Ensayos
sobre POLÍTICA ECONÓMICA

Efeitos da intermediação financeira sobre o crescimento econômico colombiano

Constanza Martínez Ventura[*]

Os países que contam com sistemas financeiros altamente desenvolvidos tendem a apresentar maiores taxas de crescimento do PIB per capita do que aqueles que não atingiram esta desejável etapa financeira. Por trás desta premissa existe uma complexa estrutura teórica, associada aos efeitos que a intermediação financeira tem sobre as atividades produtivas. Segundo a literatura das crises bancárias os efeitos a curto prazo são negativos, enquanto que para a literatura endógena o crescimento destes efeitos é positivo a longo prazo. Avaliações empíricas para o caso colombiano, obtidas a partir de modelos ARDL, demonstram que os efeitos da intermediação financeira sobre o crescimento do produto são positivos tanto a curto como a longo prazo; resultados que apóiam a hipótese sustentada pela literatura endógena, mas contradizem o estabelecido pela literatura das crises bancárias.

Palavras chave: crescimento econômico, desenvolvimento financeiro, crise bancárias.

Classificação JEL: G21, O11, O16.

Efectos de la intermediación financiera sobre el crecimiento económico colombiano

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Los países que cuentan con sistemas financieros altamente desarrollados tienden a presentar mayores tasas de crecimiento del PIB per cápita que aquellos que no han alcanzado esta deseable etapa financiera. Detrás de esta premisa existe una compleja estructura teórica, asociada con los efectos que la intermediación financiera tiene sobre las actividades productivas. Según la literatura de las crisis bancarias los efectos de corto plazo son negativos, mientras que para la literatura endógena el crecimiento de estos efectos es positivo en el largo plazo. Evaluaciones empíricas para el caso colombiano, obtenidas a partir de modelos ARDL, demuestran que los efectos de la intermediación financiera sobre el crecimiento del producto son positivos tanto a corto como a largo plazo; resultados que apoyan la hipótesis provista por la literatura endógena, pero contradicen lo establecido por la literatura de las crisis bancarias.

Palabras clave: crecimiento económico, desarrollo financiero, crisis bancarias.

Clasificación JEL: G21, O11, O16.

The Effects of Financial Intermediation on Colombian Economic Growth

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Countries with highly developed financial systems tend have higher GDP growth rates than those than have not reached this desirable financial stage. Behind this premise there is a complex theoretical structure associated to the effects that financial intermediation have on the economic growth. The Literature on banking crises suggests that these effects may be negative in the short run whereas in the economic growth literature these are positive in the long run. In Colombia, the effects of financial intermediation on growth, evaluated by means of ARDL models, are positive in both the short and long run supporting the hypothesis of economic growth literature, but contradicting the hypothesis of banking crises literature.

Keywords: Economic growth, financial development, banking crises.

JEL classification: G21, O11, O16.

I.   INTRODUCTION

Traditional growth theory states that the functioning of the financial system can foster or delay economic growth. This relationship is fully supported by theoretical and empirical literature since both agree that its behavior tends to move inevitably in the same direction during periods of expansion and recession (Schumpeter, 1911; Greenwood and Jovanovic, 1990; Roubini and Sala-i-Martin, 1991; Bencivenga and Smith, 1991; King and Levine, 1993; Levine, 1997; Demirguc-Kunt, and Detragiache, 1998; etc.). From this perspective, a more developed financial system promotes economic growth by establishing an immediate link between savings and investment. At the same time, a more dynamic economy improves the performance of finance since an increasing output represents more money to channel through financial intermediaries. This self-evident explanation is the basis for endogenous growth literature, which simply states that economic activity and financial intermediation are positively correlated.

Nevertheless, the banking crisis literature provides an alternative approach which asserts that financial intermediation may affect growth negatively because of the existence of unexpected macroeconomic shocks that destabilize the functioning of the economy (Gavin and Hausmann, 1996; Kaminsky and Reinhart, 1999; Loayza and Ranciere, 2006). Once financial liberalization takes place, countries start to experience huge increases in foreign capital inflows, which may produce on unexpected excess of liquidity that contributes to increase credit expansion. In some cases, the inadequate regulation and supervision of the financial system, and/or the excessive risk taken by some banks may not stop credit growth. Furthermore, the occurrence of negative macroeconomic shocks may lead to a financial crisis and hence, to a deceleration in the economic growth rate.

According to Loayza and Ranciere (2006) although the effects described by these types of literature are contradictory, each one can be associated with different periods of time. While those effects may be negative in the short run, in the long run they are positive. This means that the hypothesis of banking crisis literature could be considered the best approach for studying the short run effects whereas the hypothesis of traditional growth literature would be the approach for evaluating the long run effects. However, as these authors also mentioned, short run adjustments of output growth may differ among countries since they are tied to characteristics specific to each country such as the vulnerability to shocks, monetary and fiscal adjustment mechanisms, imperfections in financial markets and price and wage flexibility. Furthermore, there is heterogeneity in short run dynamics, which is explained by the level of financial fragility and country specific characteristics (Demirguc et al., 1998, and 2000; Kaminsky et al., 1999).

During the 80's and 90's, some countries implemented policies to promote liberalization based on the idea of developing financial intermediation. Despite the fact that the consequences of those policies represent a considerable improvement in the functioning of the financial system nowadays, in some cases the adjustment process for liberalization implied high costs in terms of the recovery from the banking and economic crises that those countries underwent. Argentina (1991), Chile (1981-1982), Colombia (1982-1983), Mexico (1995), Uruguay (1982), Japan (1992) and Sweden (1991) are some cases in which financial crises were preceded by booms in banking loans mainly boosted by foreign capital (Gavin and Hausmann, 1996; Baliño and Sundararajan, 1991; Kaminsky and Reinhard,1999; Gourinchas, Landerretche and Valdes, 2001). The financial systems in some of these countries were not sufficiently prepared to face the consequences of economic shocks. In the absence of control mechanisms, the effects of banking crises and financial volatility on economic activity became even more severe (Baliño and Sundararajan, 1991).

Financial liberalization was a world-wide tendency, and Colombia was no exception. The consequences of that processsm explain the occurrence later of the economic and banking crisis, were also present in this country. This fact seems to reflect the premise of banking crisis literature whereas the positive relationship between credit and investment seems to reflect the statements of growth literature. Is it possible that both approaches contribute to explaining the relationship between financial intermediation and economic growth for the case of Colombia? In order to address this question and the existence of the hypotheses of short and long run referred to above, I implemented the ARDL model (Autorregresive Distributed Lags) proposed

by Pesaran and Pesaran (1997), which allowed me to test both effects while using the same specification.

It is important to mention that although the empirical evaluation in this document follows a structure similar to that used by Loayza and Ranciere (2006) to study the case of a group of countries with different levels of development, here the consequences of the banking crises are considered within the ARDL models rather than in a complementary analysis as was done by these authors. Thus, this document is not a contribution to the financial theory, but rather an interesting alternative analysis that integrates the above mentioned variables under a single empirical structure.

The results obtained for yearly Colombian data between 1960 and 2006 support the hypothesis of the endogenous growth literature but contradict the premise of the banking crisis literature. That is, financial intermediation affects economic growth in a positive manner in the short run as well as in the long run. Moreover, the results reveal that the variables of banking crises and financial volatility are negatively associated with economic activity. Although these findings suggest the presence of financial fragility, formal evaluations of this matter go beyond the scope of this document but would be interesting for further research.

The rest of the document is divided into four sections. Section II contains data description and stylized facts. The methodology is explained in section III. The results are given in section IV and the conclusions in section V.

II.   STYLIZED FACTS AND DATA DESCRIPTION

For the period under study (1960-2006), the influence that financial intermediation has had on Colombian economic growth is closely related to the evolution of economic activity and domestic loans as well as to the banking crises that the country underwent between 1982 and 1985 and in 1999.

According to Montenegro (1983), during 1976, the increase in the foreign prices of oil and coffee brought about a massive inflow of capital into the Colombian economy thus increasing expenditures on consumption leveraged with/by loans. The expansive economic phase was also intensified by the positive effects of the financial liberalization in 1980. However, a year later the abrupt fall in the prices of exportable goods, attributed to the international recession, generated a sudden stop

in the international capital flow as well as a considerable increase in the interest rates. As a consequence, banks began to face difficulties recovering the money from loans granted to the private sector, and at the same time, had to deal with massive withdrawals from savings accounts. Furthermore, the excessive risks taken by banks with most of the loans they granted, and the inadequate legal and regulatory framework led to a financial crisis between 1982 and 1985.

Some of the policies that the economic authorities adopted to face the banking crisis of 1982 implied a step backward in the liberalization process. However, some of these policies were temporary as the situation changed dramatically in the Nineties when the Colombian economy began to go through a trade and capital account opening and a financial liberalization process. This set of reforms together with the halt in the sterilization of foreign capital flows in 1991 tended to increase liquidity. Once again, the excess of money created by the foreign capital inflows augmented the domestic credit granted by the financial institutions until it reached a peak in 1993 (Vargas, 1996). In the mean time, this excess of liquidity contributed to the boom in the construction activity, which pushed up the prices of real estate. The situation remained the same until 1994 when the Central Bank was forced to increase the interest rates in order to defend the exchange rate band. This monetary policy lasted two more years. In 1998, a second and deeper banking crisis came about as a result of the economic crisis that had negative effects on banks (Echeverry and Salazar 1999).

The consequences of a restrictive monetary policy were strengthened by the unexpected fall in foreign capital inflows, which brought about a decrease in both savings and deposits. The economic recession, attributed in part to the high level of interest rates and to a worsening in the quality of loans, did limit the capacity of the banks to recover the loans–especially from debtors in real estate (Zuleta, 1997; Echeverry and Salazar, 1999; Olaya and Ramírez, 2004; Villar, Salamanca and Murcia, 2005).

After this brief review, it is important to emphasize the fact that the two crises the Colombian economy underwent have some common elements such as the effects generated by the flow of foreign capital on credit, and the expansion of domestic consumption financed with loans. In addition, both crises were preceded by the occurrence of financial liberalization, the same thing that happened in Argentina in 1980, Bolivia in 1987, Brazil in 1985 and Chile in 1981 as well as in many other cases (Kaminsky and Reinhart,1999).

All of the above mentioned elements are valuable for establishing the relationships that can be found between the growth rate of per capita gross domestic product (GDP), and the independent variables. The data include annual information for the 1960-2006 period (the statistical sources used to construct all the variables are listed in the appendix). The growth rate of per capita GDP is the dependent variable, and the ratio of domestic credit to GDP is the variable that measures financial intermediation (Graph 1).

Graph 1
Effects of Financial Intermediation on the Colombian Economic Growth: 1960-2006

A.   Growth Rate of GDP Per capita
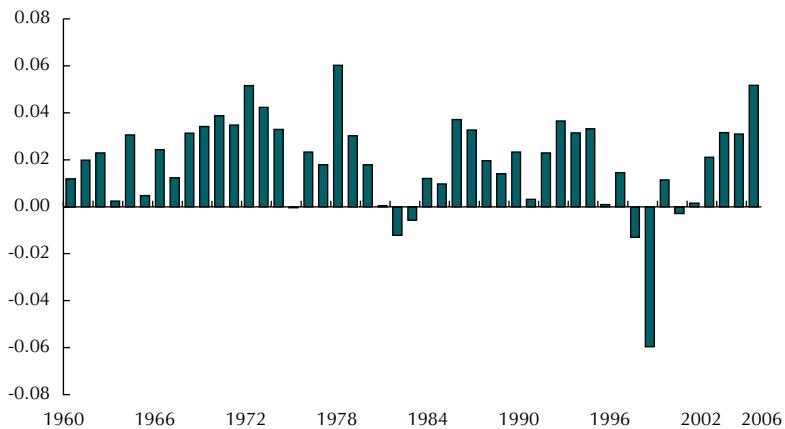
B.   Financial Intermediation
      Domestic credits/GDP
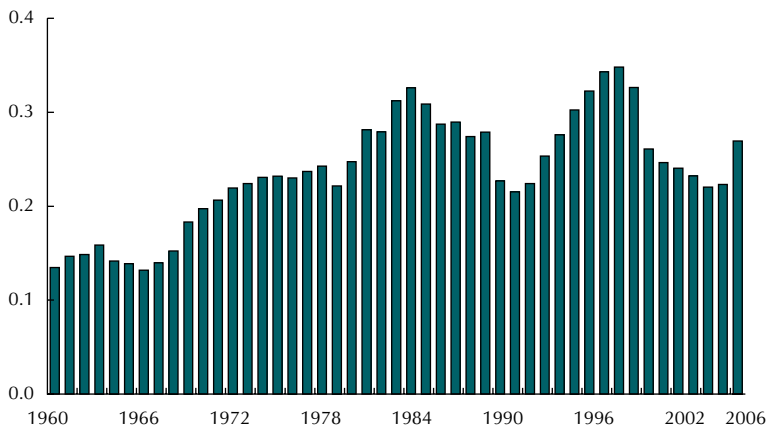
Source: DANE and Banco de la República; estimations of the author.

The estimations also include two additional variables related to financial intermediation: financial volatility and the banking crises as well as a set of control variables to reflect other elements related to the behavior of the GDP growth rate. These control variables, considered to be the most traditional determinants of economic growth, are the government size as a ratio to GDP, trade openness (imports and exports as a ratio to GDP), inflation index, number of years of schooling, reserve requirement, and kidnapping rate (ratio of the number of kidnappings per hundred thousand inhabitants). With respect to this, a priori positive effects of education and trade openness are expected on an almost intuitive level and negative effects of inflation, reserve requirements, government size, and kidnapping rate on economic growth.

III.   METHODOLOGY

The procedures for addressing the short and long run effects are restricted to two alternatives–one is provided by the cointegration analysis, and the other is the Autoregressive Distributed Lags (ARDL) model. As argued by Shrestha and Chowdhury (2005) both methodologies make it possible to evaluate the short and long run effects, but the ARDL procedure seems to have more power since this method does not display the limitations that cointegration models have when the variables exhibit different orders of integration.

Multivariate cointegration models make reference to the work done by Johansen (1988 and 1991) and Johansen and Juselius (1990), and the tests derived from this procedure are based on the Maximum Likelihood estimation of cointegrating relationships under error correction models (Pesaran and Pesaran, 1997). The only requirement needed to provide valid results is that all of the variables have the same order of integration.

Recently, some weaknesses in the methods of cointegration (Loayza and Ranciere, 2006; Shrestha and Chowdhury, 2005) have been identified in the economic literature. One of them is related to the fact that the procedure does not provide alternatives if the variables considered exhibit different orders of integration. The other criticism makes reference to the low power of the trace test used to determine the number of cointegrating vectors, which can cause the existence of a long run relationship to be determined erroneously.

In contrast, and according to Pesaran and Pesaran (1997), the ARDL model yields consistent estimation of the parameters independently of the integration level of the variables. Hence, this is a more suitable alternative than the Johansen cointegration procedure if the integration level of the variables is unknown or if the variables exhibit different orders of integration (Shrestha and Chowdhury, 2005). That is, the ARDL model is a linear specification of multiple equations that consists of a two step procedure. The first step involves the estimation the long run relationship between variables, which depends on the lag structure selected. In the second step, after proving the existence of the long run relationship, the error correction representation is necessary to examine the short and long run dynamics. For this procedure to generate valid results, the specification should include sufficient lags so as to capture the generating process in order to ensure that the regressors are exogenous and to guarantee that the error term does not exhibit serial correlation problems (Laurenceson and Chai, 2003).

Considering the characteristics stated previously, the OLS model used to evaluate the long term relationship between per capita GDP growth and the independent variables is defined by equation (1):

$$LGDP_t = \zeta_0 + \zeta_1 t + \beta \, LINTER_t + \delta \, VOLAT_t + \phi \, BANKING_t + \tau \, LX_t + \varepsilon_t \qquad (1)$$

The term $LGDP_t$ is the logarithm of per capita GDP and ζ_0 and ζ_1 account for the coefficients of the constant term and trend as the deterministic regressors. $LINTER_t$ is the logarithm of financial intermediation, $VOLAT_t$ is the variable of financial volatility, $BANKING_t$ is the banking crisis dummy and LX_t includes the additional variables that may also influence economic growth such as: trade openness, inflation index, government size, number of years of schooling, reserve requirements, and kidnapping rate. In the models the control variables are included in groups of two in order to have enough degrees of freedom to get consistent estimates of the short and long run relationships. In this sense, it is important to remember that 47 years of data is available besides the fact that each model includes, at most, four lags of the variables.

The ARDL models allow the error correction term, which is the one that captures the speed of convergence towards equilibrium, to be analyzed. This term is obtained from the long term coefficients of equation (1) and, in this case, is explained by equation (2):

$$ECM_t = LGDP_t - \beta \, LINTER_t - \delta \, VOLAT_t - \phi \, BANKING_t - \tau \, LX_t - \zeta_0 - \zeta_1 t \qquad (2)$$

The standard specification of the ARDL model (equation 3) facilitates the evaluation of the short and long run association between financial intermediation and output growth:

$$\Delta LGDP_t = \alpha_0 + \alpha_1 t + \lambda_1 LGDP_{t-1} + \lambda_2 LINTER_{t-1} + \lambda_3 VOLAT_{t-1} +$$

$$+ \lambda_4 LX_{t-1} + \sum_{i=0}^{p1} \gamma_i \Delta LGDP_{t-i} + \sum_{i=0}^{p2} \beta_i \Delta LINTER_{t-i} + \sum_{i=0}^{p3} \delta_i \Delta VOLAT_{t-i} + \qquad (3)$$

$$+ \sum_{i=0}^{p4} \tau_i \Delta LX_{t-i} + \psi_i BANKING_t + v_t$$

In this equation λ_1, λ_2, λ_3 and λ_4 represent the long run coefficients of per capita GDP, financial intermediation, financial volatility and the additional control variables included. And, γ_i, β_i, δ_i, τ_i and ψ_i are the coefficients that explain the economic growth in the short run. Specifically, $\Delta LGDP_t$ is the rate of growth of the GDP per capital $\Delta LINTER_t$, is the rate of growth of financial intermediation, $\Delta VOLAT_t$ is the difference in the financial volatility level, and ΔLX_t represents the rate of growth of the additional control variables. The terms *(p1, p2, p3 and p4)* represent the number of lags for each one of the variables included in the specifications.

The general error correction representation of this ARDL model is given by equation 4:

$$\Delta LGDP_t = \alpha_0 + \alpha_1 t + \phi_i ECM_{t-1} + \sum_{i=0}^{p1} \gamma_i \Delta LGDP_{t-i} + \sum_{i=0}^{p2} \beta_i \Delta LINTER_{t-i} +$$

$$+ \sum_{i=0}^{p3} \delta_i \Delta VOLAT_{t-i} + \sum_{i=0}^{p4} \tau_i \Delta LX_{t-i} + \psi_i BANKING_t + v_t \qquad (4)$$

Where ECM_{t-1}, is the error correction term, which was obtained from the long run ARDL estimation and, v_t represents the error term for this specification.

IV.   EMPIRICAL RESULTS

Table 1 presents the Augmented Dickey Fuller tests of Unit Root for all the variables. This, although it is not part of the procedure proposed by the methodology of the ARDL model, demonstrates that differences in the order of integration of the variables do exist and, therefore, confirms that the chosen model is an appropriate

Table 1
Augmented Dickey Fuller Test of Unit Root, 1960-2006

Variable	Model	Optimal number of lags Schwarz criteria	Ljung & box p-value (Chi^2)	T-statistic	Critical value 5%	Conclusion
Log of GDP per capita	Intercept, time trend	1.0	0.285	-2.19	(3.41)	I (1)
Financial intermediation Log of (domestic credit/GDP)	Intercept, no time trend	1.0	0.917	-1.78	(2.86)	I (1)
Financial volatility (Standard deviation of monthly active interest rate)	Intercept, no time trend	0.0	0.852	(4.09)	(2.86)	I (0)
Government size Log of (government functioning expenditure/GDP)	Intercept, no time trend	0.0	0.754	(4.48)	(2.86)	I (0)
Trade Log of (exports + imports/GDP)	Intercept, time trend	0.0	0.973	(3.68)	(3.41)	I (0)
Log of consumer price index	Intercept, no time trend	2.0	0.751	(1.54)	(2.86)	I (1)
Log of number of schooling years [a]	Intercept, no time trend	1.0	0.258	(1.97)	(2.86)	I (1)
Log of instrumented variable of required reserve ratio	Intercept, no time trend	2.0	0.719	(3.48)	(2.86)	I (0)
Log of kidnappings rate	Intercept, time trend	0.0	0.416	(1.46)	(3.41)	I (1)

a/ Critical values of Mackinnon, J. (1993).
Estimation and Inference in Econometrics, Oxford University Press.
Source: estimations of the author.

procedure for studying the Colombian case. As can be seen from the results, the number of lags was determined by means of the Schwarz Bayesian criterion since it represents the most parsimonious specification. Furthermore, notice also that none of the variables present serial correlation problems as displayed by the results of the Ljung & Box tests.

The results of unit root tests reveal that the GDP, financial intermediation, consumer price index, years of schooling and kidnapping rates are non-stationary variables (I(1)). But the measures of financial volatility, trade, government size and the reserve requirement are stationary (I(0)). The mixed order of integration of the variables supports the ARDL methodology as a suitable alternative for addressing the short and long run dynamics.

The methodology proposed by Pesaran and Pesaran (1997) consists of two steps. In the first place, it requires demonstrating that the long term relationship between the variables does exist so that the ARDL estimation makes sense and makes it possible to proceed with the construction of the Error Correction Representation in the second step. The null hypothesis (Ho) for the non-existence of long term relationships is defined as:

$$H_0 : \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$$

Against $H_1 : \lambda_1 \neq 0, \lambda_2 \neq 0, \lambda_3 \neq 0, \lambda_4 \neq 0$

Where λ_1, λ_2, λ_3 and λ_4 are the long term coefficients included in equation 3. The evaluation of this hypothesis is done by means of the F-test. Moreover, consistency requires that the results of these F-tests and the significance level of the ECM_{t-1} term in the error correction representation (equation 4) coincide with respect to the existence of the long term relationship.

It is also relevant to clarify that, as explained by Pesaran and Pesaran (1997), the F-statistic has a non-standard distribution so that it is necessary to consider two critical bounds to contrast the long run hypothesis. According to Pesaran, Shin and Smith (2001), those critical bounds make it possible to identify three intervals. The first goes from zero to I(0). The second is from I(0) to I(1), and the last interval is from I(1) to any positive superior value. The idea behind these intervals is simply to interpret the existence of long term relationships. That is, if the F-test result is lower than the minimum bound, there is no long term relationship between variables and, therefore, the ARDL model does not make any sense. If the result of the F-test is higher than the upper bound, it is clear that a long term relationship exists and the ARDL model can be estimated. However, if the result of the F- test is inside the interval defined by the critical values, a conclusion can not be drawn, since this area defines a region of uncertainty about the existence of a long run relationship.

The F-tests for each of the models including four lags are presented in Table 2. In Model 1, F(*LGDP/ LINTER, LTRADE, LGSIZE, VOLAT*), denotes the F-statistic for testing (Ho) that the growth rate of GDP per capita is not related in the long term to financial intermediation, trade openness, government size and financial volatility. In this case, the null hypothesis can be rejected since the test (7.11) exceeds the upper critical bound (4.25) evaluated at 5%. Similarly, the F-tests for models 2 to 6 exceed the upper critical boundary. That is to say that there is a long term relationship between the variables, which makes it possible to proceed with the estimation of the ARDL models.

Table 2
Test for the Existence of a Levels Relation, Colombia, 1960-2006

	Model	Dummy of banking crises		*F-test*		Critical bounds at 5%	
						I(0)	I(1)
1	Intercept & trend	1982-1985; 1998-1999	F(lgdp/linterm, ltrade, lgsize, volat)	F(5, 15)	7.11	3.12	4.25
2	Intercept & trend	1982-1985; 1998-1999	F(lgdp/linterm,lcpi, volat)	F(4, 19)	6.61	3.47	4.57
3	Intercept	1982-1985; 1998-1999	F(lgpd/linterm, lschool, trade)	F(4, 20)	8.55	2.86	4.01
4	Intercept & trend	1982-1985; 1998-1999	F(lgdp/linterm, livrr, lgsize, volat)	F(5, 15)	7.81	3.12	4.25
5	Intercept & trend	1982-1985; 1998-1999	F(lgdp/linterm, lkidnap, lgsize, volat)	F(5, 14)	5.88	3.12	4.25
6	Intercept & trend	1998-2006	F(lgdp/linterm, lgsize, ltrade, volat)	F(5, 14)	7.21	3.12	4.25
7	Intercept	1998-2006	F(lgdp/linterm, lschool, ltrade, volat)	F(5, 14)	3.57	2.62	3.79
8	Intercept & trend	1998-2006	F(lgdp/linterm, lkinap, ltrade, volat)	F(5, 13)	2.55	3.12	4.25
9	Intercept & trend	1998-2006	F(lgdp/linterm, ltrade, volat)	F(4, 19)	2.14	3.47	4.57

Source: Pesaran, Shin and Smith (2001), asymptotic critical value bounds for the *F* statistic.
Critical values for unrestricted intercept and no trend, and for unrestricted intercept and unrestricted trend; respectively.

The results for models 7, 8 and 9 are quite different from the other cases. The F-test for Model 7 is inconclusive about the existence of a long run relationship because the value of the test falls into the region of uncertainty. For models 8 and 9, the results clearly show the absence of long run effects since the values are below the minimum boundaries.

The inference about the finance and growth association is based on the first six models that account for the dynamics in the short and long run. The terms in parenthesis are the lags of the variables that define the GDP in terms of the structure of lags. For example, Model 2 which is an ARDL (3, 2, 4, 0) depends on three lags of the GDP, two lags of financial intermediation, four lags of inflation index, and zero lags of financial volatility.

The traditional diagnostic tests demonstrate that the error term fulfills the ideal conditions in all the models, which includes the absence of serial correlation and heteroscedasticity, normality and an adequate functional form (Table 3). Among these tests the most relevant is the lack of serial correlation since it labels the variables as exogenous, which is essential to validating the results (Demirguc and Detragiache, 1998; Loayza and Ranciere, 2006). Note that except for Model 5, all the other tests far surpass a value of 0.05 indicating that the error term is not correlated.

In addition to the diagnostic test on the error term, the Cumulative Sum of Recursive Residuals (CUSUM) stability test and the Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) are additional ways to examine how closely the specifications fit. The graphs corresponding to each model (graphs 2, 3, 4, 5 and 6) demonstrate that, at 5% of significance in the critical bounds, structural breaks are absent and models are correctly specified. The structural break tests for model 6 are not presented because this model is focused on the last seven years and, therefore, they are completely incomparable with the other results.

In the interpretation of the model coefficients, the results of long and short run effects are treated separately while keeping in mind the fact that each case may be associated with a particular hypothesis. In general, the results show that most of the coefficients exhibit the expected sign and are statistically significant at 10%.

A.   LONG RUN RESULTS

The results support the existence of a positive and significant effect of financial intermediation on the per capita GDP growth rate. The t-statistic associated with the coefficient of this variable in all the specifications confirms the existence of the traditional growth hypothesis, according to which the reduction in credit cost promotes economic activities. Furthermore, this result is in line with the findings of King and Levine (1993), Levine, Loayza and Ranciere (2000) and, Loayza and Rancíere (2006) in the sense that a deeper financial intermediation is essential for economic growth.

Table 3
Equilibrium Correction Form of the ARDL
Rate of growth of the GDP per capita, 1960–2006

Variables		Model 1 ARDL(1,2,0,4,3)		Model 2 ARDL(3,2,4,0)		Model 3 ARDL(2,1,3,4)	
		Coeff.	T-ratio	Coeff.	T-ratio	Coeff.	T-ratio
Long run coefficients							
	Financial intermediation	0.085	1.65*	0.110	3.07***	0.239	4.09***
	Government size	-0.292	-3.52***				
	Trade openness	0.258	2.29**			0.258	1.85*
	Inflation index			-0.056	-2.08**		
	Number of schooling years					0.512	3.22***
	Financial Volatility	-2.812	-1.77*	-0.351	-0.7		
	Dummy of banking crises 1982-1985, 1998-1999			-0.068	-2.73***	-0.109	-2.15**
	Intercept	13.430	30.50***	13.662	123.54***	13.987	30.22***
	Trend	0.019	4.58***	0.027	5.32***		
Error correction coefficients							
	Phi	-0.299	-3.27***	-0.497	-3.33***	-0.327	-2.95***
Short run coefficients							
Δ	Growth of GDP(-1)	0.701	7.66***	0.845	5.42***	1.078	6.31***
Δ	Growth of GDP(-2)			-0.212	-1.08	-0.405	-2.56***
Δ	Growth of GDP(-3)			-0.130	-0.85		
Δ	Financial intermediation	0.113	3.00***	0.062	1.84*	0.048	1.32
Δ	Financial intermediation(-1)	-0.060	-1.13	0.056	1.26	0.030	0.83
Δ	Financial intermediation(-2)	-0.028	-0.81	-0.064	-1.99**		
Δ	Trade openness	0.077	3.33***			0.051	1.78*
Δ	Trade openness(-1)					-0.051	-1.70*
Δ	Trade openness(-2)					0.032	1.33
Δ	Trade openness(-3)					0.003	0.14
Δ	Trade openness(-4)					0.050	2.28**
Δ	Government size	-0.060	-2.012**				
Δ	Government size(-1)	0.051	1.84*				
Δ	Government size(-2)	-0.032	-1.17				

Table 3 (continue)
Equilibrium Correction Form of the ARDL
Rate of growth of the GDP per capita, 1960–2006

	Variables	Model 1 ARDL(1,2,0,4,3)		Model 2 ARDL(3,2,4,0)		Model 3 ARDL(2,1,3,4)	
		Coeff.	T-ratio	Coeff.	T-ratio	Coeff.	T-ratio
Δ	Government size(-3)	0.055	1.78*				
Δ	Government size(-4)	-0.101	-3.61***				
Δ	Inflation index			0.045	1.13		
Δ	Inflation index(-1)			0.029	0.65		
Δ	Inflation index(-2)			0.003	0.07		
Δ	Inflation index(-3)			-0.020	-0.52		
Δ	Inflation index(-4)			-0.086	-3.14***		
Δ	Number of schooling years					0.058	0.19
Δ	Number of schooling years(-1)					0.775	1.54
Δ	Number of schooling years(-2)					-1.181	-2.39***
Δ	Number of schooling years(-3)					0.516	1.72*
Δ	Financial volatility	-0.500	-2.52***	-0.175	-0.79		
Δ	Financial volatility(-1)	-0.172	-0.83				
Δ	Financial volatility(-2)	0.392	1.75*				
Δ	Financial volatility(-3)	-0.561	-2.65**				
Dummy of banking crises 1982-1985, 1998-1999				-0.034	-4.21***	-0.036	-3.53***
	Intercept	4.019	3.35***	6.794	3.30***	4.579	2.89***
	Trend	0.006	2.34***	0.014	3.97***		
Diagnostic tests							
	Serial correlation	F(1, 26)	0.885 [0.355]	F(1, 27)	1.179 [0.287]	F(1, 26)	0.014 [0.907]
	Functional form	F(1, 26)	2.031 [0.166]	F(1, 27)	0.930 [0.343]	F(1, 26)	0.694 [0.412]
	Normality	CHSQ (2)	0.168 [0.919]	CHSQ (2)	0.671 [0.715]	CHSQ (2)	3.948 [0.139]
	Heteroscedasticity	F(1, 41)	0.286 [0.595]	F(1, 41)	0.392 [0.535]	F(1, 40)	2.316 [0.136]

Table 3 (continue)
Equilibrium Correction Form of the ARDL
Rate of growth of the GDP per capita, 1960–2006

| Variables		Model 4 ARDL(1,0,0,4,1)		Model 5 ARDL(1,3,0,4,3)		Model 6 ARDL(1,1,4,0,3)	
		Coeff.	T-ratio	Coeff.	T-ratio	Coeff.	T-ratio
Long run coefficients							
	Financial intermediation	0.252	3.33***	0.137	1.94*	0.098	2.42***
	Government size	-0.416	-3.52***	-0.359	-3.83***	-0.218	-2.26**
	Trade openness					0.232	2.62***
	Kidnappings			-0.011	-1.00		
	Required reserves ratio_iv	-0.071	-1.68*				
	Financial volatility	-2.680	-1.45	-3.718	-1.72*	-2.167	-1.57
	Dummy of banking crises 1982-1985,1998-1999	-0.135	-2.08**	-0.093	-1.87*		
	Dummy of banking crises 1998-2006					-0.033	-1.04
	Intercept	13.207	34.28***	12.862	31.91***	13.624	31.36
	Trend			0.027	7.63***	0.018	4.73***
Error correction coefficients							
	Phi	-0.222	-2.46***	-0.257	-2.72***	-0.346	-3.60***
Short run coefficients							
Δ	Growth of GDP(-1)	0.778	8.62***			0.654	6.79***
Δ	Financial intermediation	0.056	2.70***	0.075	1.95*	0.124	3.63***
Δ	Financial intermediation(-1)			-0.022	-0.39	-0.090	-3.09***
Δ	Financial intermediation(-2)			-0.006	-0.12		
Δ	Financial intermediation(-3)			-0.012	-0.37		
Δ	Trade openness					0.080	3.39***
Δ	Government size	-0.060	-2.42***	-0.070	-2.40***	-0.057	-1.89*
Δ	Government size(-1)	0.053	2.02**	0.053	1.91*	0.056	2.19**
Δ	Government size(-2)	-0.022	-0.87249	-0.018	-0.63	-0.033	-1.22
Δ	Government size(-3)	0.011	0.43784	0.033	1.02	0.059	1.99**

Table 3 (continue)
Equilibrium Correction Form of the ARDL
Rate of growth of the GDP per capita, 1960–2006

	Variables	Model 4 ARDL(1,0,0,4,1)		Model 5 ARDL(1,3,0,4,3)		Model 6 ARDL(1,1,4,0,3)	
		Coeff.	T-ratio	Coeff.	T-ratio	Coeff.	T-ratio
	Government size (-4)	-0.075	-2.96***	-0.091	-3.10***	-0.100	-3.66***
Δ	Kidnappings			-0.003	-1.14		
Δ	Required reserves ratio_iv	-0.016	-2.40***				
Δ	Financial volatility	-0.193	-0.93	-0.264	-1.28	-0.383	-1.80*
Δ	Financial volatility (-1)	-0.402	-2.00**	-0.246	-1.13	-0.148	-0.73
Δ	Financial volatility (-2)			-0.051	-0.23	0.387	1.74*
Δ	Financial volatility (-3)			-0.395	-1.78*	-0.605	-3.18***
	Dummy of banking crises 1982-1985,1998-1999	-0.030	-4.00***	-0.024	-2.79***		
	Dummy of banking crises 1998-2006					-0.011	-0.98
	Intercept	2.933	2.47***	3.307	2.70***	4.711	3.64***
	Trend	0.005	2.38***	0.007	2.88***	0.006	2.58***
	Diagnostic tests						
	Serial correlation	F(1, 29)	0.690 [0.413]	F(1, 24)	5.128 [0.033]	F(1, 26)	2.087 [0.161]
	Functional form	F(1, 29)	0.340 [0.564]	F(1, 29)	1.209 [0.282]	F(1, 26)	1.849 [0.186]
	Normality	CHSQ (2)	1.849 [0.397]	CHSQ (2)	0.028 [0.986]	CHSQ (2)	0.769 [0.681]
	Heteroscedasticity	F(1, 41)	2.409 [0.128]	F(1, 41)	0.116 [0.735]	F(1, 41)	0.188 [0.667]

Significant at (*)10%, (**)5% and (***)1%
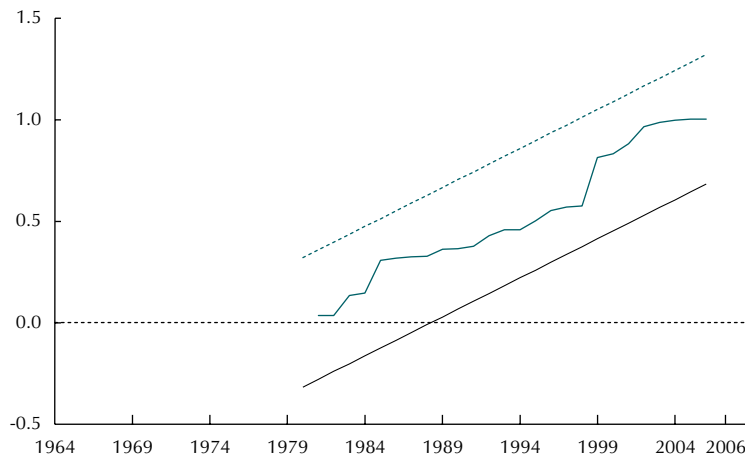Source: estimations of the author

Graph 2
Model 1 ARDL (1, 0, 0, 0, 1)

A.   Plot of cumulative sum of recursive residuals
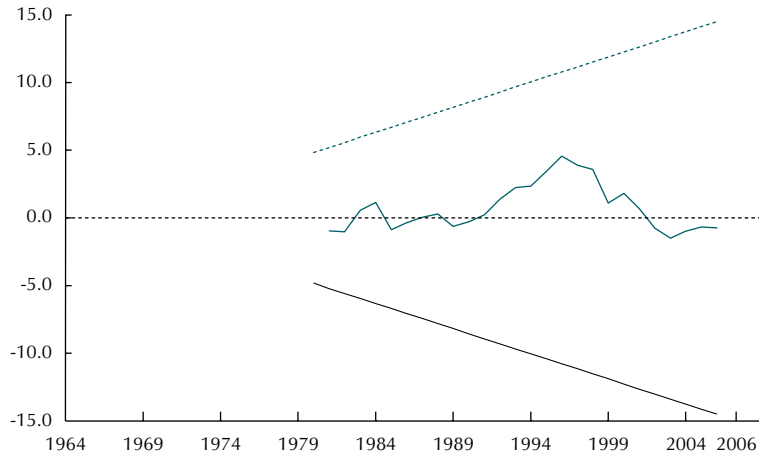
Note: The straight lines represent critical bounds at 5% significance level.

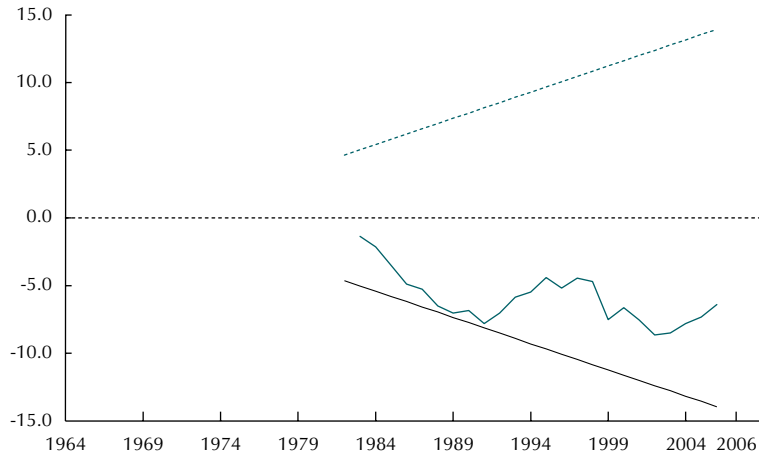B.   Plot of cumulative sum of squares of recursive residuals

Note:The straight lines represent critical bounds at 5% significance level.
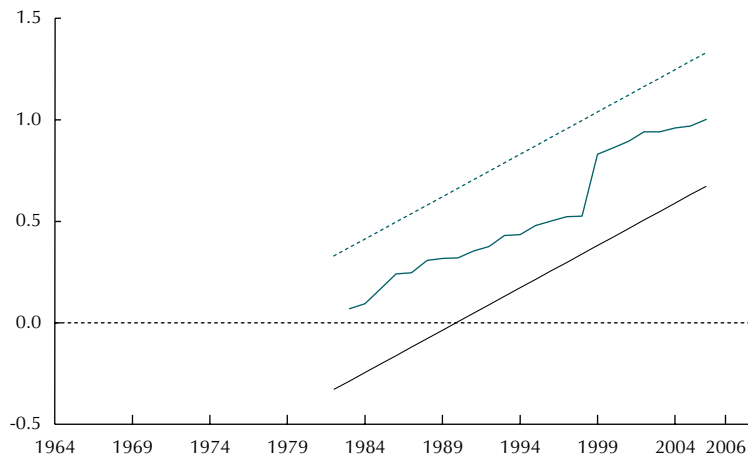Source: estimations of the author

Graph 3
Model 2 ARDL (3, 2, 4, 0)

A.   Plot of cumulative sum of recursive residuals

Note: The straight lines represent critical bounds at 5% significance level.

B.   Plot of cumulative sum of squares of recursive residuals
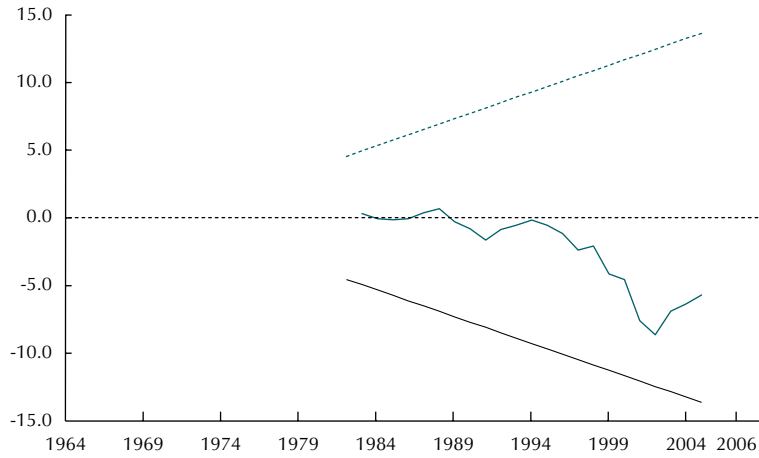

Note: The straight lines represent critical bounds at 5% significance level.
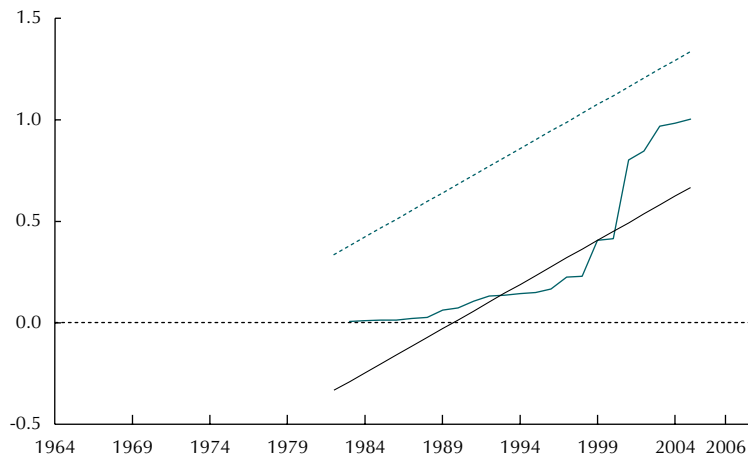Source: estimations of the author

Graph 4
Model 3 ARDL (2, 1, 3, 4)

A.   Plot of cumulative sum of recursive residuals

Note: The straight lines represent critical bounds at 5% significance level.

B.   Plot of cumulative sum of squares of recursive residuals
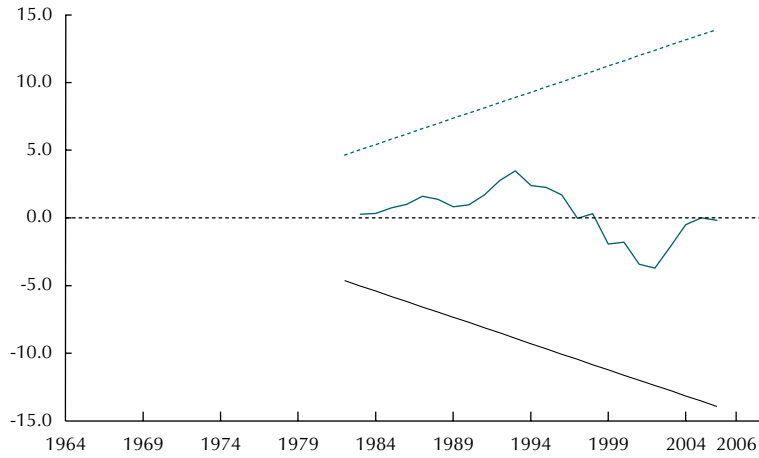

Note: The straight lines represent critical bounds at 5% significance level.
Source: estimations of the author

Graph 5
Model 4 ARDL (1, 0, 0, 4, 1)

A.   Plot of cumulative sum of recursive residuals

Note: The straight lines represent critical bounds at 5% significance level.

B.   Plot of cumulative sum of squares of recursive residuals

Note: The straight lines represent critical bounds at 5% significance level.
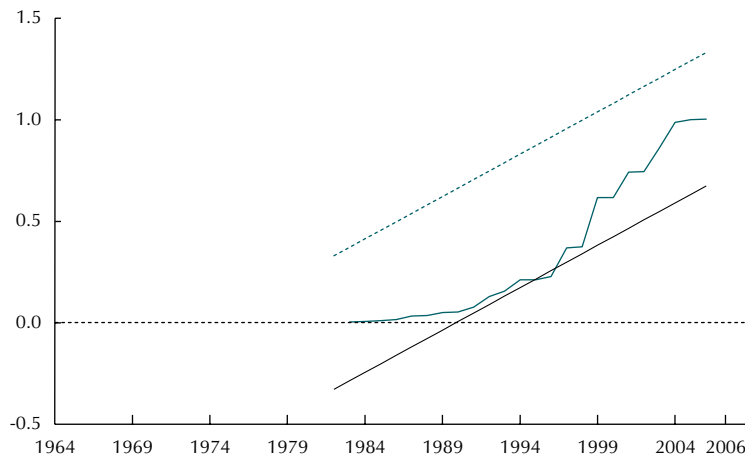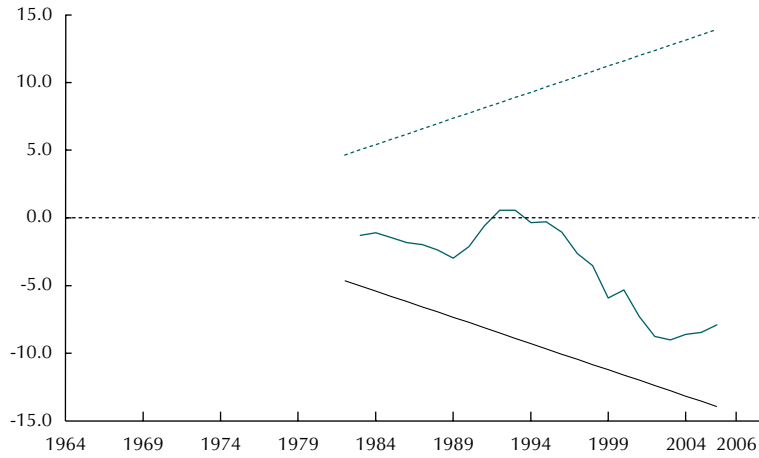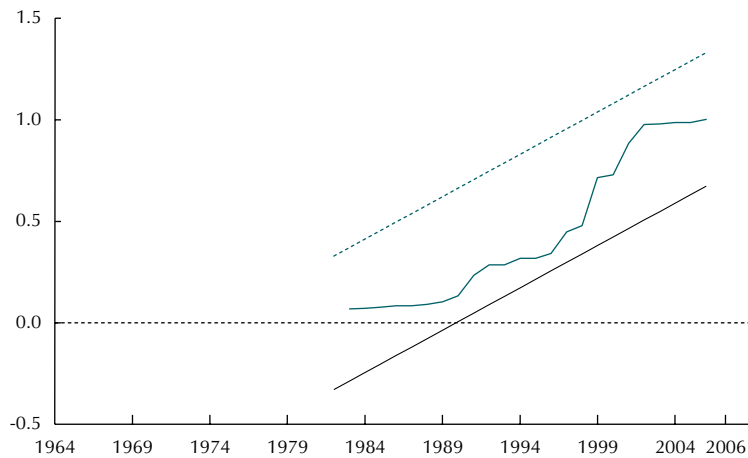Source: estimations of the author

Graph 6
Model 5 ARDL (1, 3, 0, 4, 3)

A.   Plot of cumulative sum of recursive residuals

Note: The straight lines represent critical bounds at 5% significance level.

B.   Plot of cumulative sum of squares of recursive residuals

Note: The straight lines represent critical bounds at 5% significance level.
Source: estimations of the author

The positive effects on economic growth come from the trade openness and educational variables. Firstly, the coefficient of trade (0.258 in model 3 and 0.232 in model 6) supports the new trade theory according to which the differences in comparative advantages represent additional gains as international trade increases. In return, this would create better conditions for improving the growth rate of the GDP. In relation to the variable of years of schooling, model 3 predicts a positive contribution to growth (0.512). This result confirms the previous deduction in relation to the advantages that higher educational levels represent to productive activities.

Other variables such as inflation, banking crises, financial volatility, government size and reserve requirements exert a negative effect on economic growth.

As expected, the inflation index (-0.056 in model 2) and the banking crisis variable (in models 1 to 5) are negatively related to the GDP. In other words, more stable levels of inflation and the absence of banking crises would improve economic activities.

The tests related to the banking crises consider two cases. Models 1 to 5 evaluate the specific time period of each crisis (from 1982 to 1985, and from 1998 to 1999) while model 6 evaluates the duration of the effects of the crisis at the end of 90s. According to the results, both crises negatively affected the rates of output growth. However, their consequences in regards to the per-capita GDP growth were temporary.

With respect to the variable of financial volatility, the results should be interpreted carefully since, though its effects on growth are always negative, these turn out to be significant only in models 1 and 5.

Similarly, the variables that capture government size and the reserve requirements are negatively related to economic activity. In the case of the government variable, models 1, 4, 5 and 6 display extremely high values thus warning us about the importance of reducing its size in order to stimulate productive activities. In the case of reserve requirements, the coefficient (-0.071 in model 4) confirms the idea that liquidity restrictions may limit investment decisions and productive activities. However, the coefficient of this variable is quite small, which may be linked to the fact that this ratio has been remained steady over the last eight years.

Last but not least, with respect to the relationship between kidnappings and economic growth, the estimated coefficient in model 5 is negative but does not imply any effect on GDP growth since this parameter is not statistically different from zero.

B.   SHORT RUN RESULTS

The short run dynamics described by the results suggest that the immediate effects of financial intermediation on economic growth are positive thus supporting the fact that the evolution of both variables is closely connected. However, this result contradicts the premise of the banking crisis literature since the expected negative sign was not found in the coefficients of financial intermediation. This is a very interesting result since the specifications include the variables of financial volatility and banking crises in order to capture the effects of financial fragility on economic growth. With respect to this, note that the coefficients of the banking crises and financial volatility are significant, and that both take negative values in all the models thus reflecting the occurrence of economic downturns. The economic theory associates both variables with the existence of financial fragility, which is particularly important if its level exceeds the socially desirable level. Since the ARDL procedure does not allow this premise to be tested formally, it can not be concluded that financial fragility is above or below that point. Furthermore, this result brings to mind a remark made by Loayza and Ranciere (2006) according to which adjustments of output growth may be countries-heterogeneous thus proving that there are differences between countries' sensitivity to shocks, economic policies, price flexibility, and market imperfections.

By adding the coefficients of the lags for the short run for each of the variables included, the results may be easily summarized by a positive association of trade and a negative association of inflation index and reserve requirements. The trade openness variable contributes to growth as the results in models 1 and 6 establish. In contrast, the variables of inflation and the reserve requirements end up reducing GDP growth rates, according to models 2 (-0.086) and 4 (-0.016) respectively.

The consequences of the other variables represent the lag structure that supports the estimates of the short run dynamics. The error correction coefficient (ECM_{t-1}) is even more important than this as it collects the speed of convergence to equilibrium when the economy is exposed to a shock in addition to confirming the existence of long term relationship. In all of the models, the ECM term is statistically significant at 5% thus verifying the long term relationship between financial intermediation and GDP growth rates. In addition, in five out of the six specifications (models 2 to 6) the speed of convergence is above 22%.

To summarize, financial intermediation and the growth rate of the GDP per capita are positively associated in the short and long run. These results support the

hypothesis of the endogenous growth literature and of long run effects, which reflect the advantages that credit expansions represent when they are transformed into increasing investments and promote economic activities. However, the short run estimates, also positive, contradict the statements of the banking crisis literature.

These short run effects are not surprising since previous research by King and Levine (1993) on this subject also found the same positive association under several measures of financial intermediation and for a set of eighty countries with different levels of development. A plausible explanation for this is that the adjustment dynamics among countries may present heterogeneities, mostly explained by the level of financial fragility and the specific characteristics of the country (Demirguc and Detragiache, 1998, 2000; and Kaminsky and Reinhart, 1999). These specific characteristics indirectly determine the short run relationship between finance and economic growth. Moreover, according to Bergoeing, Kehoe, Kehoe and Soto (2002) the extent of negative shocks, their duration and effects on output growth are deeply connected to the institutional structure and regulatory environment that surround financial activities. In other words, the responses of output to similar negative shocks may differ among countries with similar levels of development since the recovery process is linked to the policies adopted in each economy.

V.   CONCLUSIONS

The endogenous growth literature states that financial intermediaries may trigger or delay the rates of economic growth due to the direct relationship between credit and investment and their interaction with productive activities. The banking crisis literature proposes a different view of this relationship, which states that financial intermediation may sometimes represent a negative influence since financial instability may negatively affect the economic activities, predominantly during periods of financial crises. To summarize the discussion, as previously noted by Loayza and Ranciere (2006), these hypotheses do not represent a contradiction because each may be associated with different time lengths. That is to say, in the long run the financial intermediation effect is positive according to the traditional growth literature and in the short run, the effect could be negative, as explained by the banking crisis literature.

The results for the Colombian economy, based on the ARDL models, indicate that financial intermediation affects economic activities positively in all the specifications

of short and long run. These are similar to King and Levine's results (1993) under different measures of financial intermediation and output growth. The positive sign of the contemporaneous effect may be attributed to the institutional structure and regulatory environment that surround financial activities, the level of financial fragility and to the policies adopted in the economy.

In addition to this, the estimation also included two complementary measures related to financial intermediation and a set of control variables to correctly estimate the evolution of the growth rate of the GDP per capita.

The complementary financial measures, the financial volatility and the banking crises dummy, display a negative sign, which suggests the existence of financial fragility in the economy. However, a formal evaluation of this goes beyond the objectives of this work but may be considered an interesting alternative to work on in future research. With respect to the banking crisis at the end of the nineties, the results point out negative though temporary consequences, which means that after the occurrence of this shock, economic activity returned to its growth path.

Finally, with respect to the set of control variables, the estimation reflect the most traditional results of economic growth by displaying the expected signs in the long run. In particular, the variables of trade openness and education present a positive sign while the reserve requirements ratio, the inflation index and the size of government exhibit negative associations with economic growth. These associations warn of the importance of controlling prices and reducing the size of government in order to stimulate productive activities.

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APPENDIX
Sources of Data, Colombia, 1960–2006

Variables	Source
GDP	DANE
Population	DANE
Domestic credits	Banco de la República
Active interest rate	Caycedo, González, and Zambrano (1996)
Government expenditure	Banco de la República and Contraloría General de la República
Exports and imports	IMF-IFS
Consumer price index	DANE
Number of schooling years	DANE
Required reserve ratio	Banco de la República
M1	Banco de la República
Number of kidnappings	Policía Nacional-Dijin

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