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**Financial Development, Financial Fragility and Growth**

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# FINANCIAL DEVELOPMENT, FINANCIAL FRAGILITY, AND GROWTH\*

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## Abstract

This paper studies the apparent contradiction between two strands of the literature on the effects of financial intermediation on economic activity. On the one hand, the empirical growth literature finds a positive effect of financial depth as measured by, for instance, private domestic credit and liquid liabilities (e.g., Levine, Loayza, and Beck 2000). On the other hand, the banking and currency crisis literature finds that monetary aggregates, such as domestic credit, are among the best predictors of crises and their related economic downturns (e.g., Kaminski and Reinhart 1999). The paper accounts for these contrasting effects based on the distinction between the short- and long-run impacts of financial intermediation. Working with a panel of cross-country and time-series observations, the paper estimates an encompassing model of short- and long-run effects using the Pooled Mean Group estimator developed by Pesaran, Shin, and Smith (1999). The conclusion from this analysis is that a positive long-run relationship between financial intermediation and output growth co-exists with a, mostly, negative short-run relationship. The paper further develops an explanation for these contrasting effects by relating them to recent theoretical models, by linking the estimated short-run effects to measures of financial fragility (namely, banking crises and financial volatility), and by jointly analyzing the effects of financial depth and fragility in classic panel growth regressions.

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# FINANCIAL DEVELOPMENT, FINANCIAL FRAGILITY, AND GROWTH

## I. INTRODUCTION

This paper analyzes the apparent contradiction between two strands of the literature on the effects of financial intermediation on economic activity. On the one hand, the empirical growth literature finds a positive effect of measures of private domestic credit and liquid liabilities on per capita GDP growth (as illustration, see Figure 1). This is interpreted as the growth enhancing effect of financial development (e.g., King and Levine, 1993; Levine, Loayza, and Beck, 2000). On the other hand, the banking and currency crisis literature finds that monetary aggregates, such as domestic credit, are among the best predictors for crises (e.g., Demirguc-Kunt and Degatriache, 1998 and 2000; Gourinchas, Landerretche, and Valdés, 1999; Kaminsky and Reinhart, 1999). Since banking crises usually lead to recessions, an expansion of domestic credit would then be associated to growth slowdowns (see Figure 2).

A similar divide exists at the theoretical level.<sup>1</sup> According to the endogenous growth literature, financial deepening leads to a more efficient allocation of savings to productive investment projects (see Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991). Conversely, the financial crisis literature points to the destabilizing effect of financial liberalization as it leads to an unduly large expansion of credit. Overlending would occur through a combination of channels, including a limited monitoring capacity of regulatory agencies, the inability of banks to discriminate good projects during investment booms, and the existence of an explicit or implicit insurance against banking failures (Schneider and Tornell, 2004; Aghion, Bacchetta and Banerjee, 2003). Not surprisingly, each strand of the literature has produced its own set of policy implications. Thus, researchers that emphasize the findings of the endogenous growth literature advocate financial liberalization and deepening (e.g., Roubini and Sala-i-Martin, 1992), while those that concentrate on crises caution against “excessive” financial liberalization (e.g., Balino and Sundarajan, 1991; Gavin and Hausman, 1995).

This paper contributes to the debate on the effects of financial deepening from an empirical perspective. First, we want to highlight and illustrate the contrasting effects of

financial liberalization and credit expansion on economic activity. Second, we attempt to provide an empirical explanation to these contrasting effects. In particular, on the one hand we relate the positive influence of financial depth on investment and growth to the *long-run* effect of financial liberalization; and, on the other, we describe a link between the negative impact of financial volatility and crisis and the *short-run* effect of liberalization. Although it is not our purpose to test competing theories, our empirical results provide support to some recent theoretical models predicting that financial liberalization can both generate short-run instability and higher long-run growth.

The paper is organized as follows. In section II we examine the output growth effects of cyclical and trend changes of financial intermediation. For this purpose, we estimate an encompassing model of short- and long-run effects using a panel of cross-country and time-series observations. Our basic econometric technique is the Pooled Mean Group estimator developed by Pesaran, Shin, and Smith (1999). By focusing on effects at different time horizons, we set the basis for an explanation of the apparently contradictory effects of financial intermediation on economic activity. In section III, we discuss and develop further this explanation. First, we link our short- and long-run results to recent theoretical models on the effects of financial liberalization. Second, since our econometric methodology allows us to estimate *country-specific* short-run effects of financial intermediation on output growth, we analyze their relationship with country-specific measures of financial fragility, namely, banking crises and volatility. And third, we go back to the classic context of growth regressions and consider whether the volatility and crises aspects of financial liberalization are relevant growth determinants, along with the usual measures of financial depth. Section IV concludes.

## **II. SHORT- AND LONG-RUN GROWTH EFFECTS OF FINANCIAL INTERMEDIATION**

In this section we estimate an empirical model that encompasses the short- and long-run growth effects of financial intermediation. We use the estimation results to formulate an empirical explanation of the apparently contradictory effects of financial intermediation on economic activity. This explanation is based on the distinction

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<sup>1</sup> Except for a few rather recent papers, some of the reviewed below in the paper.

between the cycle and trend changes of financial intermediation and their corresponding effects on output growth.

Instead of averaging the data per country to isolate trend effects, we estimate both short- and long-run effects using a data-field composed of a relatively large sample of countries and annual observations. Our method can be summarized as a panel error-correction model, where short- and long-run effects are estimated jointly from a general autoregressive distributed-lag (ARDL) model and where short-run effects are allowed to vary across countries.

We propose this panel error-correction method as an alternative to the traditional method of time averaging for the following reasons. First, while averaging clearly induces a loss of information, it is not obvious that averaging over fixed-length intervals effectively eliminates business-cycle fluctuations. Second, averaging eliminates information that may be used to estimate a more flexible model that allows for some parameter heterogeneity across countries. Third, and most importantly for our purposes, averaging hides the dynamic relationship between financial intermediation and economic activity, particularly the presence of opposite effects at different time frequencies.<sup>2</sup>

### **A. Methodology**

Empirical estimation poses two issues. The first is the need to separate and estimate short- and long-run effects without the need to decompose directly trend and transitory components of growth, financial intermediation, and the other explanatory variables. We treat this issue below in the context of single-country estimation. The second issue is the likely possibility that the parameters in the relationship between financial intermediation and economic activity be different across countries. It can be argued that country heterogeneity is particularly relevant in short-run relationships, given that countries are affected by overlending and financial crises to widely different degrees. On the other hand, we can expect that long-run relationships would be more homogeneous across countries. We discuss below the issue of heterogeneity in the context of multi-country estimation.

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<sup>2</sup> Similar arguments are made by Attanasio, Scorcu, and Picci (2000) in their cross-country study on the dynamic relationship between saving, investment, and growth.

### *Single-country estimation*

The challenge we face is to estimate long- and short-run relationships without observing the long- and short-run components of the variables involved. Over the last decade or so, a booming cointegration literature has focused on the estimation of long-run relationships among I(1) variables (Johansen 1995, Phillips and Hansen 1990). From this literature, two common misconceptions have been derived. The first one is that long-run relationships exist *only* in the context of cointegration among integrated variables. The second one is that standard methods of estimation and inference are incorrect.

A recent literature, represented in Pesaran and Smith (1995), Pesaran (1997) and Pesaran and Shin (1999), has argued against both misconceptions. These authors show that simple modifications to standard methods can render consistent and efficient estimates of the parameters in a long-run relationship between both integrated and stationary variables and that inference on these parameters can be conducted using standard tests. Furthermore, these methods avoid the need for pre-testing and order-of-integration conformability given that they are valid whether the variables of interest are I(0) or I(1). The main requirements for the validity of this methodology are that, first, there exist a long-run relationship among the variables of interest and, second, the dynamic specification of the model be sufficiently augmented so that the regressors are strictly exogenous and the resulting residual is serially uncorrelated.<sup>3</sup> Pesaran and co-authors label this the “autoregressive distributed lag (ARDL) approach” to long-run modeling.

In order to comply with the requirements for standard estimation and inference, we embed a long-run growth regression equation into an ARDL ( $p, q$ ) model. In error-correction form, this can be written as follows:

$$\Delta(y_i)_t = \sum_{j=1}^{p-1} \gamma_j^i \Delta(y_i)_{t-j} + \sum_{j=0}^{q-1} \delta_j^i \Delta(X_i)_{t-j} + \varphi^i [(y_i)_{t-1} - \{\beta_0^i + \beta_1^i (X_i)_{t-1}\}] + \varepsilon_{it} \quad (1)$$

where,  $y$  is the per capita GDP growth rate,  $X$  represents a set of growth determinants including financial depth and control variables,  $\gamma$  and  $\delta$  are the short-run coefficients

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<sup>3</sup> It is worth noting that the assumption of a unique long-run relationship underlies implicitly the various single-equation based estimators of long-run relationships commonly found in the cointegration literature. Without such assumption, these estimators would at best identify some linear combination of all the long-run relationships present in the data.

related to growth and its determinants,  $\beta$  are the long-run coefficients,  $\varphi$  is the speed of adjustment to the long-run relationship,  $\varepsilon$  is a time-varying disturbance, and the subscripts  $i$  and  $t$  represent country and time, respectively. The term in square brackets contains the long-run growth regression, which acts as a forcing equilibrium condition:

$$(y_i)_t = \beta_0^i + \beta_1^i (X_i)_t + \mu_{i,t} \quad \text{where } \mu_{i,t} \sim I(0) \quad (2)$$

### ***Multi-country estimation***

The sample we use for estimation is a “data field,” in the sense that it is characterized by time-series (T) and cross-section (N) dimensions of roughly similar magnitude. In such conditions, there are a number of alternative methods for multi-country estimation that vary on the extent to which they allow for parameter heterogeneity across countries. At one extreme, the fully heterogeneous-coefficient model imposes no cross-country parameter restrictions and can be estimated on a country-by-country basis -- provided the time-series dimension of the data is sufficiently large. When, in addition, the cross-country dimension is also large, the mean of long- and short-run coefficients across countries can be estimated consistently by the unweighted average of the individual country coefficients. This is the mean group (MG) estimator introduced by Pesaran, Smith, and Im (1996). At the other extreme, the fully homogeneous-coefficient model requires that all slope and intercept coefficients be equal across countries. This is the simple pooled estimator.

In between the two extremes, there are a variety of estimators. The dynamic fixed effects estimator restricts all slope coefficients to be equal across countries but allows for different country intercepts. The pooled mean group (PMG) estimator, introduced by Pesaran, Shin and Smith (1999), restricts the long-run slope coefficients to be the same across countries but allows the short-run coefficients (including the speed of adjustment) and the regression intercept to be country specific. The PMG estimator also generates consistent estimates of the mean of short-run coefficients across countries by taking the simple average of individual country coefficients (provided that the cross-sectional dimension is large).

The choice among these estimators faces a general trade-off between consistency and efficiency. Estimators that impose cross-country constraints dominate the heterogeneous estimators in terms of efficiency if the restrictions are valid. If they are

false, however, the restricted estimators are inconsistent. In particular, imposing invalid parameter homogeneity in dynamic models typically leads to downward-biased estimates of the speed of adjustment (Robertson and Symons 1992, Pesaran and Smith 1995).

For our purposes, the pooled mean group estimator offers the best available compromise in the search for consistency and efficiency. This estimator is particularly useful when the long run is given by conditions expected to be homogeneous across countries while the short-run adjustment depends on country characteristics such as vulnerability to domestic and external shocks, monetary and fiscal adjustment mechanisms, financial-market imperfections, and relative price and wage flexibility. Furthermore, the PMG estimator is sufficiently flexible to allow for long-run coefficient homogeneity over only a subset of variables and/or countries.

Therefore, we use the PMG method to estimate a long-run relationship that is common across countries (i.e.,  $\beta_l^i = \beta_l^j$  for all countries  $i, j$ ) while allowing for unrestricted country heterogeneity in the adjustment dynamics and fixed effects. The interested reader is referred to Pesaran, Shin and Smith (1999) where the PMG estimator is developed and compared with the MG estimator. Briefly, the PMG estimator proceeds as follows. First, the estimation of the long-run slope coefficients is done jointly across countries through a (concentrated) maximum likelihood procedure. Second, the estimation of short-run coefficients (including the speed of adjustment  $\phi$ ), country-specific intercepts  $\beta_0^i$ , and country-specific error variances is done on a country-by-country basis, also through maximum likelihood and using the estimates of the long-run slope coefficients previously obtained.<sup>4</sup>

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<sup>4</sup> The comparison of the asymptotic properties of PMG and MG estimates can be put also in terms of the general trade-off between consistency and efficiency noted in the text. If the long-run coefficients are in fact equal across countries, then the PMG estimates will be consistent and efficient, whereas the MG estimates will only be consistent. If, on the other hand, the long-run coefficients are not equal across countries, then the PMG estimates will be inconsistent, whereas the MG estimator will still provide a consistent estimate of the mean of long-run coefficients across countries. The long-run homogeneity restrictions can be tested using Hausman or likelihood ratio tests to compare the PMG and MG estimates of the long run coefficients. In turn, comparison of the small sample properties of these estimators relies on their sensitivity to outliers. In small samples (low T and N), the MG estimator, being an unweighted average, is very sensitive to outlying country estimates (for instance those obtained with small T). The PMG estimator performs better in this regard because it produces estimates that are similar to *weighted* averages of the respective country-specific estimates, where the weights are given according to their precision (that is, the inverse of their corresponding variance-covariance matrix).



An important assumption for the consistency of the PMG estimates is the independence of the regression residuals across countries. In practice, non-zero error covariances usually arise from *omitted* common factors that influence the countries' ARDL processes. We attempt to eliminate these common factors and, thus, ensure the independence condition by allowing for time-specific effects in the estimated regression; this is equivalent to a regression in which each variable enters as deviations with respect to the cross-sectional mean in a particular year.

As indicated in the previous section, for each country the order of the ARDL process must be augmented to ensure that the residual of the error-correction model be exogenous and serially uncorrelated. At the same time, with a limited number of time-series observations, the ARDL order should not be overextended as this imposes excessive parameter requirements on the data. When the main interest is on the long-run parameters, the lag order of the ARDL can be selected using some consistent information criteria (such as the Schwartz-Bayesian Criterion) on a country-by-country basis. However, when there is also interest in analyzing and comparing the short-run parameters, it is recommended to impose a common lag structure across countries, in accordance to the characteristics of the analytical model to be studied and the limitations of the data. We use the latter approach in this paper's implementation of the ARDL approach.

## **B. Data and Results**

The sample consists of 75 countries with annual data during the period 1960-2000. See Appendix 1 for the list of countries included in the sample. Given the procedure's requirements on the time-series dimension of the data, we include only countries that have at least 20 consecutive observations. The dependent variable is the growth rate of GDP per capita. The measure of financial intermediation is private domestic credit as ratio to GDP.<sup>5</sup> The control variables are the initial level of GDP per capita, government consumption as ratio to GDP, the structure-adjusted volume of trade as ratio to GDP, and the inflation rate. In order to capture proportional effects, all control

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<sup>5</sup> The other popular measure of financial intermediation is the ratio of liquid liabilities to GDP. As a robustness check, we have repeated all empirical exercises presented in the paper substituting liquid liabilities for private credit. Since these results are essentially the same as those using private credit/GDP, we have omitted them in this version of the paper but can make them available upon request.

variables are specified in natural logs. See Appendix 2 for definitions and sources of all variables used in the paper, and Appendix 3 for their descriptive statistics.

Table 1 presents the results on specification tests and the estimation of long- and short-run parameters linking per capita GDP growth, financial intermediation, and other growth determinants. We emphasize the results obtained using the pooled mean group (PMG) estimator, which we prefer given its gains in consistency and efficiency over other panel error-correction estimators. For comparison purposes, we also present the results obtained with the mean group (MG) and the dynamic fixed-effects (DFE) estimators.

As outlined in the previous section, the consistency and efficiency of the PMG estimates relies on several specification conditions. The first are that the regression residuals be serially uncorrelated and that the explanatory variables can be treated as exogenous. We seek to fulfill these conditions by including in the ARDL model, 3 lags of the growth rate, 3 lags of the measure of finance intermediation, and 1 lag of each control variable. We could not expand the lag structure any further because we would run into problems of lack of degrees of freedom. We chose to use a richer (longer) lag structure for the dependent variable (growth) and the variable of interest (financial intermediation) because our main concern was to characterize their long- and short-run relationships.

The second specification condition is that both country-specific effects and cross-country common factors be accounted for. We control for country-specific effects by allowing for an intercept for each country, and we attempt to eliminate cross-country common factors by demeaning the data using the corresponding cross-sectional means for every period (which is algebraically the same as allowing for year-specific intercepts).

The third condition refers to the existence of a long-run relationship (dynamic stability) and requires that the coefficient on the error-correction term be negative and not lower than  $-2$  (that is, within the unit circle). In the second panel of Table 1, we report the estimates for the *pooled* error-correction coefficient and its corresponding standard error. This coefficient falls within the dynamically stable range in the cases of the PMG and dynamic fixed effects estimators. The fact that the pooled error correction coefficient falls outside the allowed range in the case of the mean group estimator reveals that for

some countries the dynamic stability condition does not hold. We come back to this issue below.

The fourth condition is that the long-run parameters be the same across countries. As explained in the section on econometric methodology, we can test the null hypothesis of homogeneity through a Hausman-type test, based on the comparison between the Pooled Mean Group and the Mean Group estimators. In Table 1 we present the Hausman test statistic and the corresponding p-values for the coefficients on each of the explanatory variables and for all of them jointly. The homogeneity restriction is not rejected jointly for all parameters; it is not rejected for individual parameters either except in the case of trade openness.

Regarding the estimated parameters, our analysis focuses on those obtained with the PMG estimator. In the long run, the growth rate of GDP per capita is negatively related to initial income, the size of government, and the inflation rate, and positively related to international trade openness. These are standard results from the empirical growth literature, and it is reassuring that we are able to reproduce them with our methodology.

Most importantly for our purposes, we find that economic growth is positively and significantly linked to the measure of financial intermediation in the long run. This effect is also economically significant as the point estimate implies that a 1 percent increase in the ratio of private credit to GDP leads to a rise of 0.7 percentage points in the growth rate of per capita GDP.

The short-run coefficients on financial intermediation tell a different story. As explained earlier, short-run coefficients are not restricted to be the same across countries, so that we do not have a single *pooled* estimate for each coefficient. Nevertheless, we can still analyze the *average* short-run effect by considering the mean of the corresponding coefficients across countries. We find that the short-run average relationship between the growth rate of GDP per capita and the measure of financial intermediation appears to be strongly negative, with a point estimate several times larger than that of the long-run effect of financial intermediation. Thus, comparing the long- and short-run estimates, a first broad conclusion is that the sign of the relationship

between economic growth and financial intermediation depends on whether their movements are temporary or permanent.

In the next section we will take advantage of the cross-country variation of short-run coefficients to draw a connection between the negative effects of financial intermediation and the occurrence of financial volatility and crisis. Before we do that, however, we need to make sure that our results are robust to the exclusion of outlying and dynamically unstable observations. In particular, we want to check to what extent the long-run coefficients and especially the *average* of short-run coefficients are sensitive to the exclusion of countries whose estimated short-run effects are considerably larger (in absolute value) than typical effects in the sample and countries that present error-correction coefficients that statistically fall outside the dynamic stable range. We exclude the countries whose short-run coefficients fall outside 2 standard deviations from the mean; they are Dominican Republic, Ghana, Sierra Leone, Thailand, Turkey, and Democratic Republic of Congo. We also exclude the countries with unstable dynamics; they are Senegal, Uganda, and Zambia.

The results on the restricted sample are presented in Table 2. They are qualitatively similar to those on the full sample. The signs and statistical significance of all long-run and most short-run coefficients remain unchanged. The Hausman test does not reject the joint homogeneity of all long-run parameters; and it does not reject the homogeneity of individual long-run coefficients except for that on initial income. Moreover, the long- and short-run effects of private credit on growth are not only qualitatively but also quantitatively very similar for the restricted and full samples.

### **III. FINANCIAL FRAGILITY, ALONGSIDE FINANCIAL DEPTH, IN THE PATH TO FINANCIAL DEVELOPMENT**

By focusing on the effects of financial intermediation at different time horizons, the analysis conducted in the previous section helps us set the basis for an explanation of the apparently contradictory effects of financial intermediation on economic activity. In this section, we discuss and develop further this explanation. First, we review a selected set of recent theoretical models that examine the evolution of the effects of financial liberalization through time. All of them differentiate between short- and long-run effects

on economic growth. Moreover, they highlight the point that financial liberalization is not only associated with financial depth but also to financial fragility (as captured by banking crises and financial volatility), and it is this aspect of financial liberalization that explain why intermediation may have a negative short-run effect on growth. Second, we consider this possibility by examining connection between *country-specific* measures of financial volatility and crisis and the *country-specific* short-run effects of financial intermediation estimated in the previous section. Finally, as a further test of the relevance of our results, we take the usual approach of empirical growth analysis in order to consider whether the volatility and crises aspects of financial liberalization, and not only the customary measures of financial depth, are significant determinants of economic growth.

### **A. Theoretical discussion**

How can we explain the contrast between the short- and long-run effects of financial intermediation? Recent theories on the aftermath of financial liberalization can provide some guidance to answer this question. We do not attempt to tell them apart by testing their particular implications; rather, we intend to draw on their similarities to build a sensible explanation. Gaytán and Rancière (2003) develop a model of banking development where banks serve the purpose of providing liquidity insurance --which avoids the need for costly asset liquidation-- but are subject to confidence crises leading to bank runs. Banks have the option to insure against these crises, but this is costly as it entails less money available for investment. Gaytán and Ranciere find that in emerging countries it is optimal for banks to be only partially covered against the risk of bank runs. This is so because in these countries the opportunity cost of full insurance, given by the marginal rate of return to investment, is too high. As countries develop and capital productivity decreases, it becomes optimal for banks to be fully covered against crises. Therefore, the model predicts that in the short run after financial liberalization, there is the chance that emerging countries will face financial crises, switch from non-crisis to crisis equilibria, and thus experience volatility of credit and low output growth. In the long run, however, financial development would be free from crises and would render stable growth.

Dell'Arricia and Marquez (2004a, 2004b) view the aftermath of financial liberalization as a period marked by excessive lending, as banks' screening incentives are not at par with the rapid growth for credit demand. In their model, banks' incentives to screen potential borrowers come from adverse selection among banks –banks screen to avoid financing firms whose projects have been tested and rejected by other banks. When financial markets are liberalized and many *new* and untested projects request funding, banks do not have strong incentives to screen its pool of applicants and rapid credit expansion ensues. In this case the quality of banks' portfolio is likely to deteriorate and over-lending will result in financial fragility. At the macroeconomic level, as negative shocks occur, financial fragility will give way to financial instability and output losses. Overtime, however, as most potential borrowers are tested, banks' screening incentives and practices are restored, and lending begins to grow at stable rates. Then, whereas the short run of financial liberalization is marked with financial crisis, volatility, and low output growth, in the long run financial liberalization is bound to improve economic growth.

Rajan (1994) develops a similar mechanism that focuses on bankers' incentives to explain financial fragility. In his model, bank managers tend to hide non-performing loans by maintaining liberal credit policies when most borrowers are solvent (“good” times). When the economy is hit by an aggregate shock and the relative ability of individual managers becomes less discernible, they have the incentive to tighten credit policy. This procyclical credit practice tends to finance bad projects in good times and squeeze credit away from worthy firms in distress times. The way to solve this inefficient credit practice is through proper banking supervision. However, in the short run after financial liberalization, a great need for credit expansion occurs in the face of a poor development of supervisory capacity. In this context, cycles of booms and busts in credit and output growth are likely to arise, and they are only gradually replaced by stable financial depth and output growth as institutional and supervisory capacities develop.

For Wynne (2002) the fundamental problem underlying financial fragility does not reside in banks' incentives to screen and monitor potential borrowers; rather, the problem is that it takes time and effort for firms to build financial reputation and public knowledge about the quality of their investment projects. This is important because of

the intrinsic asymmetry of information between potential borrowers and creditors. Firms create “information” capital only gradually through a higher survival rate and wealth accumulation. When financial liberalization occurs and a large cohort of new firms enters the market, the absence of information capital leads to high interest rates, a risky banks’ loan portfolio, and inevitably credit misallocation. At the macroeconomic level, this may result in banking crises, cycles of credit expansion and contraction, and low output growth, particularly if the economy is hit by large shocks. Overtime, however, good firms build information capital, lending rates decrease, and bank’s loan portfolios become safer. At the aggregate level in the long run, proper credit allocation results in higher and more stable productivity growth.

All these models predict a positive long-run relationship between financial intermediation and economic growth. They also predict that in the short run this relationship may be negative and explain through what channels this might occur. What these explanations have in common is that they all link the potential negative short-run impact of financial intermediation with the presence of financial volatility and the likelihood of banking crises. Given that our panel data methodology allows us to recover country-specific short-run coefficients, we can analyze their connection with financial volatility and crises, and to this we turn next.

### **B. Analysis of Short-Run Coefficients**

We consider the question of whether the negative short-run relationship between growth and financial intermediation can be linked to the occurrence of systemic banking crisis and financial volatility. We quantify this short-run relationship by the short-run coefficients on financial intermediation estimated previously for each country in the sample. As a proxy for financial crises, we use the number of years in the period 1960-2000 that the country has experienced systemic banking crises, according to Caprio and Klingbiel (2003). We measure financial volatility as the standard deviation of the growth rate of the private credit to GDP ratio over the period 1960-2000.

Table 3 reports the simple and rank correlation coefficients --along with the corresponding p-values-- between the short-run coefficients and the measures of financial crisis and financial volatility. We present statistics corresponding to both the full and restricted samples. Not surprisingly, the correlation between crisis and volatility is

positive and significant, with values between 0.35 and 0.40. This is large enough to reveal a meaningful connection but sufficiently small to indicate that each variable contains independently relevant information. Most importantly, both financial crisis and volatility have a negative and significant correlation (close to -0.30) with the estimated short-run coefficients; that is, larger volatility or higher frequency of crises are related to more negative short-run impacts of financial intermediation on output growth.

Another approach to examine this connection is by dividing the sample of countries according to criteria given by financial crisis and volatility and then comparing the corresponding group means of short-run coefficients. Regarding financial crises, we divide the sample, first, according to whether countries had or not any crises during the 40 year period (about 60% had at least one year of crisis), and, second, according to whether they are above or below the median number of crises. Regarding financial volatility, we divide the sample using as thresholds, first, the 75<sup>th</sup> percentile of volatility and, second, its median value.

Table 4 presents the tests of the difference in short-run coefficient means for the various ways of grouping countries. We do so for both the full and restricted samples. Countries that experienced financial crises in the last 40 years exhibit an average short-run impact of financial intermediation on output growth that is significantly more negative than the average of countries that did not have any crisis. In fact, for the non-crisis countries, the average short-run impact of intermediation on growth is statistically zero. A similar result is obtained when we divide the sample according to the median frequency of crises: high-crisis countries show significantly more negative short-run impacts than low-crisis countries, and for the latter this impact is indistinguishable from zero. Concerning financial volatility, when we divide the sample using its 75<sup>th</sup> percentile as threshold, we find that the group of high financial volatility has an average short-run effect that is significantly more negative than the group of low and medium volatility. The results are similar when we use the median volatility as threshold, but in this case the difference in the average short-run coefficients between the two groups is not statistically significant at conventional levels.

Figure 3 (a) presents the (smoothed) frequency distributions of short-run coefficients for the groups of crisis and non-crisis countries. Figure 3 (b) does the same



for the groups of high-volatility and medium-to-low-volatility countries (using the 75<sup>th</sup> percentile as threshold). In both cases we consider only the restricted sample of countries (that is, without outliers and dynamically unstable observations). The distributions appear to be basically symmetrical. We can see that the groups of crisis and high-volatility countries not only have more negative average short-run coefficients but also have more dispersed distributions, with fatter tails particularly towards the negative portion of the spectrum.

### **C. Classical Growth Regressions: The role of financial volatility and crisis**

So far our analysis has used a novel empirical estimator to distinguish between short- and long-run effects of financial intermediation on economic growth. This methodology uses the time-series dimension of the data at least as intensively as the cross-country dimension. It represents a departure from the typical empirical growth literature in which high-frequency movements in the data are averaged out prior to estimation. Typical panel-data growth studies work with country data averaged for periods of 5 or 10 years and, therefore, are likely to combine short- and long-run effects. In previous sections of the paper, we have argued that the contrasting effects of financial intermediation come from different aspects associated to the process of financial development --financial depth and fragility. The growth literature has emphasized the role of financial depth and found a positive and significant effect on growth (see King and Levine 1993 a, b; and Levine, Loayza, and Beck 2000). In order to provide further support to the arguments developed in the paper, we would like to use the typical growth-regression framework to analyze whether financial fragility is also a relevant determinant of growth.<sup>6</sup>

#### ***Data and Methodology***

We work with a pooled (cross-country, time-series) data set consisting of 82 countries and, for each of them, at most 8 non-overlapping five-year periods over 1960-2000. See Appendix 1 for the list of countries in the sample.

As is standard in the literature, our growth regression equation is dynamic in the sense that it includes the initial level of per capita output as an explanatory variable. In

addition, the regression includes as control variables the average rate of secondary school enrollment, the average structure-adjusted ratio of trade volume to GDP, the average ratio of government consumption to GDP, and the average inflation rate. The explanatory variables of interest were introduced above. They are the average ratio of private credit to GDP, as measure of financial depth, and the frequency of systemic banking crises and the standard deviation of the growth rate of private credit/GDP, as measures of financial fragility. Finally, the regression equation allows for both unobserved time-specific and country-specific effects.

We use an estimation method that is suited to panel data, deals with a dynamic regression specification, controls for unobserved time- and country-specific effects, and accounts for some endogeneity in the explanatory variables. This is the generalized method of moments (GMM) for dynamic models of panel data developed by Arellano and Bond (1991) and Arellano and Bover (1995).

The regression equation to be estimated is the following,

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta' X_{i,t} + \delta FD_{i,t} + \gamma FF_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}$$

where,  $y$  is the logarithm of real per capita output,  $X$  is a set of control variables,  $FD$  is the indicator of financial depth,  $FF$  represents the indicator(s) of financial fragility,  $\mu_t$  is a time-specific effect,  $\eta_i$  is an unobserved country-specific effect, and  $\varepsilon$  is the error term. The subscripts  $i, t$  represent country and time-period, respectively.

We relax the assumption of strong exogeneity of the explanatory variables by allowing them to be correlated with current and previous realizations of the error term  $\varepsilon$ . However, we assume that future realizations of the error term do not affect current values of the explanatory variables. Furthermore, we assume that the error term  $\varepsilon$  is serially uncorrelated. We allow the unobserved country-specific effect  $\eta_i$  to be correlated with the explanatory variables. However, following a stationarity condition, we assume that *changes* in the explanatory variables are uncorrelated with the country-specific effect. As Arellano and Bond (1991) and Arellano and Bover (1995) show, this set of assumptions generates moment conditions that allow estimation of the parameters of interest. The

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<sup>6</sup> See Hnatkovska and Loayza (2004) for a general treatment of the link between economic growth and macroeconomic volatility, whether this comes from financial fragility, external shocks, monetary instability, or other sources.

instruments corresponding to these moment conditions are appropriately lagged values of the levels and differences of the explanatory and dependent variables. Since typically the moment conditions over-identify the regression model, they also allow for specification testing through a Sargan-type test.

### ***Results***

Table 5 reports the regression estimation results as well as the Sargan and Serial-correlation specification tests. These tests indicate that the hypothesis of correct identification cannot be rejected, thus supporting the estimation results to which we turn next. The first column presents the results of a typical growth regression. It confirms the negative growth impact of initial GDP per capita (conditional convergence), the size and burden of government, and monetary instability through high inflation. It also shows the positive growth effect of education investment, international trade openness, and, most importantly for our purposes, financial depth. The period shifts are also significant and indicate that world conditions deteriorated in the last twenty years making it more difficult for countries to grow in the 1980s and 1990s than in the previous decades.

The second and third columns include, respectively, financial volatility and the frequency of systemic banking crises as additional explanatory variables. The fourth column includes both indicators of financial fragility at the same time. Whether by themselves or together, financial volatility and the frequency of banking crises present a significantly negative coefficient. Financial depth maintains its positive and significant coefficient in all regressions. We can get a broad sense of the economic importance of these effects by using the point estimate of the regression coefficients to calculate the growth impact of a change in our financial measures. An increase of one sample standard deviation in financial volatility leads to a decrease of 0.3 percentage points in the annual growth rate of GDP per capita, and an analogous increase in the frequency of systemic banking crises produces a 0.7 percentage point drop in annual growth. On the other hand, an increase in one sample standard deviation of financial depth leads to economic growth rising by 0.9 percentage points. Naturally, these are *ceteris paribus* calculations, and our conjecture is that the total effect of financial liberalization and intermediation may be a combination of these effects, with weights for financial depth and financial fragility depending on the stage of financial development that the country is undergoing.

#### IV. CONCLUSIONS

Over the long run, financial development supports and promotes economic growth. However, the path to development is far from smooth; and along the way, economic growth can suffer from the financial fragility that characterizes maturing systems. The process of financial development entails a deepening of markets and services that channel savings to productive investment and allow risk diversification; these positive aspects of financial development lead to higher economic growth in the long run. As economies mature, however, the same process can present weaknesses evidenced by systemic banking crises, cycles of booms and busts, and overall financial volatility. Whether intrinsic to the process of development or induced by policy mistakes, these elements of financial fragility can hurt economic growth and will do so until maturity is reached.

Recognizing the possibility of a dual effect of financial intermediation on economic growth, this paper estimates an encompassing empirical model of long- and short-run effects using a sample of cross-country and time-series observations. We find that a positive long-run relationship between financial intermediation and output growth can coexist with a negative short-run relationship, which indeed is the case for the average country in the sample. Since the methodology allows us to obtain the short-run effects of financial intermediation on growth country by country, we can attempt to link these effects to the aspects of financial liberalization that the literature proposes as harmful to growth. We find that financially fragile countries, namely those that experience banking crises or suffer high financial volatility, tend to present significantly negative short-run effects of intermediation on growth. For more stable countries, this effect is in average nil.

Finally, attempting to relate our results to the empirical growth literature, we go back to the classic context of growth regressions using panel data. We find that the volatility and crisis aspects of financial intermediation are relevant growth determinants, along with the usual measures of financial depth. However, whereas financial depth leads to higher growth, financial fragility --as captured by financial volatility and banking crises-- has negative growth consequences. The total impact of financial liberalization

and intermediation on economic growth may be a combination of these effects, where the relative influences of financial depth and financial fragility would depend on each country's stage of financial development.

## REFERENCES

- Aghion P., P. Bacchetta, and A. Banerjee, 2003, "Capital Markets and the Instability of Open Economies," *Journal of Monetary Economics*, forthcoming
- Alonso-Borrego C. and M. Arellano, 1999, "Symmetrically Normalized Instrumental-Variable Estimation Using Panel Data," *Journal of Business & Economic Statistics*, 17, 36-49.
- Arellano M. and S. Bond, 1991, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 58, 277-297.
- Arellano M. and O. Bover, 1995, "Another Look at the Instrumental-Variable Estimation of Error-Components Models," *Journal of Econometrics*, 68, 29-51.
- Attanasio O., L. Picci, and A. Scorcù, 2000, "Saving, Growth and Investment: A Macroeconomic Analysis using a panel of countries," *Review of Economics and Statistics*, 82(2), 182-211.
- Balino T. and V. Sundarajan, editors, 1991, *Banking Crises: Cases and Issues*, Washington: International Monetary Fund.
- Barro R., 1991, "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics*, 106(2), 407-443.
- Beck T, A. Demirguc-Kunt, and R. Levine, 2000, "A New Database on Financial Development and Structure," *World Bank Economic Review*, 14 (3), pp.597-605.
- Beck, T., R. Levine, and N. Loayza, 2000, "Financial Development and the Sources of Growth," *Journal of Financial Economics*, 58 (1-2), 261-300.
- Bencivenga, V. and B. Smith, 1991, "Financial Intermediation and Endogenous Growth," *Review of Economic Studies*, 58, 195-209.
- Blundell R, and S. Bond, 1998, "Initial conditions and Moment Conditions in Dynamic Panel Data Models," *Journal of Econometrics*, 87, 115-143.
- Caprio G. and D. Klingbiel, 1996, "Bank Insolvencies: Cross-country Experience," World Bank policy research working paper 1620.
- Caprio G. and D. Klingbiel, 2003, "Episodes of Systemic and Borderline Financial Crises," mimeo, The World Bank.

Caselli A., G. Esquivel and G. Lefort, 1996, "Reopening the Convergence Debate: a new look at the Cross-Country Growth Empirics," *Journal of Economic Growth*, 1 (3), 363-389.

Demirguc A. and G. Degatriache, 2000, "Banking Sector Fragility: A Multivariate Logit Approach," *World Bank Economic Review*, 14 (2), 287-307.

Demirguc A. and G. Degatriache, 1998, "The Determinants of Banking Crises in Developing and Developed Countries," *International Monetary Fund Staff Papers*, 45 (1), 81-109.

De Gregorio J. and P. Guidotti, 1995, "Financial Development and Economic Growth," *World Development*, 23(3), 433-448.

Dell'Araccia, G and R. Marquez, 2004a, "Lending Booms and Lending Standards," mimeo

Dell'Araccia, G and R. Marquez, 2004b, "Information and Bank Credit Allocation," *Journal of Financial Economics*, forthcoming.

Eichengreen, B and A. Rose, 1998, "Staying Afloat When the Wind Shifts: External Factors and Emerging-Market Banking Crises," NBER working paper W6370.

Gavin M., and R. Hausman, 1996, "The roots of banking crises: The macroeconomic context," in *Banking crises in Latin America*, Ricardo Hausmann and Liliana Rojas-Suarez, editors, Washington: Interamerican Development Bank.

Gaytan, A. and R. Rancière, 2003, "Banks, Liquidity Crises and Economic Growth," mimeo.

Gourinchas P.O., O. Landerretche, and R. Valdes, 2001, "Lending Booms: Latin America and the World," *Economia*, 1 (2), 47-100.

Greenwood J. and B. Jovanovic, 1990, "Financial Development, Growth, and the Distribution of Income," *Journal of Political Economy*, 98, 1076-1107

Griliches Z. and J. Hausman, 1986, "Errors in Variables in Panel Data," *Journal of Econometrics*, 31, 93-118.

Hnatkovska V. and N. Loayza, 2004, "Volatility and Growth," in *Managing Volatility and Crises: A Practitioner's Guide Overview*, The World Bank.

Holtz-Eakin D., Newey N, and Harvey S. Rosen, 1988, "Estimating Vector Autoregressions with Panel Data," *Econometrica*, 56 (6), 1371-1395

Johansen, S., 1995, *Likelihood Based Inference of Cointegration in the Vector Error Correction Model*, Oxford University Press.

King R. and R. Levine, 1993, "Finance and Growth: Schumpeter Might Be Right," *Quarterly Journal of Economics*, 153(3), 717-38.

Kaminsky G. and C Reinhart, 1999, "The Twin Crises: The Causes of Banking and Balance of Payments Problems," *American Economic Review*, Vol. 89, No. 3, 473-500.

King R. and R. Levine, 1993, "Finance, Entrepreneurship, and Growth: Theory and Evidence," *Journal of Monetary Economics*, 32(3), 513-542.

Levine R., N. Loayza, and T. Beck, 2000, "Financial Intermediation and Growth: Causality and Causes," *Journal of Monetary Economics*, 46(1), 31-77.

Pesaran H. and R. Smith, 1995, "Estimating Long-Run Relationships from Dynamic Heterogeneous Panels," *Journal of Econometrics*, 68, 79-113.

Pesaran H., R. Smith, and K. Im, 1996, "Dynamic Linear Models for Heterogeneous Panels," in *The Econometrics of Panel Data*, L. Matyas and P. Sevestre, editors, 145-195, Dordrecht: Kluwer Academic Publishers.

Pesaran H., 1997, "The Role of Econometric Theory in Modeling the Long Run," *Economic Journal*, 107, 178-191.

Pesaran H. and Y. Shin, 1999, "An Autoregressive Distributed Lag Modelling Approach to Cointegration," chapter 11. in *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*. Cambridge University Press.

Pesaran H., Y. Shin, and R. Smith, 1999, "Pooled Mean Group Estimation of Dynamic Heterogeneous Panels," *Journal of the American Statistical Association*, 94, 621-634.

Phillips P.C.B and B.E. Hansen, 1990, "Statistical Inference in Instrumental Variables Regression with I(1) Processes," *The Review of Economic Studies*, 57 (1), 99-125.

Rajan, R., 1994, "Why Bank Credit Policies Fluctuate: A Theory and Some Evidence," 1994, *Quarterly Journal of Economics*, 109, 399-442.

Robertson D. and J. Symons," Some Strange Properties of Panel Data Estimators," *Journal of Applied Econometrics*, 7, 175-189.



Roubini N. and X. Sala-i-Martin, 1992, "Financial Repression and Economic Growth," *Journal of Development Economics*, Vol. 39 (1), 5-30.

Sachs J., A. Tornell, and A. Velasco, 1996, "Financial Crises in Emerging Markets: The Lessons from 1995," *Brookings Papers on Economic Activity*, 147-198.

Schneider, M. and A. Tornell, 2004, "Balance Sheet Effects, Bailout Guarantees and Financial Crises," *Review of Economic Studies*, forthcoming.

Wynne J., 2002, "Information Capital, Firm Dynamics and Macroeconomic Performance," mimeo.

## TABLES

**Table 1. The Long- and Short-Run Effect of Financial Intermediation on Economic Growth**

*Estimators: Pooled mean group, mean group, and dynamic fixed effects, all controlling for country and time effects*

*Dynamic specification: ARDL(3,3,1,1,1,1)*

*Sample: All countries, annual data 1960-2000*

Variables	Pooled Mean Group		Mean Group		Hausman Tests		Dynamic Fixed Effect	
	Coef.	St. Er.	Coef.	St. Er.	h-test	p-val	Coef.	St. Er.
<b>Long-Run Coefficients</b>								
Financial intermediation	0.708	0.179	0.948	1.226	0.04	0.84	0.121	0.473
Initial GDP per capita	-8.609	0.571	-13.803	4.52	1.34	0.25	-3.489	0.488
Government size	-5.705	0.463	-9.217	4.122	0.48	0.49	-2.022	0.462
Trade openness	1.059	0.281	5.176	2.199	4.56	0.03	1.504	0.340
Inflation	-5.969	0.684	4.335	5.899	0.08	0.78	-4.979	0.767
<b>Joint Hausman Test:</b>					8.5	0.13		
<b>Error Correction Coefficients</b>								
Phi	-0.973	0.063	-2.36	0.156			-0.943	0.034
<b>Short-Run Coefficients</b>								
$\Delta$ Growth (-1)	0.178	0.056	1.003	0.121			0.041	0.027
$\Delta$ Growth (-2)	0.02	0.035	0.447	0.07			-0.017	0.020
$\Delta$ Financial intermediation	-4.517	1.136	-2.814	2.008			-10.258	2.137
$\Delta$ Financial intermediation (-1)	-0.591	1.028	-0.087	1.662			4.930	2.328
$\Delta$ Financial intermediation (-2)	-0.856	1.310	0.486	1.617			-5.570	2.262
$\Delta$ Initial GDP per capita	-4.954	2.947	-9.019	5.052			-5.142	1.919
$\Delta$ Government size	-0.08	1.751	3.76	2.288			-2.894	0.738
$\Delta$ Trade openness	3.344	2.223	-4.294	3.626			2.127	0.752
$\Delta$ Inflation	-2.258	1.842	-0.782	5.046			-0.674	0.871
Intercept	-1.24	2.273	-10.121	13.104			-0.010	0.007
<b>Sum of Coefficients on Financial Intermediation</b>								
$\Sigma \Delta$ Financial intermediation coeffs.	-5.964	2.316	-2.415	4.24				
No. Countries	75		75				75	
No. Observations	2501		2501				2501	
Avg. Rbar squared	0.454		0.67				0.484	

Source: Authors' estimations

**Table 2. The Long- and Short-Run Effects of Financial Intermediation on Economic Growth, Reduced Sample***Estimators: Pooled mean group, mean group, and dynamic fixed effects, all controlling for country and time effects**Dynamic specification: ARDL(3,3,1,1,1,1)**Sample: Countries that are not outliers or dynamically unstable (66 countries), annual data 1960-2000*

Variables	Pooled Mean Group		Mean Group		Hausman Tests		Dynamic Fixed Effect	
	Coef.	St. Er.	Coef.	St. Er.	h-test	p-val	Coef.	St. Er.
<b>Long-Run Coefficients</b>								
Financial intermediation	0.632	0.259	0.165	1.314	0.06	0.81	0.107	0.260
Initial GDP per capita	-5.181	0.513	-13.886	3.893	5.09	0.02	-3.423	0.512
Government size	-2.342	0.41	-1.53	4.06	0.04	0.84	-2.022	0.462
Trade openness	2.422	0.188	2.871	3.133	0.03	0.89	1.458	0.352
Inflation	-5.029	0.596	-4.568	5.849	0.01	0.94	-5.162	0.771
<b>Joint Hausman Test:</b>					7.72	0.17		
<b>Error Correction Coefficients</b>								
Phi	-0.901	0.069	-1.867	0.118			-0.916	0.035
<b>Short-Run Coefficients</b>								
$\Delta$ Growth (-1)	0.144	0.049	0.739	0.091			0.056	0.028
$\Delta$ Growth (-2)	0.001	0.031	0.314	0.053			-0.003	0.021
$\Delta$ Financial intermediation	-5.056	1.033	-4.571	1.762			-2.453	0.591
$\Delta$ Financial intermediation (-1)	-0.113	1.090	-1.027	1.675			-0.079	0.591
$\Delta$ Financial intermediation (-2)	-0.534	1.029	-0.64	1.434			-0.346	0.594
$\Delta$ Initial GDP per capita	-6.115	2.613	-7.511	4.192			-4.712	2.007
$\Delta$ Government size	-6.509	2.171	-7.14	3.525			-3.192	0.751
$\Delta$ Trade openness	3.358	2.18	-2.819	2.719			2.660	0.816
$\Delta$ Inflation	-4.789	1.576	4.752	4.14			-1.873	0.901
Intercept	-0.881	1.312	-7.696	10.063			-0.004	0.007
<b>Sum of Coefficients on Financial Intermediation</b>								
$\Sigma \Delta$ Financial intermediation coeffs.	-5.702	1.628	-6.238	4.31				
No. Countries	66		66				66	
No. Observations	2206		2206				2206	
Avg. Rbar squared	0.449		0.65				0.47	

Source: Authors' estimations

**Table 3. Short-Run Coefficients on Financial Intermediation,  
Banking Crises, and Financial Volatility**

*Standard correlation coefficients in upper right triangular matrix*

*Spearman rank correlation coefficients in lower left triangular matrix*

**(a) Sample: All Countries, average 1960-2000**

	Short-run coefficients	Number of crisis	Financial volatility
Short-run coefficients	1	-0.303 (0.008)	-0.379 (0.001)
Number of crisis	-0.2693 (0.0195)	1	0.449 (0.000)
Financial volatility	-0.2980 (0.0094)	0.3947 (0.0005)	1

**(b) Sample: 66 Countries, average 1960-2000**

	Short-run coefficients	Number of crisis	Financial volatility
Short-run coefficients	1	-0.243 (0.049)	-0.345 (0.005)
Number of crisis	-0.2740 (0.0260)	1	0.366 (0.002)
Financial volatility	-0.3153 (0.0099)	0.3565 (0.0033)	1

Note: p-values reported in parenthesis

Source: Authors' estimations

**Table 4. Short-Run Effects of Financial Intermediation Depending on Presence of Banking Crises an**

**(a) No crisis vs. Some crisis**

	Full sample			Restricted sample		
	Mean short-run coefficients	Std. error	N° obs.	Mean short-run coefficients	Std. error	N° obs.
No crisis	-0.199	2.58	30	-1.093	1.77	29
Some crisis	-9.808	3.36	45	-9.315	2.49	37
Test of difference in means: Ho: mean(no crisis) - mean(some crisis) = diff = 0 vs. Ha: diff > 0						
	diff	t-value	p-value	diff	t-value	p-value
	9.609	2.27	0.013	8.222	2.69	0.005

**(b) Low crisis vs. High crisis**

	Full sample			Restricted sample		
	Mean short-run coefficients	Std. error	N° obs.	Mean short-run coefficients	Std. error	N° obs.
Low crisis	-0.343	2.33	34	-1.472	1.62	32
High crisis	-10.626	3.64	41	-9.684	2.7	34
Test of difference in means: Ho: mean(crisis below median) - mean(crisis above median) = diff = 0 vs. Ha: diff > 0						
	diff	t-value	p-value	diff	t-value	p-value
	10.283	2.38	0.01	8.211	2.61	0.006

**(c) Low and medium financial volatility vs. High financial volatility**

	Full sample			Restricted sample		
	Mean short-run coefficients	Std. error	N° obs.	Mean short-run coefficients	Std. error	N° obs.
Low and medium volatility	-3.064	2.53	56	-4.227	1.91	51
High volatility	-14.515	4.92	19	-10.717	3.16	15
Test of difference in means: Ho: mean(fin. vol. below 75 percentile) - mean(fin. vol. above 75 percentile) = diff = 0 vs. Ha: diff > 0						
	diff	t-value	p-value	diff	t-value	p-value
	11.451	2.07	0.024	6.49	1.76	0.045

**(d) Low financial volatility vs. High financial volatility**

	Full sample			Restricted sample		
	Mean short-run coefficients	Std. error	N° obs.	Mean short-run coefficients	Std. error	N° obs.
Low volatility	-3.933	2.9	37	-3.903	2.41	36
High volatility	-7.943	3.6	38	-7.861	2.23	30
Test of difference in means: Ho: mean(fin. vol. below median) - mean(fin. vol. above median) = diff = 0 vs. Ha: diff > 0						
	diff	t-value	p-value	diff	t-value	p-value
	4.009	0.87	0.195	3.958	1.21	0.116

Notes: - Crisis: Number of years when the country experienced a systemic banking crisis during the period 1960-2000, from Caprio and Klingbiel (2003)

- Financial volatility: Standard deviation of the growth rate of private credit/GDP

Source: Authors' calculations

**Table 5: The growth effect of financial depth, financial volatility, and financial crises***Dependent Variable: Growth rate of GDP per capita**(Standard errors are presented below the corresponding coefficient)*

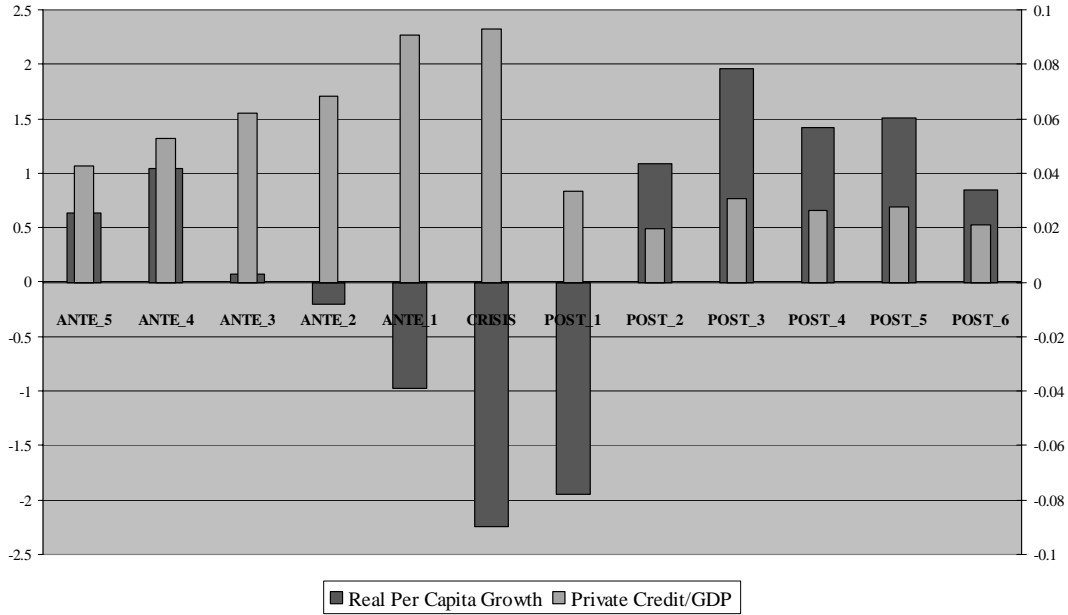
Period:	1961-2000			
Unit of observation:	Non-overlapping 5-year averages			
Estimation Technique:	System GMM			
	[1]	[2]	[3]	[4]
Financial Depth (private domestic credit/GDP, in logs)	0.9738 ** 0.0896	0.9094 ** 0.0943	0.9865 ** 0.0894	1.0014 ** 0.0569
Financial Volatility (Std. Dev. of growth rate of private domestic credit/GDP)		-5.7453 ** 0.9959		-3.7681 ** 0.9638
Systemic Banking Crises (frequency of years under crisis: 0-1)			-2.6989 ** 0.1966	-2.6020 ** 0.2184
<i>Control Variables:</i>				
Initial GDP Per Capita (in logs)	-0.1244 * 0.0642	-0.1852 ** 0.0788	-0.2056 ** 0.0721	-0.3452 ** 0.0928
Education (secondary enrollment, in logs)	1.6426 ** 0.0970	1.6419 ** 0.1098	1.8303 ** 0.1288	2.0464 ** 0.1323
Trade Openness (structure-adjusted trade volume/GDP, in logs)	0.4853 ** 0.1117	0.3701 ** 0.1301	0.7358 ** 0.1200	0.1973 * 0.1206
Government Size (government consumption/GDP, in logs)	-1.7347 ** 0.1445	-1.7225 ** 0.1387	-1.9488 ** 0.1785	-1.9708 ** 0.1898
Lack of Price Stability (inflation rate, in log [100+ inf. rate])	-3.4775 ** 0.2527	-2.4940 ** 0.3582	-1.7811 ** 0.2143	-1.3138 ** 0.3293
Period Shifts benchmark for Cols. 4				
	71-75: -0.4348	-0.1019	-0.7126 **	-0.4403 **
	76-80: -1.2907 **	-0.8449 **	-1.5133 **	-1.2029 **
	81-85: -3.3432 **	-2.9626 **	-3.1966 **	-2.9614 **
	86-90: -2.5525 **	-2.1066 **	-2.4078 **	-2.1162 **
	91-95: -2.9852 **	-2.4348 **	-2.8070 **	-2.5337 **
	96-99: -3.1688 **	-2.4931 **	-2.8753 **	-2.5298 **
Intercept	16.4400 ** 1.1319	12.5041 ** 1.6125	9.1010 ** 1.0434	7.2593 ** 1.5605
No. Countries / No. Observations	82/545	82/545	82/545	82/545
SPECIFICATION TESTS (P-Values)				
(a) Sargan Test:	0.202	0.245	0.263	0.206
(b) Serial Correlation :				
First-Order	0.000	0.000	0.000	0.000
Second-Order	0.325	0.336	0.445	0.438

\*\* means significant at 5% and \* means significant at 10%

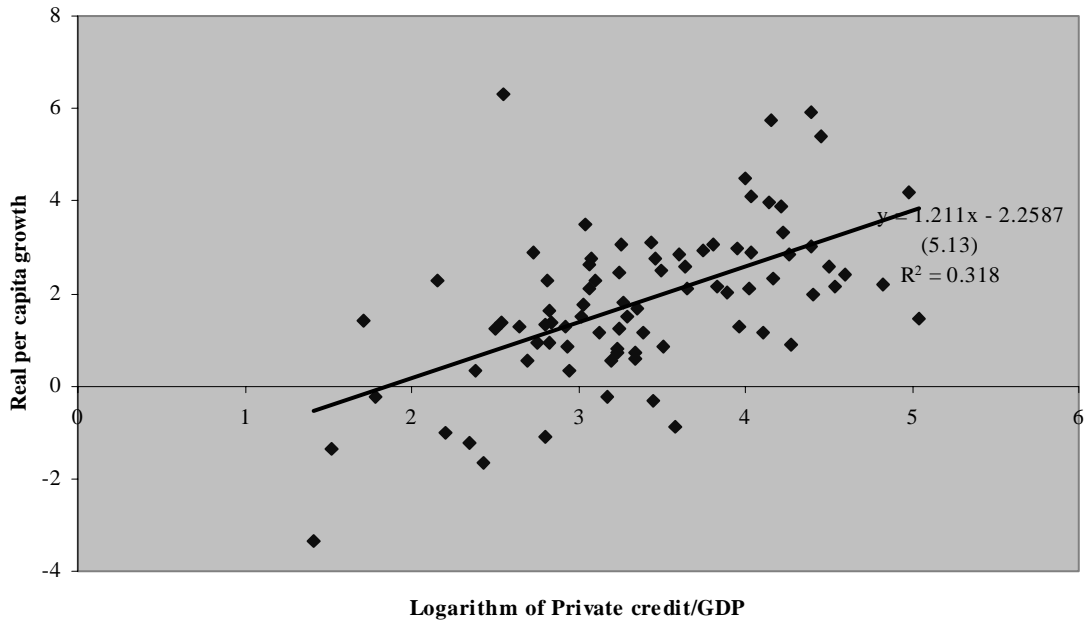
Source: Authors' estimations

## FIGURES

**Figure 1. Economic Growth and Financial Intermediation around Banking Crisis**  
Cross-country means for the years surrounding the start of a systemic banking crisis



**Figure 2. Economic Growth and Financial Intermediation in the Long Run**  
Averages for 1960-2000

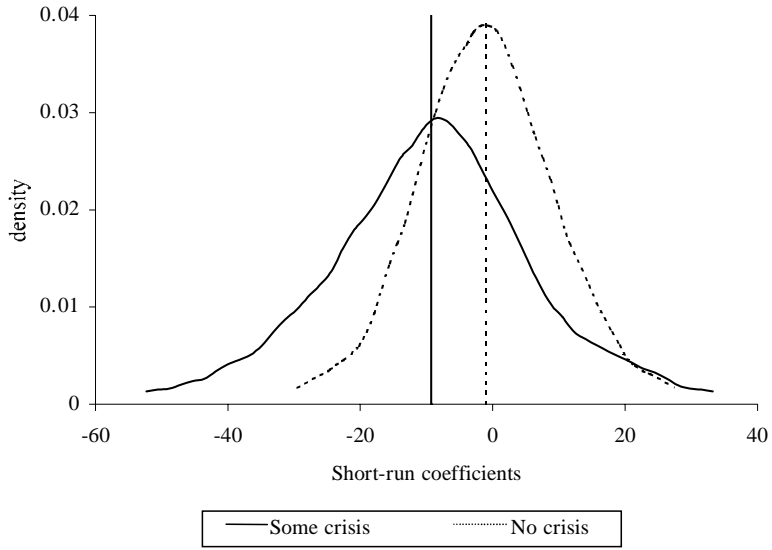


Note: t-statistic between parenthesis using robust OLS.

**Figure 3. Frequency distributions of short-run coefficients for various groupings**

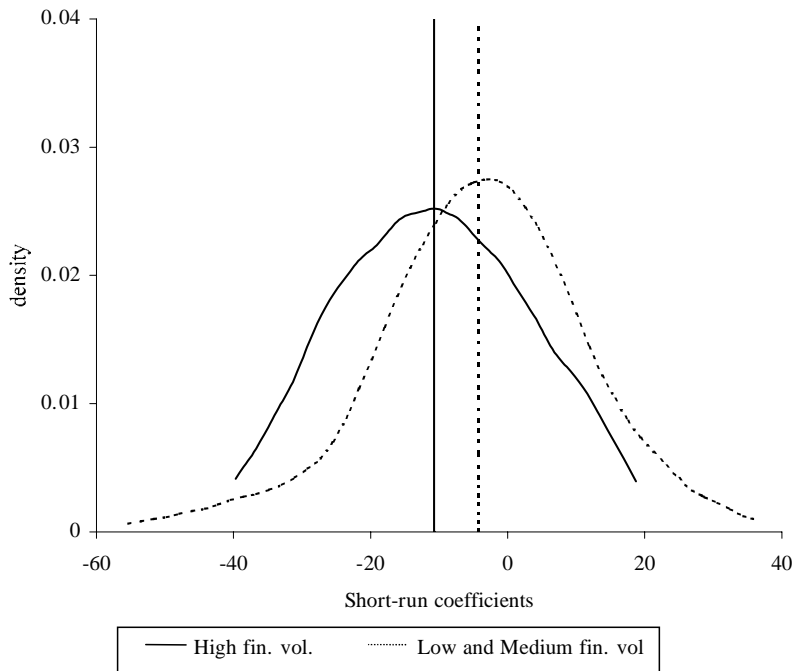
**(a) No crisis vs. Some crisis**

*Sample: 66 Countries 1961-2000*



**(b) Low and medium financial volatility vs. High financial volatility**

*Sample: 66 Countries 1961-2000*





## APPENDICES

### Appendix 1: Sample of countries

Country	Pooled Mean Group Estimation		GMM Estimation (82 countries)
	Full Sample (75 countries)	Restricted Sample (66 countries)	
Algeria	x	x	x
Argentina	x	x	x
Australia	x	x	x
Austria	x	x	x
Bangladesh	-	-	x
Belgium	x	x	x
Bolivia	x	x	x
Botswana	-	-	x
Brazil	x	x	x
Burkina Faso	x	x	x
Canada	x	x	x
Chile	x	x	x
China	-	-	x
Colombia	x	x	x
Congo, Dem. Rep.	x	-	x
Congo, Rep.	x	x	x
Costa Rica	-	-	x
Cote d'Ivoire	x	x	x
Denmark	x	x	x
Dominican Republic	x	-	x
Ecuador	x	x	x
Egypt, Arab Rep.	x	x	x
El Salvador	x	x	x
Finland	x	x	x
France	x	x	x
Gambia, The	x	x	x
Germany	-	-	x
Ghana	x	-	x
Greece	x	x	x
Guatemala	x	x	x
Haiti	x	x	x
Honduras	x	x	x
Iceland	x	x	x
India	x	x	x
Indonesia	x	x	x
Iran, Islamic Rep.	x	x	x
Ireland	x	x	x
Israel	x	x	x
Italy	x	x	x
Jamaica	x	x	x
Japan	x	x	x
Jordan	-	-	x
Kenya	x	x	x
Korea, Rep.	x	x	x
Madagascar	x	x	x
Malawi	x	x	x
Malaysia	x	x	x
Mexico	x	x	x
Morocco	x	x	x
Netherlands	x	x	x
New Zealand	x	x	x
Nicaragua	x	x	x
Niger	x	x	x
Nigeria	x	x	x
Norway	x	x	x
Pakistan	x	x	x

Country	Pooled Mean Group Estimation		GMM Estimation (82 countries)
	Full Sample (75 countries)	Restricted Sample (66 countries)	
Panama	x	x	x
Papua New Guinea	-	-	x
Paraguay	x	x	x
Peru	x	x	x
Philippines	x	x	x
Portugal	x	x	x
Senegal	x	-	x
Sierra Leone	x	-	x
Singapore	x	x	x
South Africa	x	x	x
Spain	x	x	x
Sri Lanka	x	x	x
Sweden	x	x	x
Switzerland	x	x	x
Syrian Arab Republic	x	x	x
Thailand	x	-	x
Togo	x	x	x
Trinidad and Tobago	x	x	x
Tunisia	x	x	x
Turkey	x	-	x
Uganda	x	-	-
United Kingdom	x	x	x
United States	x	x	x
Uruguay	x	x	x
Venezuela, RB	x	x	x
Zambia	x	-	x
Zimbabwe	-	-	x

## Appendix 2: Definitions and Sources of Variables Used in Regression Analysis

Variable	Definition and Construction	Source
GDP per capita	Ratio of total GDP to total population. GDP is in 1985 PPP-adjusted US\$.	Authors' construction using Summers and Heston (1991) and The World Bank (2002).
GDP per capita growth	Log difference of real GDP per capita.	Authors' construction using Summers and Heston (1991) and The World Bank (2002).
Initial GDP per capita	Initial value of ratio of total GDP to total population. GDP is in 1985 PPP-adjusted US\$.	Authors' construction using Summers and Heston (1991) and The World Bank (2002).
Education	Ratio of total secondary enrollment, regardless of age, to the population of the age group that officially corresponds to that level of education.	World Development Network (2002) and The World Bank (2002).
Private Credit	Ratio of domestic credit claims on private sector to GDP	Author's calculations using data from IFS, the publications of the Central Bank and PWD. The method of calculations is based on Beck, Demiguc-Kunt and Levine (1999).
Trade Openness	Residual of a regression of the log of the ratio of exports and imports (in 1995 US\$) to GDP (in 1995 US\$), on the logs of area and population, and dummies for oil exporting and for landlocked countries.	Author's calculations with data from World Development Network (2002) and The World Bank (2002).
Government Size	Ratio of government consumption to GDP.	The World Bank (2002).
CPI	Consumer price index (1995 = 100) at the end of the year	Author's calculations with data from IFS.
Inflation rate	Annual % change in CPI	Author's calculations with data from IFS.
Systemic Banking Crises	Number of years in which a country underwent a systemic banking crisis, as a fraction of the number of years in the corresponding period.	Author's calculations using data from Caprio and Klingebiel (1999), and Kaminsky and Reinhart (1998).
Period-specific Shifts	Time dummy variables.	Authors' construction.

### Appendix 3: Descriptive Statistics

#### (a) Univariate

	Data in 5-Year Periods			Data in 1-Year Periods		
	82 Countries, 545 Observations			75 Countries, 2908 Observations		
	Mean	Std. Dev.	Max.	Mean	Std. Dev.	Max.
Growth rate of GDP per capita	1.6142	2.7577	-10.9242	1.8044	4.4232	-33.8733
Private domestic credit/GDP (in logs)	3.3752	0.8944	-1.0841	3.2808	0.9353	-1.5128
Initial GDP per capita (in logs)	7.7751	1.5594	4.9769	7.7432	1.5753	4.7932
Structure-adjusted trade volume/GDP (in logs)	0.0453	0.4902	-1.4605	-0.0065	0.5572	-2.8184
Government consumption /GDP (in logs)	2.6438	0.3778	1.4564	2.6018	0.3786	1.1275
Inflation (in log [100+ inf. rate])	4.7341	0.1744	4.5851	4.7250	0.1805	3.9158
Std. Dev. of growth of private credit/GDP	0.0854	0.0741	0.0072			
Frequency of years under banking crisis	0.1130	0.2685	0.0000			
Secondary enrollment (in logs)	3.6418	0.8365	0.1126			

#### (b) Bivariate Correlations. Data in 5-Year periods, 82 countries (lower left triangular matrix) and Data in 1-Year periods (upper right triangular matrix)

	Growth rate of GDP per capita	Private domestic credit/GDP (in logs)	Initial GDP per capita (in logs)	Structure-adjusted trade volume/GDP (in logs)	Government consumption /GDP (in logs)	Inflation (in log [100+ inf. rate])	Std. Dev. of growth of private credit/GDP	Frequency of years under banking crisis	Secondary enrollment (in logs)
Growth rate of GDP per capita	1	0.122964898	0.15	0.03	-0.04888398	-0.2			
Private domestic credit/GDP (in logs)	0.29	1	0.72	0.09	0.388084107	-0.33548991			
Initial GDP per capita (in logs)	0.23	0.71	1	-0.17	0.41	-0.11			
Structure-adjusted trade volume/GDP (in logs)	0.07	0.1	-0.18	1	0.2	-0.21			
Government consumption /GDP (in logs)	-0.04	0.35	0.41	0.23	1	0.2			
Inflation (in log [100+ inf. rate])	-0.35	-0.4	-0.13	-0.27	-0.09	1			
Std. Dev. of growth of private credit/GDP	-0.37	-0.45	-0.36	0	-0.04	0.48	1		
Frequency of years under banking crisis	-0.26	-0.12	-0.15	0.03	-0.1	0.27	0.26	1	
Secondary enrollment (in logs)	0.21	0.58	0.78	-0.06	0.35	-0.02	-0.23	0.02	1

Source: Authors' calculations