development upon economic growth changes rather in a complicated way. Estimated result is in Table 10. For all the parameters, asymptotic t vales are rather significant. Our main focus is to see, how these effects changes according to the values of the financial indicator. Hence, calculated effects using these estimates are plotted in Figure 4. It is noteworthy that in this result the effects of financial developments at the very early stage are, in fact, almost nil for many countries. This evidence and the ever-increasing effects of the financial development at later stage seem to be consistent with the aforementioned theoretical arguments. Though this result serves only as an illustration, the existence of the financial threshold level might be reasonably

[14]Obviously, in this treatment, we ignore the non-linear effects of human capital accumulation.

Table 10　Non-Linear Estimation of Effects of Financial Development 1960-1989	
Dependent Variable: Unexplained Per Capita GDP Growth Rate	
α	0.0267
	(0.00718)
β	0.0295
ʹ	(0.00757)
δ	2.918
	(1.269)

Figure.4　Non-linear Effects of Financial Development
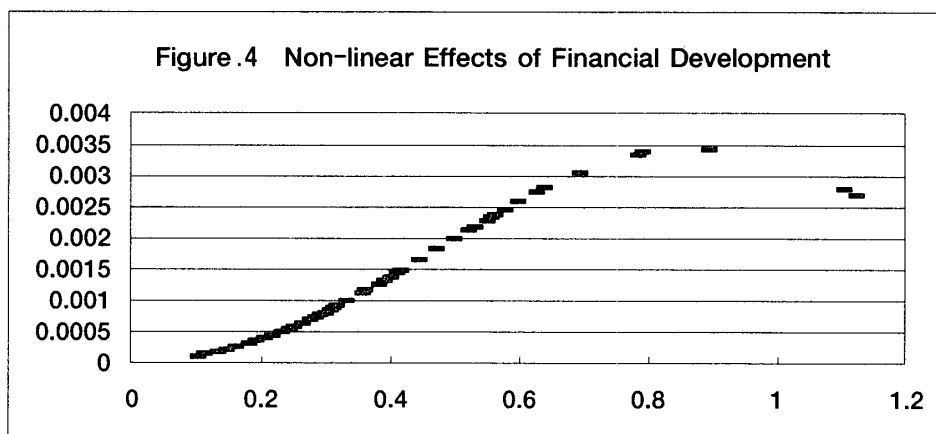
suspected.

V. Institutional Aspects of the Financial Development

In a stimulating paper Keefer and Knack (1997), they focused on institutional environment as another critical obstacle to the convergence of the world economy. Without appropriate institutional environment, a country may not accomplish required investment to absorb technological advances from developed countries. Furthermore they advocate that some countries with very poor institutions may face slower growth even after the effects of human and physical capital accumulation have been controlled for. Based on Gerschenkron (1952) type of technological catch up theory, they modified basic Barro type growth equation. First, they add a term called "income gap". Income gap is defined to be the difference between the log of 1960 real GDP per capita of U.S. (richest country) and the log of 1960 real per capita GDP for respective countries. It is understood that this term is formulated in a way to capture the notion of "relative backwardness". Another novelty in their analyses is a variable called " institutions". To measure institutional quality of a country, indicators such as country risk index, business risk index, executive constraints index were used. Moreover, they have additional term interacting institutional quality and income gap. They argue that, given a certain income gap for a country, the presence of better institutional environment will enhance incentives to move factors to more productive sectors of the economy. Moreover, the adoption of highly prospective new technology can be less easily adopted with deficient institutions. That is, the degree of the institutional quality may affect the degree at which relatively late-comer countries can take advantage of their relative position. In fact, they found several measures of institutional quality were statistically significant in their modified growth equation. Income gap term was highly significant as well.

In former sections of the study, we focused quantitative developments of financial sector of the economy. However, there should be no doubt that financial institutions are one of the most critical factors determining overall institutional quality of the economy; Financial institutions facilitate exchanges of the goods and services and realize better risk management for the economy and so on. Hence it is of our great concern to see how this type of institutional aspect of financial intermediaries may affect dynamic growth path of the economy.

Tough question for this inquiry is simply, how to find appropriate indexes measuring for institutional quality of financial intermediaries. However, Laporta, Lopez-de-Silanes, Shleifer, Vishny (1996) constructed a cross-country data with information on the legal and regulatory treatment of creditors and the efficiency of the legal system in enforcing contracts. Since these factors form the basis of financial activity, we may use this newly created data as surrogate variables for quality indexes of the financial institutions of the economy. As mentioned before, Levine (1997b) indeed employed these measures as instrumental variables for the financial indicators used in King and Levine (1993a), further validating their evidence. Nonetheless, here we are more concerned with the institutional character of the financial developments. Thus, we use these measures as indexes for the insitutional quality of the financial sector of the economy[15].

In line with Levine (1997b), we focus following variables. First, concerning regulatory systems for creditor's rights, three indicators will be used. AUTOSTAY equals one if a country's bankruptcy and reorganization laws impose an automatic stay on the assets of the firm, otherwise being zero. MANAGES equals one if the firm continues to manage its property pending the resolution of the reorganization process. Finally SECURED1 equals one if secured creditors are ranked first in the distribution of the proceeds resulting from the disposition of the assets of a bankrupt firm. Levine (1997b) further uses a combined indicator called CREDITOR. CREDITOR is defined as CREDITOR = SECURED - AUTOSTAY - MANAGES. Thus, it takes on values between 1 and -2. This combined index is expected to be positively correlated with higher quality of financial institutions. Secondly, regarding the efficiency of the legal system for enforcing contracts, three measures will be used. RISK OF EXPROPRIATION measures the risk of confiscation and forced nationalization of foreign enterprises. RISK OF REPUDIATION OF CONTRACTS is a measure of the risk that government will repudiate the terms of contracts with foreign business. Finally RULE OF LAW is scored high when a country exhibits sound political system, a string court system, and provision for an orderly succession of power. Furthermore, most of financial contracts use accounting measures in particular actions. Thus Levine (1997b) focuses another measure of the quality of information disclosed by corporate 's accounts. This measure called, ACCOUNT, is an index of the comprehensiveness of company reports.

In line with Keefer and Knack (1997), our specification for growth equation is,

$$GYP_i = a_0 + a_1 LSEC_{i,1960} + a_2 IG_{i,1960} + a_3 FQI_i + a_3 (IG_{i,1960} \times FQI_i) \tag{4}$$

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[15]There exist two problems. One problem is that using this data set restricts our empirical investigation for a much smaller size of sample countries. Second, some measures are rather of recent vintages, such as average value over the period 1982 to 1995. However, legal and regulatory environment may vary little over time, thereby somewhat justifying these measures.

Where

    IG: Income Gap in 1960.

    FQI: Financial Quality Indexes discussed above.

somewhat surprisingly the interactive terms were found insignificant in all cases. Regarding financial indexes, first, the estimated results using indexes associated with the efficiency of legal system are summarized in Table 11. All of these variables are significant at 1 % level. Moreover, the ACCOUNTvariable was significant at the 10% level without interactive term. However, somewhat surprisingly the interactive terms were found insignificant in all cases. Regarding financial indexes relating regulatory systems for creditors rights, the results are summarized in Table 12. Only variable which is marginally significant at 10% level is SECURED1 at this point. Furthermore, as for the legal indexes, interactive terms were insignificant as well. However, since we did not control other potential determineants in our growth equation , these results should not be taken as conclusive.

Table 11 Legal System Indeces for Financial Contracts and Economic Growth				
Dependent Variable: Average Growth Rate of Real Per Capita GDP				
Independent Variable	Risk of Expropriation	Risk of Repudation of Contracts	Rule of Law	Account
Constant	-0.078	-0.0068	-0.048	-0.03
	(0.012)	(0.011)	(0.01)	(0.015)
SEC	0.019	0.021	0.029	0.037
	(0.0102)	(0.01)	(0.011)	(0.014)
Income Gap	0.008	0.0081	0.0086	0.006
	(0.00097)	(0.00096)	(0.0012)	(0.0014)
Insitituional Variable	0.0089	0.0072	0.0044	0.00033
	(0.0012)	(0.0012)	(0.00094)	(0.00018)
Insitutional Variable × Income Gap	-0.00808	-0.0075	-0.0061	-0.0008
	(0.0053)	(0.0049)	(0.0035)	(0.00099)
R2	0.67	0.68	0.57	0.34
NOB	45	45	45	38

Table 12 Reguratory System Indeces for Creditor and Economic Growth				
Dependent Variable: Average Growth Rate of Real Per Capita GDP				
Independent Variable	Auto	SECU1	MANA	CRED
Constant	-0.024	-0.015	-0.071	-0.034
	(0.012)	(0.012)	(0.014)	(0.013)
SEC	0.035	0.037	0.038	0.036
	(0.014)	(0.014)	(0.014)	(0.014)
Income Gap	0.0044	0.0052	0.005	0.0045
	(0.00016)	(0.0016)	(0.0019)	(0.0017)
Insitituional Variable	-0.0025	0.0087	-0.0024	0.0018
	(0.0041)	(0.0052)	(0.0048)	(0.0024)
Insitutional Variable × Income Gap	0.017	0.007	0.0032	-0.109
	(0.0041)	(0.022)	(0.018)	(0.0099)
R2	0.17	0.2	0.13	0.15
NOB	42	42	42	42

Ⅳ. Conclusion

In this study, we first focused upon threshold effects associated with financial development. The results of quantile group regression echo with the existence of threshold effects due to educational and financial developments. Moreover, empirical evidences using of the convergence club regressions are not at odds with financial threshold effects either. An illustration of direct estimation of non-linear effects of financial development revealed some interesting empirical observations. Furthermore, we examined the institutional aspects of financial development using several measures. The results were, at the least, not hopeless.

However, the results obtained here should be taken with serious reservations because of various remaining problems; First of all, the empirical specification procedure for our growth regression would be the most serious problem. A hybrid specification of King and Levine (1993b) and Berthelemy and Varoudakis (1996b) for our growth equation should be reconsidered. Secondly, we should extend the data set so that the empirical analyses for the financial indicators can cover richer experiences, leading to sharper conclusions. Especially we should extend our data for initial financial indicators so that we can estimate growth regressions using instrumental variables. In this context, extending our data set to panel data will pave several new ways for the overcoming econometrical issues in Barro type of growth equations. Fourthly, we may seek more appropriate empirical measures regarding development of financial intermediaries in the economy.

Although this work remains only as preparatory exercises at this stage, we strongly feel that this area of research is promising but still rather unexplored and warrants further empirical examinations.

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