



Venice Summer Institute 2001

Workshop on Financial Crises and Recovery

Venice International University, San Servolo
20-21 July 2001

Financial Development, Financial Fragility and Growth

Norman Loayza
&
Romain Ranciere

CESifo

Poschingerstr. 5, 81679 Munich, Germany

Phone: +49 (89) 9224-1410 - Fax: +49 (89) 9224-1409

E-mail: office@CESifo.de

Internet: <http://www.cesifo.de>

FINANCIAL DEVELOPMENT, FINANCIAL FRAGILITY, AND GROWTH¹

Norman Loayza
World Bank and Central Bank of Chile

Romain Ranciere
NYU and CERAS

First draft: October 2000

This draft: April 2001

ABSTRACT

This paper attempts to reconcile 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 for crises (e.g., Kaminski and Reinhart 1999) and their related economic downturns. This paper starts by illustrating these opposing effects by, first, analyzing the dynamics of output growth and financial intermediation around systemic banking crises and, second, showing that the growth enhancing effects of financial depth are weaker in countries that experienced such crises. After these illustrative exercises, the paper attempts an empirical explanation of the apparently opposing effects of financial intermediation. This explanation is based on a distinction between short-run (transitory) and long-run (trend) changes and effects of domestic credit aggregates. Working with a panel of cross-country and time-series observations, the paper estimates an encompassing model of long- and short-run effects, following, among others, Pesaran, Shin, and Smith (1999)'s Pooled Mean Group Estimator. The main result of the paper is that a positive long-run relationship between financial intermediation and output growth co-exists with a, mostly, negative short-run relationship.

¹ This paper was written while Ranciere worked in the research department of the Central Bank of Chile. We are grateful for the comments and advice from J. Benhabib, J. Cummins, F. Gallego, P. Gourinchas, K. Schmidt-Hebbel, and R. Soto.

FINANCIAL DEVELOPMENT, FINANCIAL FRAGILITY AND GROWTH

I. INTRODUCTION

This paper attempts to reconcile 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. 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 1997, 1999; Gourinchas, Landerretche, and Valdes 1999; Kaminski and Reinhart 1999). Since banking crises usually lead to recessions, an expansion of domestic credit would then be associated to growth slowdowns.

A similar divide exists at the theoretical level. According to the endogenous growth literature, financial deepening leads to a more efficient allocation of savings to productive investment projects (see Greenwood-Jovanovic 1990; Bencivenga-Smith 1991). Conversely, the financial crisis literature points to the destabilizing effect of financial liberalization as it leads to overlending. 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 (Shneider-Tornell, 2000; Aghion, Bacchetta and Banerjee 1999). 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, Sala-y-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 seeks to contribute to the debate from an empirical perspective. In section II we examine how the relationship between measures of financial depth and economic growth is affected by the presence of financial crises. For this purpose, we first

describe the behavior of financial intermediation and output growth around episodes of banking crises. We then reconsider the evidence on the positive growth effect of financial deepening by analyzing whether this effect is weaker in countries afflicted by financial crises.

In section III the paper attempts an empirical explanation of the apparently contradictory effects of financial intermediation on economic activity. This explanation is based on the distinction between cycle and trend changes of financial intermediation and their corresponding effects on output growth. Working with a panel of cross-country and time-series observations, we estimate an encompassing model of long- and short-run effects. Section IV concludes.

II. THE RELATIONSHIP BETWEEN FINANCIAL DEPTH AND GROWTH IN THE PRESENCE OF FINANCIAL CRISES

In this section we examine how the relationship between measures of financial depth and economic growth is affected by the presence of financial crises. First, we describe the behavior over time of financial intermediation and output growth around banking crises. We do it by using an event-study methodology applied to a panel of countries that have experienced such crises, as identified by Caprio and Klingbiel (1999). Second, we revisit the evidence on the positive growth effect of financial deepening by testing whether this effect is weaker in countries that have experienced banking crises. For this purpose, we follow the GMM cross-country panel-data approach to growth empirics in Levine, Loayza and Beck (2000).²

A. The behavior of financial intermediation and economic activity around episodes of financial crises

Here we describe the behavior of financial intermediation and economic activity in a typical country before and after the start of a banking crisis. We use total liquid liabilities and domestic credit to the private sector, both as ratios to GDP, as the measures of financial intermediation. Economic activity is measured with total and per capita GDP growth rates. We first identify the episodes of banking crises for a large sample of

² See also Caselli, Esquivel, and Lefort (1996), Easterly, Loayza, and Montiel (1997), and Beck, Levine, and Loayza (2000).

countries following the Caprio and Klingbiel (1999)'s classification. Then, applying an event-study methodology, we make country experiences comparable by re-scaling calendar time into crisis-centered time for each country. Moreover, to eliminate country-specific effects, we demean each observation with the corresponding country mean. We focus the analysis on the 12-year window centered on the start of the banking crisis. Figure 1 presents the behavior of the typical country-year observation, which is given by the median across countries in a particular year for each measure of financial intermediation and output growth. Table 1 presents Students' t-tests for the significance of level and correlation changes over the 12-year period.

Both liquid liabilities and private credit rise rapidly before the crisis then drop drastically once it starts. They recover partially in the following years but remain far below their pre-crisis levels. On the other hand, total and per capita GDP growth rates fall in the years prior to the banking crisis, reach the bottom at the onset of the crisis, and recover gradually afterwards. The correlation between the measures of financial intermediation and economic activity depend on the starting and ending year. Prior to the crisis, the correlation between growth and financial intermediation is strongly negative, while it is mildly negative or zero in the aftermath of the crisis. In summary, this first exercise shows that credit booms do precede banking crisis and that the relationship between financial intermediation and growth is negative before and during banking crises.

B. Revisiting the evidence on the growth effects of financial deepening

Working with a large cross-section of countries, King and Levine (1993a, 1993b) find a positive relationship between initial financial intermediation depth and subsequent long-run growth performance. In these and related studies, the long-run growth rate is estimated as the average rate over periods of time as long as 25-30 years. King and Levine use initial measures of financial intermediation (rather than, say, period averages) to be able to conclude that more developed financial systems lead to higher growth. Levine, Loayza, and Beck (2000) address directly the issue of joint endogeneity of financial development through the use of instrumental variables in their growth regressions. They use the countries' legal origin as the "external" instrument for financial depth in their cross-sectional regressions and the lagged observations of all

Fig 1a: Financial Intermediation

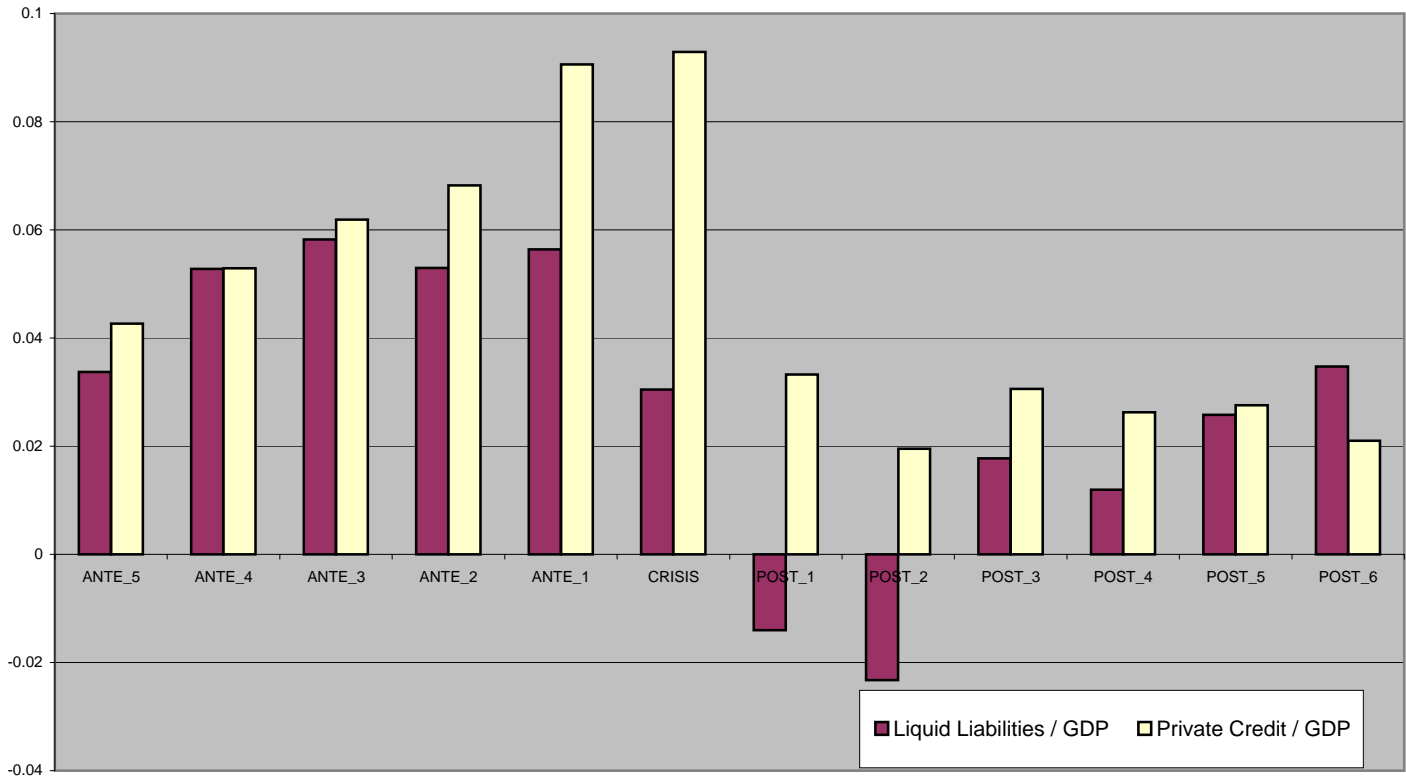
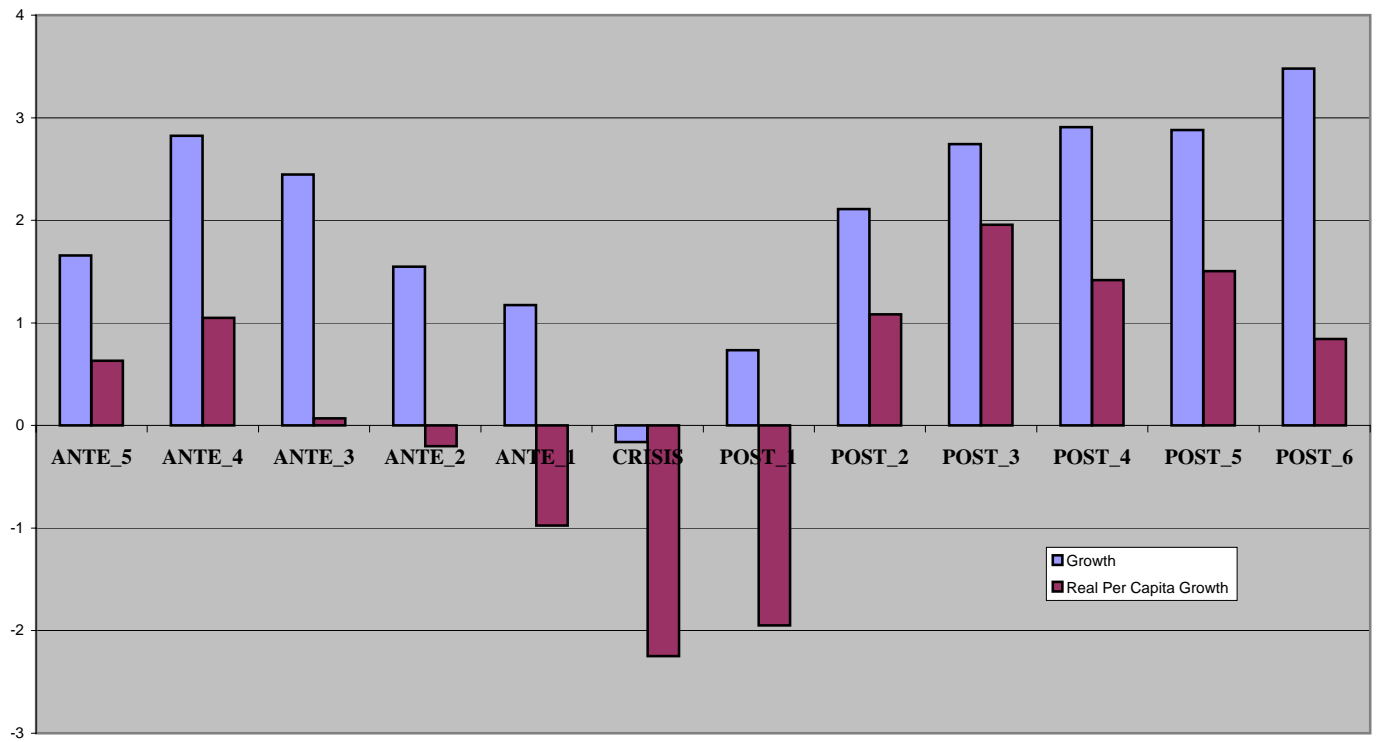


Fig 1b: Growth



explanatory variables as “internal” instruments in their pooled (cross-country and time-series) regressions. The data panels used by Levine et al. consist of about 74 countries and, for each of them, non-overlapping five-year averages covering the period 1960-95. They use five-year averages, rather than annual observations, to smooth out transitory or business-cycle fluctuations. Confirming previous results, Levine et al. find robust evidence that financial development and depth lead to an improved growth performance.

It is arguable that in most cases, using low-frequency data (such as averages over five or more years) allows the researcher to concentrate on long-run effects. However, in cases of prolonged or deep recessions, such as those associated with financial crises, even averages over long periods may be contaminated by cycle effects. Developing this argument, DeGregorio and Guidotti (1995) present evidence that while in cross-sectional regressions involving a worldwide sample of countries financial intermediation is positively linked with growth, in panel regressions for only Latin American countries, the relationship is negative. They suggest that their results for Latin America may reflect the lasting impact of the repeated financial crises (and associated overlending) that the region has suffered. However, DeGregorio and Guidotti do not offer direct evidence on the role of financial crises in distorting the financial intermediation and growth relationship. Moreover, it is possible that their contrasting results between the worldwide and Latin American samples are actually due to the use of cross-sectional vs. panel-data estimators.

We now analyze how the presence of financial crises modifies the estimated link between measures of financial intermediation and economic growth. For this purpose, we work with the same data and methodology as in Levine, Loayza, and Beck (2000) but allow for, respectively, a banking-crisis and a Latin America effect.

Data and Methodology

We work with a pooled (cross-country, time-series) data set consisting of 74 countries and, for each of them, at most 7 non-overlapping five-year periods over 1960-95. This is an unbalanced panel data set. See Annex 1 for the description of the data and country sample.

We estimate a growth regression using panel data. As standard in the literature, the regression equation is dynamic given that it includes the initial level of per capita output as an explanatory variable. Apart from the measure of financial intermediation,

the regression equation considers a set of control variables, including initial per capita output, average secondary school attainment of the adult population, the average ratio of government consumption to GDP, the average inflation rate, and the average black market premium on foreign exchange. To deal with time effects, the regression considers period-specific dummy variables. Finally, the regression equation allows for unobserved country-specific effects and the joint endogeneity of the explanatory variables. The method of estimation is the generalized method of moments (GMM) for dynamic models using panel data, as developed by Arellano and Bond (1991) and Arellano and Bover (1995).

The regression equation to be estimated is the following,

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

where, y is the logarithm of real per capita output, X is a set of control variables, FD is an indicator of financial depth, μ_t is a time-specific effect, η_i is an unobserved country-specific effect, and ε is the error term. The subscripts i, t represent country and time-period, respectively. We assess the banking-crisis and the Latin-America effects by introducing a slope dummy on the financial depth indicator.

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 ε . 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 ε is serially uncorrelated. We allow the unobserved country-specific effect η_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 generate moment conditions that allow estimation of the parameters of interest. The 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 overidentify the regression model, they also allow for specification testing through a Sargan-type test.

Results

Tables 2 and 3 report the growth regression results. We study how the effect of financial intermediation on growth varies in the presence of financial turmoil by including a slope dummy for countries that have suffered a banking crisis (Table 2). Furthermore, in order to reconsider De Gregorio and Guidotti's findings, we also assess the effect of a slope dummy for Latin American countries (Table 3). In each case, we work with two indicators of financial intermediation, namely, the ratio of liquid liabilities to GDP and the ratio of domestic credit to the private sector to GDP.

The results in Table 2 confirm the positive growth effect of larger financial depth. This effect is significantly positive for the samples of non-crisis and crisis countries. However, as the size and significance of the slope dummy coefficient reveals, the positive growth effect is statistically smaller for crisis than for non-crisis countries. This is true for both indicators of financial intermediation (i.e., liquid liabilities and private domestic credit). In Table 3, we reconsider De Gregorio and Guidotti's results. We agree with them that the growth effect of financial deepening is smaller in Latin American countries than in the rest. However, we find that even for Latin American countries an expansion of financial intermediation, as measured in the frequencies of five-year averages, leads to higher growth rates. Qualitatively, the results obtained with the two types of slope dummies are similar; this is not surprising given that most Latin countries have suffered from banking crisis. In summary, the estimated growth effect of financial deepening is smaller, but still positive, in countries that have faced financial crisis, and particularly those in Latin America.

III. SHORT- AND LONG-RUN GROWTH EFFECTS OF FINANCIAL DEEPENING

In this section we attempt an empirical explanation of the apparently contradictory effects of financial intermediation on economic activity. This explanation is based on the distinction between cycle and trend changes of financial intermediation and their corresponding effects on output growth. Instead of averaging the data to isolate trend effects, we estimate both long- and short-run effects using annual data in a panel containing a large sample of countries. Our method can be summarized as a panel, error-

correction model, where long- and short-run effects are estimated jointly from a general autoregressive distributed-lag (ARDL) model.

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.³

A. Methodology

Empirical estimation poses two issues. The first is the need to separate and estimate short- and long-run effects without being able 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.

Single-country estimation

As said above, we face the challenge to estimate long- and short-run relationships without being able to observe 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 of

³ Similar arguments are made by Attanasio, Scorcu, and Picci (2000) in their cross-country study on the dynamic relationship between saving, investment, and growth.

integrated variables. The second one is that standard methods of estimation and inference are incorrect. Pesaran and Smith (1995), Pesaran (1997) and Pesaran and Shin (1999) have argued against both misconceptions, showing how small modifications to standard methods can render consistent and efficient estimates of the parameters in a long-run relationship between both integrated and stationary variables. Furthermore, the methods proposed by Pesaran and co-authors avoid the need for pre-testing and order-of-integration conformability given that they are valid whether or not 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 augmented such that the regressors are strictly exogenous and the resulting residual is not serially correlated. For reasons that will become apparent shortly, Pesaran and co-authors call their method “an autoregressive distributed lag (ARDL) approach” to long-run modelling.

As an illustration, consider the following simple bivariate model:

$$y_t = a + by_{t-1} + cX_{t-1} + v_t \quad (1)$$

$$X_t = \gamma + \rho X_{t-1} + \varepsilon_t \quad (2)$$

where y_t , the decision variable, is the per capita GDP growth rate in year t ; and X , the forcing variable, represents a set of growth determinants including financial depth and control variables. Furthermore, assume that the residuals (or shocks) have the following distributional properties:

$$\begin{pmatrix} v_t \\ \varepsilon_t \end{pmatrix} iid(0, \Sigma), \quad \Sigma = \begin{pmatrix} \sigma_{vv} & \sigma_{v\varepsilon} \\ \sigma_{v\varepsilon} & \sigma_{\varepsilon\varepsilon} \end{pmatrix} \quad (3)$$

The first point to note is that X does not depend on past values of y (beyond its dependence on previous values of X). If a more general process for X were allowed, the long-run relationship between the two variables would not be unique. That is, both variables would be endogenous and additional identification assumptions would be needed to discern between various long-run relationships.⁴ Since multiple long-run relationships are beyond the scope of this paper, we restrict the dynamic process for X to be purely autoregressive.

The second point to note is that the existence of a long-run relationship requires the process for y to be stable, which in this simple example entails that $|b| < 1$. Notice that once we have restricted the process of X to be purely autoregressive, the existence of a long-run relationship does not rely on whether X is $I(0)$ or $I(1)$; that is, there is no restriction on whether $\rho = 1$. Pesaran, Shin, and Smith (2000) present a test for the null hypothesis that there is no long-run relationship when it is not known *a priori* whether X is $I(0)$ or $I(1)$. The test consists on examining the null that $b = 1$ against the alternative that $|b| < 1$.

In order to be able to derive the long-run relationship between y and X , we must obtain a dynamic regression equation in which, first, the regression residual is serially uncorrelated and, second, the regressors, X , are *strictly* exogenous (that is, independent of the residuals at all leads and lags.) Given the assumptions on the distributional properties of the residuals ν and ε (equation 3), the requisite that the residuals be serially uncorrelated is met in our simple example. If this were not the case, we would need to augment the lag order in (1) and (2) until the residuals become serially independent (Pesaran and Shin 1999). The second pre-requisite to derive a long-run relationship is, however, not met in our simple example – X is not *strictly* exogenous given that the non-zero correlation between the shocks entails a contemporaneous feedback between y and X . As explained by Pesaran and Shin (1999), the way to control for this contemporaneous feedback is also to augment the dynamic specification in (6). The purpose of augmenting the regression equation is to replace the (correlated) residual ν with a linear predictor based on leads and lags of X and a new residual that by construction is independent of X . In our simple example, we model the contemporaneous correlation between ν_t and ε_t by a linear regression of ν_t on ε_t as follows,

$$\nu_t = \left(\frac{\sigma_{\nu\varepsilon}}{\sigma_{\varepsilon\varepsilon}} \right) \varepsilon_t + \eta_t \quad (4)$$

where $(\sigma_{\nu\varepsilon}/\sigma_{\varepsilon\varepsilon})$ represents the population coefficient of the regression, and η_t is distributed independently from ε_t .

⁴ See Hsiao (1997) and Pesaran and Shin (1999).

Substitute the above expression for v_t into equation (1). Then, using the AR model for X , express ε_t in terms of X_t and X_{t-1} . The ensuing regression equation is an auto-regressive distributed lag model (ARDL) for y from which a long-run relationship can be derived. The resulting ARDL (1,1) for y is given by,

$$y_t = \left(a - \gamma \frac{\sigma_{v\varepsilon}}{\sigma_{\varepsilon\varepsilon}} \right) + by_{t-1} + \left(\frac{\sigma_{v\varepsilon}}{\sigma_{\varepsilon\varepsilon}} \right) X_t + \left(c - \rho \frac{\sigma_{v\varepsilon}}{\sigma_{\varepsilon\varepsilon}} \right) X_{t-1} + \eta_t \quad (5)$$

Note that the original process for y (equation 1) is now augmented by the inclusion of the additional regressor X_t .

The error-correction model (ECM) implied by the ARDL (1,1) given above can be expressed as,

$$\Delta y_t = -(1-b) \left[y_{t-1} - \left(\frac{a - \gamma \frac{\sigma_{v\varepsilon}}{\sigma_{\varepsilon\varepsilon}}}{1-b} \right) - \left(\frac{c + \frac{\sigma_{v\varepsilon}}{\sigma_{\varepsilon\varepsilon}}(1-\rho)}{1-b} \right) X_{t-1} \right] + \left(\frac{\sigma_{v\varepsilon}}{\sigma_{\varepsilon\varepsilon}} \right) \Delta X_t + \eta_t \quad (6)$$

where the expression in brackets is the error-correction term and $(1-b)$ is the speed of adjustment.

Therefore, the long-run (steady-state) relationship implied by the dynamic system in equations (1)-(4) is given by,

$$y^* = \left(\frac{a - \gamma \frac{\sigma_{v\varepsilon}}{\sigma_{\varepsilon\varepsilon}}}{1-b} \right) + \left(\frac{c + \frac{\sigma_{v\varepsilon}}{\sigma_{\varepsilon\varepsilon}}(1-\rho)}{1-b} \right) X^* + \eta^* \quad (7)$$

or, $y^* = \alpha + \beta x^* + \eta^*$.

The presentation of this simple empirical model serves to highlight the assumptions and properties of the ARDL method proposed by Pesaran and Smith (1995), Pesaran (1997), and Pesaran and Shin (1999) for the estimation of a long-run relationship. The advantage of the method is that standard estimation and inference can be used regardless of whether the regressors are stationary or integrated. The main assumption is that there exist a single long-run relationship between the endogenous and

forcing variables.⁵ The pre-requisites for consistent and efficient estimation are that the shocks in the dynamic specification be serially uncorrelated and that the forcing variables be strictly exogenous. As we illustrated, the pre-requisites can be met by augmenting sufficiently the lag order of the dynamic regression equation. The resulting equation will generally be an ARDL(p, q) model of sufficiently large lag order.

Multi-country estimation

Our empirical samples below are characterized by time-series (T) and cross-section (N) dimensions of relatively large size. In such conditions, there are a number of alternative methods for multi-country estimation, which allow for different degrees of 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 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 coefficients to be the same across countries but allows the short-run coefficients (including the speed of adjustment) to be country specific. The PMG estimator also generates consistent estimates of the mean of short-run coefficients across countries by taking the unweighted average of the individual country coefficients (provided that the cross-sectional dimension is large).

⁵ It is worth noting that this assumption 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.

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 financial development, institutional quality, and relative price flexibility. Furthermore, the PMG estimator is sufficiently flexible to allow for long-run coefficient homogeneity over only a subset of variables and/or countries.

In view of these considerations, we use the PMG method to estimate a long-run relationship that is common across countries while allowing for unrestricted country heterogeneity in the adjustment dynamics. 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. The estimation of the long-run coefficients is done jointly across countries through a (concentrated) maximum likelihood procedure. Then the estimation of short-run coefficients (including the speed of adjustment), country-specific intercepts, 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 coefficients previously obtained.⁶

⁶ 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 excessively sensitive to the inclusion of 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 our 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 seek 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.

B. Data and Results

The sample consists of 48 countries with annual data for the period 1960-97. 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 measures of financial depth are liquid liabilities and private domestic credit, both as ratios to GDP. The control variables are government consumption, the inflation rate, and the volume of trade.

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 at least one lag of each explanatory variable and as many as 4 lags of the growth rate, the dependent variable. The second are that both country-specific effects and cross-country common factors be eliminated. We do this by including, respectively, country-specific and 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. We report the estimates for this coefficient and its corresponding standard error, and we find evidence supporting the dynamic stability of the model. The fourth condition is that the long-run parameters be the same across countries. We present Hausman tests which allow us to conclude that the homogeneity of long-run parameters cannot be rejected.

Tables 4 and 5 present the estimation of long- and short-run parameters linking per capita GDP growth, financial intermediation, and other growth determinants. In Table 4 the measure of financial intermediation is the ratio of liquid liabilities to GDP, while in Table 5 it is the ratio of private domestic credit to GDP. In both tables, we

present 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.

Focusing on the PMG estimator, the main results are the following. In the long-run, per capita GDP growth is positively and significantly related with financial depth. However, in the short-run the average relationship between them is negative. Thus, the sign of the relationship depends on whether their movements are cyclical or permanent. This is true whether the measure of financial depth is liquid liabilities or private domestic credit.

IV. CONCLUSIONS

The results in this paper can be summarized as follows.

- The dynamic relationship between economic growth and financial intermediation is negative around financial crises. Furthermore, the positive link between “long-run” economic growth and financial deepening is smaller in countries that have suffered banking crises than in the rest.
- Using recent econometric methods for the estimation of dynamic models using panel data, we find that a positive long-run relationship between financial intermediation and output growth co-exists with a, mostly, negative short-run relationship. We propose this result as an empirical explanation for the apparent contradiction between the crisis literature and the endogenous-growth literature on the effects of financial deepening.

REFERENCES

- Aghion P., P. Bacchetta, and A. Banerjee, 1999, "Capital Markets and the Instability of Open Economies," unpublished.
- 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. Scorcu, 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.
- Caprio G. and D. Klingbiel, 1996, "Bank Insolvencies: Cross-country Experience," World Bank policy research working paper 1620.
- Caprio G. and D. Klingbiel, 1999, "Episodes of Systemic and Borderline Financial Crises," mimeo World Bank.
- Caselli A., G. Esquivel and G. Lefort, "Reopening the Convergence Debate: a new look at the Cross-Country Growth Empirics, *Journal of Economic Growth*, 1(3), 363-389.
- De Gregorio J. and P. Guidotti, 1995, "Financial Development and Economic Growth," *World Development*, 23(3), 433-448.
- 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.

Gourinchas P.O., O. Landerretche, and R. Valdes, 1999, "Lending Booms: Some Stylized Facts", unpublished.

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

King R. and R. Levine, 1993, "Finance and Growth: Schumpeter Might Be Right," *Quarterly Journal of Economics*, 108(3), 717-38.

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

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.

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

Sachs J., A. Tornell, and A. Velasco, 1996, "Financial Crises in Emerging Markets: The Lessons from 1995," *Brookings Papers on Economic Activity*, 147-98.

Tornell A. and M. Schneider, 2000, "Lending Booms and Speculative Crises," unpublished.

Table 1 Descriptive Statistics for Countries with Crisis Experience

	ANTE CRISIS PERIOD	CRISIS PERIOD	T-test P-Value
	t-5 to the starting year of crisis, t	t+1 to t+6	Ho: ante=crisis
Liquid Liabilities /GDP	0.047578843	0.007509945	0.07
<i>OBS</i>	48	50	
Private Credit/ GDP	0.066891752	0.027435856	0.06
<i>OBS</i>	48	49	
Real Per Capita Growth	-0.269641648	0.780450416	0.0157
<i>OBS</i>	56	53	
Correlation (Liquid Liabilities, Growth)	-0.1072	-0.1208	0.35
<i>OBS</i>	42	40	
Correlation (Private Credit, Growth)	-0.347	-0.18	0.07
<i>OBS</i>	42	41	

TABLE 2: Financial Intermediation, Crisis Experience and Growth; system estimator

Regressors	Coefficient	Std Error	Coefficient	Std Error
Constant	0.751883	1.0316	3.06879	0.9624
Log of Initial Income per Capita	-0.204635	0.1096	0.10722	0.1226
Average year of secondary schooling	0.477162	0.1463	0.14471	0.1519
Liquid Liabilities	2.086862	0.1837		
Liquid Liabilities*Crisis Experience	-0.379457	0.0414		
Private Credit			1.43412	0.0634
Private Credit*Crisis Experience			-0.26059	0.0411
Government size	-1.187689	0.2865	-1.90475	0.2665
Inflation Rate	0.325441	0.3941	-0.39897	0.3056
Black Market Premium	-1.980017	0.09	-1.18752	0.0859
Dummy 71-75	-0.833267	0.08	-0.98195	0.0642
Dummy 76-80	-0.882677	0.1251	-0.96971	0.1158
Dummy 81-85	-3.043068	0.1322	-2.96185	0.1672
Dummy 86-90	-2.074279	0.1594	-2.01945	0.1674
Dummy 91-95	-2.867901	0.1776	-2.77716	0.1637
Sargan Test (P-value)	0.467		0.41	
2nd Order Serial Correlation (P-Value)	0.836		0.642	
Number of Countries	74		74	
Number of Obsevation	359		359	

TABLE 3: Financial Intermediation, Latin America and Growth; system estimator

Regressors	Coefficient	Std Error	Coefficient	Std Error
Constant	2.074185	0.9213	5.379823	0.9257
Log of Initial Income per Capita	-0.181326	0.0955	-0.036462	0.1106
Average year of secondary schooling	0.592854	0.1141	0.434511	0.1289
Liquid Liabilities	2.098478	0.1586		
Liquid Liabilities*Latin America	-0.203884	0.0498		
Private Credit			1.557448	0.073
Private Credit*Latin America			-0.199361	0.053
Government size	-1.946623	0.1978	-2.665188	0.2506
Inflation Rate	0.363155	0.357	-0.287723	0.2191
Black Market Premium	-1.741312	0.0957	-1.111259	0.0933
Dummy 71-75	-0.923225	0.0941	-1.03786	0.129
Dummy 76-80	-1.070274	0.1002	-1.146228	0.1307
Dummy 81-85	-3.103926	0.1268	-3.131746	0.19
Dummy 86-90	-2.271343	0.1176	-2.261626	0.1375
Dummy 91-95	-3.18211	0.1357	-3.154942	0.1465
Sargan Test (P-value)	0.467		0.461	
2nd Order Serial Correlation (P-Value)	0.836		0.655	
Number of Countries	74		74	
Number of Observations	359		359	

Table 4: ARDL(3,2,1,1,1,1); Dependant Variable: Growth; Financial Indicator: Private Credit/GDP
Pooled Mean Group, Mean Group estimators and Dynamic Fixed Effect, controlling for country and time effects
Sample: All Countries 1961-1997

Variabels	Pooled Mean Group		Mean Group		Hausman Tests		Dynamic Fixed Effect	
	Coef.	St.Er.	Coef.	St.Er.	h-test	p-val	Coef.	St.Er.
Long-Run Coefficients								
PC	0.604	0.286	-22.88	15.34	2.34	0.27	0.642	0.858
GDP(-5)	-9.421	0.5	-4.5	4.68	1.07	0.79	-3.453	1.397
GOV	-0.69	0.431	-3.04	4.342	0.3	0.59	-2.465	0.978
TRAD	1.388	0.417	3.19	1.643	1.28	0.26	3.848	1.116
INF	-9.289	1.041	-9.213	5.152	0	0.99	-3.121	0.492
Error Correction Coefficients								
Phi	-0.875	0.095	-1.956	0.178			-0.857	0.074
Short-Run Coefficients								
dGR(-1)	0.047	0.064	0.615	0.128			-0.081	0.041
dGR(-2)	-0.062	0.042	0.199	0.071			-0.059	0.039
dPC	-27.27	14.134	-4.183	10.06			-3.713	1.723
dPC(-1)	9.1	8.63	16.897	15.444			-1.496	1.447
dGDP(-5)	-8.438	2.372	-2.212	4.4523			-5.171	2.89
dGOV	-14.503	2.526	-8.685	3.134			-1.916	1.11
dTRAD	-0.209	1.728	-4.933	2.321			-2.167	1.257
dINF	-2.438	4.275	8.649	5.114			-2.48	0.079
Inpt	67.35	7.392	176.04	63.559				
No. Countries	48		48				48	
No.Observations	1211		1211				1211	
Avg RBarSq	0.65		0.68				0.44	

Table 5: ARDL(3,1,1,1,1); Dependant Variable: Growth; Financial Indicator: Liquid Liabilities/GDP
Pooled Mean Group, Mean Group estimators and Dynamic Fixed Effect, controlling for country and time effects
Sample: All Countries 1961-1997

Variabels	Pooled Mean Group		Mean Group		Hausman Tests		Dynamic Fixed Effect	
	Coef.	St.Er.	Coef.	St.Er.	h-test	p-val	Coef.	St.Er.
Long-Run Coefficients								
LLY	2.124	0.453	-30.162	48.46	0.45	0.5	1.223	1.6725
GDP(-5)	-8.616	0.513	62.848	64.449	1.23	0.27	-3.43	1.48
GOV	-0.584	0.469	-24.21	18.569	1.62	0.2	-2.28	1.08
TRAD	2.716	0.379	13.99	14.012	0.65	0.42	3.859	1.103
INF	-10.177	0.986	-10.745	25.692	0	0.98	-3.173	0.485
Error Correction Coefficients								
Phi	-0.889	0.092	-1.727	0.124			-0.849	0.07
Short-Run Coefficients								
dGR(-1)	0.079	0.055	0.453	0.087			0.076	0.038
dGR(-2)	-0.051	0.038	0.116	0.051			-0.057	0.038
dLLY	-22.22	7.34	-17.467	7.911			-11.781	3.147
dGDP(-5)	-7.193	2.576	-6.117	3.975			-4.714	2.194
dGOV	-12.889	2.706	-7.707	2.842			-1.83	1.044
dTRAD	-1.827	1.805	-6.494	2.324			-2.219	1.259
dINF	-1.077	3.195	10.962	3.905			-2.512	0.814
Inpt	57.162	5.924	68.55	36.584				
No. Countries	49		49				49	
No.Observations	1235		1235				1235	
Avg RBarSq	0.61		0.65				0.44	

APPENDIX A1: LIST OF SYTEMIC BANKING CRISES*

Country Name	Start	End	Start	End	Start	End
Argentina	1980	1982	1989	1990	1995	1995
Benin	1988	1990				
Burkina Faso	1988	1994				
Bolivia	1986	1987	1994	2000		
Brazil	1990	1990	1994	1996		
Central African Republic	1988	1999				
Chile	1976	1976	1981	1983		
Cote d'Ivoire	1988	1991				
Cameroon	1987	1993	1995	1998		
Congo, Rep.	1992	2000				
Colombia	1982	1987				
Czech Republic	1989	1991				
Algeria	1990	1992				
Ecuador	1996	2000				
Egypt, Arab Rep.	1977	1985				
Spain	1977	1985				
Estonia	1992	1995				
Finland	1991	1994				
Ghana	1982	1989				
Guinea	1985	1985	1993	1994		
Hungary	1991	1995				
Indonesia	1987	2000				
Israel	1977	1983				
Kenya	1985	1989	1992	1992	1993	1995
Korea, Rep.	1997	2000				
Kuwait	1988	1990				
Lebanon	1988	1990				
Sri Lanka	1989	1993				
Lithuania	1995	1996				
Latvia	1995	1996				
Madagascar	1988	1988				
Mexico	1995	2000				
Mali	1987	1989				
Mauritania	1984	1993				
Malaysia	1997	2000				
Niger	1987	1993				
Norway	1988	1998				
Nepal	1988	1988				
Peru	1983	1990				
Philippines	1998	2000				
Paraguay	1995	2000				
Russian Federation	1995	1995	1998	1998		
Senegal	1988	1991				
El Salvador	1989	1989				
Slovak Republic	1991	2000				
Slovenia	1992	1994				
Sweden	1991	1994				
Chad	1992	1992				
Thailand	1997	2000				
Ukraine	1997	1997				
Uruguay	1981	1984				
Venezuela	1994	2000				
Congo, Dem. Rep.	1991	1992	1994	2000		
Zimbabwe	1995	1995				

Source: Caprio and Klingbiel (1999)

* Here are only listed countries for which we get a precise time period for Banking Crises.

APPENDIX A2 : SYSTEMIC AND BORDERLINE BANKING CRISES IN BLL 74 COUNTRIES PANNEL

		systemic banking crises	borderline banking crises
ARG	Argentina	x	
AUS	Australia		x
AUT	Austria		
BEL	Belgium		
BOL	Bolivia	x	
BRA	Brazil	x	
CAF	Central African Republic	x	
CAN	Canada		x
CHE	Switzerland		
CHL	Chile	x	
CMR	Cameroon	x	
COL	Colombia	x	
CRI	Costa Rica		x
CYP	Cyprus		
DEU	Germany		
DNK	Denmark		x
DOM	Dominican Republic		
DZA	Algeria	x	
ECU	Ecuador	x	
EGY	Egypt, Arab Rep.	x	
ESP	Spain	x	
FIN	Finland	x	
FRA	France		
GBR	United Kingdom		
GHA	Ghana	x	
GMB	Gambia, The		
GRC	Greece		x
GTM	Guatemala		x
HND	Honduras		
HTI	Haiti		
IDN	Indonesia	x	
IND	India		x
IRL	Ireland		
IRN	Iran, Islamic Republic of		
ISR	Israel	x	
ITA	Italy		
JAM	Jamaica		
JPN	Japan	x	
KEN	Kenya	x	
KOR	Korea, Republic of	x	
LKA	Sri Lanka	x	
LSO	Lesotho		x
MEX	Mexico	x	
MUS	Mauritius		
MWI	Malawi		
MYS	Malaysia	x	
NER	Niger	x	
NIC	Nicaragua		
NLD	Netherlands		
NOR	Norway	x	
NZL	New Zealand		x
PAK	Pakistan		
PAN	Panama		
PER	Peru	x	
PHL	Philippines	x	
PNG	Papua New Guinea		x
PRT	Portugal		
PRY	Paraguay	x	
RWA	Rwanda		x
SDN	Sudan		
SEN	Senegal	x	
SLE	Sierra Leone		
SLV	El Salvador	x	
SWE	Sweden	x	
SYR	Syria		
TGO	Togo	x	
THA	Thailand	x	
TTO	Trinidad and Tobago		
URY	Uruguay	x	
USA	United States		x
VEN	Venezuela	x	
ZAF	South Africa		
ZAR	Zaire		
ZWE	Zimbabwe	x	
Total	74	36	12

Source: Caprio and Klingbiel (1999)

Appendix B: Countries in the Sample

Algeria	Greece	Papua New Guinea
Argentina	Guatemala	Paraguay
Australia	Haiti	Peru
Austria	Honduras	Philippines
Belgium	India	Portugal
Bolivia	Indonesia	Rwanda
Brazil	Iran	Senegal
Cameroon	Ireland	Sierra Leone
Canada	Israel	South Africa
Central African Republic	Italy	Spain
Chile	Jamaica	Sri Lanka
Colombia	Japan	Sudan
Costa Rica	Kenya	Sweden
Cyprus	Lesotho	Switzerland
Denmark	Malawi	Syria
Dominican Republic	Malaysia	Taiwan
Ecuador	Mauritius	Thailand
Egypt	Mexico	Togo
El Salvador	Netherlands	Trinidad and Tobago
Finland	New Zealand	United States of America
France	Nicaragua	Uruguay
Gambia	Niger	Venezuela
Germany	Norway	Zaire
Ghana	Pakistan	Zimbabwe
Great Britain	Panama	

Appendix C: Variables and Sources

Variable	Definition	Original source	Secondary source
Level and growth rate of GDP	Real per capita GDP	World Development Indicators	Loayza et al. (1998)
	Real per capita GDP (for initial GDP in cross-section regressions)	Penn World Tables	
Government size	Government expenditure as share of GDP	World Development Indicators	Loayza et al. (1998)
Openness to trade	Sum of real exports and imports as share of real GDP	World Development Indicators	Loayza et al. (1998)
Inflation rate	Log difference of Consumer Price Index	International Financial Statistics (IFS), line 64	
Average years of schooling	Average years of schooling in the population over 25	Barro and Lee (1996)	
Average years of secondary schooling	Average years of secondary schooling in the population over 15	Barro and Lee (1996)	
Black market premium	Ratio of black market exchange rate and official exchange rate minus one	Pick's Currency Yearbook through 1989 ; and World Currency Yearbook.	
Liquid Liabilities	$\{(0.5)*[F(t)/P_e(t) + F(t-1)/P_e(t-1)]\}/[GDP(t)/P_a(t)]$, where F is liquid liabilities (line 55l), GDP is line 99b, P_e is end-of period CPI (line 64) and P_a is the average annual CPI.	IFS	
Commercial-Central Bank	DBA(t) / (DBA(t) + CBA(t)), where DBA is assets of deposit money banks (lines 22a-d) and CBA is central bank assets (lines 12 a-d).	IFS	
Private Credit	$\{(0.5)*[F(t)/P_e(t) + F(t-1)/P_e(t-1)]\}/[GDP(t)/P_a(t)]$, where F is credit by deposit money banks and other financial institutions to the private sector (lines 22d + 42d), GDP is line 99b, P_e is end-of period CPI (line 64) and P_a is the average CPI for the year.	IFS	

Appendix D : 1960-1997 ANNUAL DATA CORRELATION (five year average data correlation in parenthesis)

	com	lly	pc	growth	inf	gov	school	trade	bmp	initial
com	1.00									
lly	0.47 (0.51)	1.00								
pc	0.55 (0.6)	0.84 (0.84)	1.00							
growth	0.21 (0.33)	0.15 (0.22)	0.14 (0.2)	1.00						
inf	-0.2 (0.6)	-0.2 (-0.26)	-0.1 (-0.26)	-0.2 (-0.29)	1.00					
gov	0.24 (0.6)	0.37 (0.21)	0.27 (0.24)	-0.0 (-0.04)	-0.11	1.00				
school	0.31	0.56	0.56	0.09 (0.13)	0.03	0.41	1.00			
trade	0.26 (0.6)	0.16 (0.13)	0.08 (0.09)	0.05 (0.13)	-0.16	0.48	0.05	1.00		
bmp	-0.3 (0.6)	-0.1 (-0.03)	-0.2 (0.22)	-0.1 (-0.2)	0.26	-0.13	-0.10	-0.21	1.00	
initial income	0.52 (0.6)	0.62 (0.61)	0.55 (0.76)	0.14 (-0.14)	-0.11	0.43	0.80	0.08	-0.23	1.00
OBS	2656.00	2509.00	2521.00	2612.00	2577.00	1551.00	2484.00	2620.00	2576.00	2766.00
5 year avg OBS	359.00	359.00	359.00	359.00	359.00	359.00	359.00	359.00	359.00	359.00

VARIABLES

com = Commercial Banks Assets / (Central Banks + Commercial Banks Assets)

lly = Liquid Liabilities / GDP

pc = Private Credit / GDP

growth= real per capita Growth

inf = inflation rate

gov= government expenditures / GDP

school = average year of secondary education

trade = trade openness

bmp=black market premium

initial income = beginning of the period real per capita income