How Much Bang For The Buck?
Mexico and Dollarization

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Abstract: Two arguments advanced in favor of Mexico abandoning the Peso and adopting the U.S. dollar are (1) to reduce exchange rate volatility and (2) to lower inflation. We are *not* able to identify a robust, independent link between exchange rate volatility and growth. Exchange rate volatility primarily reflects domestic and international factors, rather than representing an independent growth determinant. We also find that inflation does *not* independently influence growth when controlling for the level of financial development. However, lower inflation boosts financial development, and greater financial development accelerates economic growth. Our results are consistent with new theoretical predictions that inflation influences economic growth primarily by affecting financial development. For Mexico, the potential impact of dollarization on inflation, and then from inflation through financial development to growth is economically large. But, we find that dollarization is not the best way to promote financial development in Mexico. Mexico can earn much greater growth dividends by strengthening the legal rights of creditors and shareholders and enforcing those rights.

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I. **Introduction**

Two of the main arguments advanced in favor of Mexico abandoning the Peso and adopting the U.S. dollar are (1) to lower inflation (and inflation uncertainty) and (2) to reduce exchange rate volatility. From 1960 to1995, Mexico's annual inflation rate averaged about 24.5 percent, while inflation in the United States averaged 5.5 percent. In addition, Mexico has experienced severe exchange rate fluctuations against the dollar, especially in the last 15 years. Supporters of complete "dollarization" believe that reducing the rate of inflation (which moves very closely with the volatility of inflation) toward U.S. levels and eliminating exchange rate variability vis-à-vis the U.S. dollar will enhance the business climate and thereby promote economic performance. If lower inflation rates and less exchange rate variability boost growth, then this strengthens the case for dollarization. If, however, inflation and exchange rate variability do not exert a large impact on economic activity, then the arguments in favor of dollarization must be sought elsewhere.

Besides inflation and exchange rate volatility, policymakers must contemplate an array of factors in deciding on dollarization. Dollarization would eliminate discretionary monetary policy and limit lender of last resort facilities during financial sector distress. Dollarization could also influence the functioning of labor markets, business cycle fluctuations, sensitivity to external shocks, fiscal policy discipline, international trade, and international financial market integration. We do not examine these important issues. Thus, we do not provide a comprehensive evaluation of the pros and cons associated with Mexico's dollarization decision. Rather, we empirically assess two major reasons used to advocate dollarization.

This paper assesses whether dollarization – by lowering inflation and reducing exchange rate volatility – would substantially boost economic growth in Mexico. Critically, we examine the growth effects of inflation and exchange rate volatility. We do not examine the links running from dollarization to inflation and volatility per se, nor do we suggest that dollarization is the best way for Mexico to

reduction inflation or exchange rate volatility. Methodologically, we use cross-country comparisons. In particular, we use a panel data set of 73 countries over the period 1960-95. We average the data over five-year periods to abstract from business-cycle frequencies and focus on growth. This yields seven observations per country (data permitting). We use a newly developed Generalized-Method-of-Moments (GMM) panel estimator to extract consistent and efficient estimates of the impact of inflation and exchange rate variability on growth (see Arellano and Bover 1995 and Blundell and Bond 1997). This panel estimator controls for three biases that plague most cross-country growth regressions: endogeneity, omitted country-specific effects, and the routine use of lagged dependent variables as regressors. Although broad cross-country comparisons do not provide an in-depth study of Mexico per se, this paper obtains more accurate estimates of the impact of inflation and exchange rate volatility on output than past studies. We then use the estimated parameters to assess the case for dollarization in Mexico and to compare the economic growth-effects of dollarization with the growth-effects from other policy initiatives.

We do *not* find a robust, independent link between exchange rate volatility and long run growth. We believe this is the first study of exchange rate volatility and economic growth that accounts for potential biases induced by endogeneity, omitted variables, and the inclusion of lagged dependent variables as regressors. After controlling for different combinations of national characteristics -- such as changes in the terms of trade, government size, financial sector development, and inflation -- exchange rate volatility enters the growth regression insignificantly and sometimes with a positive coefficient. It is important to emphasize that many different conditioning information sets produce these results. Thus, this paper's analyses suggest that exchange rate volatility primarily reflects domestic policies and international shocks rather than representing an independent growth determinant. Since exchange rate volatility does not exert a robust, independent impact on economic growth, dollarization is unlikely to boost long-run economic growth by reducing exchange rate volatility.

We also find that inflation does *not* exert an independent influence on growth. There are two parts to this result, however. First, for a *very* wide array of control variables, we find a negative, economically meaningful relationship between inflation and long run growth. Second, the relationship between inflation and growth vanishes once we control for the level of financial intermediary development. In our analysis, financial intermediary development is the *only* country characteristic that alters the strong negative link between inflation and growth.[1] Thus, dollarization is unlikely to influence growth by reducing inflation *unless* reducing inflation boosts financial development.

Given these results, we examine the impact of inflation on financial development. Here, it is important to recognize that a growing body of evidence suggests that financial intermediary development exerts a large, positive impact on economic growth.[2] Indeed, our results show that when including both inflation and financial intermediary development in the growth regressions, the coefficient on financial development remains positive, significant, and economically large. Thus, in studying growth, there are good empirical reasons for focusing on the determinants of financial development. Furthermore, Huybens and Smith (1999) develop a theoretical model in which inflation influences growth by impeding the functioning of financial markets. Thus, there are theoretical and empirical reasons for assessing whether dollarization influences economic growth by boosting financial sector development.

We find that inflation exerts a strong, negative impact on financial development, confirming the Boyd, Levine, and Smith (2000) results. The negative relationship between inflation and financial development is not due to biases created by endogeneity, country-specific effects, or the inclusion of lagged dependent variables. The strong negative inflation-finance link is robust to alterations in the conditioning information set. This result is particularly noteworthy for Mexico. Currently, Mexico has both high interest rates and a comparatively anemic flow of credit through the banking system to new firms. Since efficient financial intermediation is important for growth (Levine, Loayza, and Beck

2000), policies to improve financial development offer real opportunities to reduce improve credit allocation and economic growth. This paper suggests that inflation reduction as a consequence of dollarization would help banking sector development in Mexico. .

Thus, dollarization, by reducing inflation, can enhance financial sector performance and substantially increase the rate of long-run economic growth. The growth-effect is potentially large. Our calculations suggest that lowering Mexico's average inflation rate from 24.5 percent to the U.S. average of 5.5 percent would accelerate annual per capita growth in Mexico by about 0.56 percentage points per year. This is large considering that Mexico's average per capita growth rate over the 35-year period was 1.74 percent per year.

Finally, we conduct a rough assessment of whether dollarization is worth it. Dollarization is a monumental policy reform. If the main route via which dollarization promotes growth is by stimulating financial sector development, this raises an important question: is dollarization the most effective means to promote financial sector development in Mexico? Put differently, if Mexico can implement one big regime change to enhance financial development, should it choose dollarization? One alternative is legal reform. Specifically, a growing body of work suggests that the legal environment critically influences financial sector development and hence long run growth [See LaPorta, Lopez-de-Silanes, Shleifer, and Vishny 1997, 1998, 1999a,b and Levine 1998,1999]. This literature focuses on how well the legal system protects outsider investors in firms (both creditors and shareholders) against expropriation by firm insiders (both managers and large shareholders). Moreover, existing work shows that Mexico is extraordinary: its legal system is the weakest in the international cross section of countries for which we currently have data. Thus, if Mexico is willing to undertake monumental reforms to promote financial development, should it reform its legal system or adopt the dollar? While analytically much less rigorous than the examination of exchange rate volatility and inflation, we find

that Mexico can earn greater growth dividends by strengthening the legal position of creditors and shareholders.

The remainder of the paper is organized as follows. Section II describes the econometric methodology. Section III discusses the results on exchange rate volatility. Section IV presents our findings on inflation and growth. The links between inflation and financial sector development are detailed in Section V. Section VI gives an empirical evaluation of whether dollarization is a better vehicle than legal reform for boosting financial development, and hence overall economic growth, in Mexico. Section VII concludes.

II. **Econometric Methodology**

This section briefly describes the GMM dynamic panel estimator that we use to assess the impact of dollarization on economic growth. Specifically, we motivate the technique and outline the procedure. Levine, Loayza, and Beck (2000) provide a more extensive explanation.

A. Motivation

We construct a panel that consists of data for 73 countries over the period 1960-95. We average the data over seven non-overlapping five-year periods. Consider the following regression equation,

$$y_{i,t} - y_{i,t-1} = (a-1)y_{i,t-1} + b' X_{i,t} + h_i + e_{i,t} \qquad (1)$$

where y is the logarithm of real per capita Gross Domestic Product (GDP), X represents the set of explanatory variables (other than lagged per capita GDP), h is an unobserved country-specific effect, ε is the error term, and the subscripts i and t represent country and time period, respectively.[3]

Using panel econometric techniques can alleviate many of the problems associated with using pure cross-country regressions to estimate equation (1). First, we can capitalize on the time-series nature of the data. For instance, the within-country sample standard deviation of real per capita GDP is about 2.4% and the between-country standard deviation is 1.7%. Thus, by moving from the pure cross-

section to the panel, we are able to exploit the additional variability of the data and attain more accurate estimates of the impact of inflation and exchange rate volatility on economic growth.

Second, in a pure cross-sectional regression, the unobserved country-specific effect is part of the error term. Therefore, correlation between η and the explanatory variables produces biased estimates. This problem is particularly likely in growth regressions since lagged per capita GDP is used as a regressor. As described below, we use an estimator that produces consistent and efficient estimates even when the country-specific effect is correlated with the explanatory variables. This yields more accurate estimates of the impact of inflation and exchange rate volatility on growth than alternative techniques.

Third, common applications of the pure cross-sectional instrumental estimator do not control for the endogeneity of all the explanatory variables. As in Beck, Levine, and Loayza (2000) and Levine, Loayza, and Beck (2000), we employ a panel estimator that uses "internal" instruments (instruments based on previous realizations of the explanatory variables) to consider the potential joint endogeneity of the other regressors as well. This produces more precise estimates of the impact of exchange rate variability and inflation on growth.[4]

B. GMM Dynamic Panel Estimator

We can rewrite equation (1).

$$y_{i,t} = a\, y_{i,t-1} + b' X_{i,t} + h_i + e_{i,t} \qquad (2)$$

Now, to eliminate the country-specific effect, take first-differences of equation (2).

$$y_{i,t} - y_{i,t-1} = a\left(y_{i,t-1} - y_{i,t-2}\right) + b'\left(X_{i,t} - X_{i,t-1}\right) + \left(e_{i,t} - e_{i,t-1}\right) \qquad (3)$$

The use of instruments is required to deal with (a) the likely endogeneity of the explanatory variables, and (b) the problem that by construction the new error term, $e_{i,t} - e_{i,t-1}$ is correlated with the lagged dependent variable, $y_{i,t-1} - y_{i,t-2}$. It should be emphasized, that instrumental variables are

employed to deal with these specific statistical issues that may confound the ability to draw accurate inferences from the data. We do not construct a structural, simultaneous equations model. Such a model would then offer an economic explanation running from the exogenous factors through to the endogenous variables. Instead, we use internal instruments – lagged values of the regressors in levels and differences – to confront potential statistical biases. Under specific assumptions, this approach controls for simultaneity bias and potential biases induced by the use of lagged dependent variables in estimating the parameters; put differently, this approach allows us to assess whether the exogenous component of the regressors is associated with the dependent variables. Under the assumptions (which we test) that (a) the error term, e , is not serially correlated, and (b) the explanatory variables, *X*, are weakly exogenous (i.e., the explanatory variables are assumed to be uncorrelated with future realizations of the error term), the GMM dynamic panel estimator uses the following moment conditions.

$$E\left[y_{i,t-s} \cdot \left(e_{i,t} - e_{i,t-1}\right)\right] = 0 \quad for\ s \geq 2; t = 3, \ldots, T \tag{4}$$

$$E\left[X_{i,t-s} \cdot \left(e_{i,t} - e_{i,t-1}\right)\right] = 0 \quad for\ s \geq 2; t = 3, \ldots, T \tag{5}$$

We refer to the GMM estimator based on these conditions as the *difference* estimator.

There are, however, conceptual and statistical shortcomings with this difference estimator. Conceptually, we would also like to study the cross-country relationship between financial development and per capita GDP growth, which is eliminated in the *difference* estimator. Statistically, Alonso-Borrego and Arellano (1996) and Blundell and Bond (1997) show that when the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regressors in the differenced equation. Instrument weakness influences the asymptotic and small-sample performance of the difference estimator. Asymptotically, the variance of the coefficients rises. In small samples, Monte Carlo experiments show that the weakness of the instruments can produce biased coefficients.

To reduce the potential biases and imprecision associated with the usual difference estimator, we use a new estimator that combines in a *system* the regression in differences with the regression in levels [Arellano and Bover 1995 and Blundell and Bond 1997]. The instruments for the regression in differences are the same as above. The instruments for the regression in levels are the lagged *differences* of the corresponding variables. These are appropriate instruments under the following additional assumption: although there may be correlation between the levels of the right-hand side variables and the country-specific effect in equation (2), there is no correlation between the *differences* of these variables and the country-specific effect. This assumption results from the following stationarity property,

$$E\left[y_{i,t+p} \cdot h_i\right] = E\left[y_{i,t+q} \cdot h_i\right] \quad \text{and} \quad E\left[X_{i,t+p} \cdot h_i\right] = E\left[X_{i,t+q} \cdot h_i\right] \quad \text{for all } p \text{ and } q \tag{6}$$

The additional moment conditions for the second part of the system (the regression in levels) are:

$$E\left[\left(y_{i,t-s} - y_{i,t-s-1}\right) \cdot \left(h_i + e_{i,t}\right)\right] = 0 \quad \text{for } s = 1 \tag{7}$$

$$E\left[\left(X_{i,t-s} - X_{i,t-s-1}\right) \cdot \left(h_i + e_{i,t}\right)\right] = 0 \quad \text{for } s = 1 \tag{8}$$

Thus, we use the moment conditions presented in equations (4), (5), (7), and (8) and employ a GMM procedure to generate consistent and efficient parameter estimates.

Consistency of the GMM estimator depends on the validity of the instruments. To address this issue we consider two specification tests suggested by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1997). The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. The second test examines the hypothesis that the error term $e_{i,t}$ is not serially correlated. In both the difference regression and the system regression we test whether the differenced error term is second-order serially correlated (by construction, the differenced error term is

probably first-order serially correlated even if the original error term is not).[5] Thus, we use the *system estimator* to assess the potential impact of dollarization on economic growth.

III. Exchange Rate Volatility and Economic Growth

A. Conceptual Overview

This section examines the relationship between exchange rate volatility and economic growth. The purpose is *not* to derive a theoretical model that elucidates the circumstances under which exchange rate volatility affects economic activity. Rather, we shed empirical light on the existing debate regarding the importance of exchange rate volatility. Dollarization's proponents frequently argue that dollarization will boost economic development in Mexico by lowering exchange rate volatility. This could occur through a number of channels. Lower exchange rate volatility could reduce the risk premia associated with investing in Mexico. Falling interest rates would lower the cost of capital and reduce government debt payments. Also, smaller risk premia might reduce credit market frictions. This could lead banks to lend more prudently, with positive implications for financial stability. Also, lower exchange rate volatility might enhance international trade and capital inflows, with beneficial repercussions on both capital accumulation and resource allocation. There are of course countervailing views. Exchange rate volatility may not represent an independent source of risk in the economy. Exchange rate volatility may simply reflect terms of trade changes. Also, agents' perceptions of erratic monetary policy, fiscal positions, and of financial sector fragility may induce exchange rate volatility. If exchange rate volatility is primarily a reflection of these policies, shocks, and distortions, then eliminating exchange rate volatility through dollarization will not stimulate much growth. In this case, policymakers must focus on improving the underlying policies and not on exchange rate volatility per se.

This section provides empirical evidence on the debate regarding the independent role of exchange rate volatility in explaining economic growth. We use the GMM dynamic panel estimator described above. This technique controls for simultaneity bias and biases induced by country-specific effects and the inclusion of lagged dependent variables as regressions. Moreover, we control for a number of other country characteristics to assess whether there is an independent link running from exchange rate volatility to growth. Specifically, we control for monetary policy, fiscal policy, financial development, terms of trade changes, and openness to international trade in order to determine whether there is a link between exchange rate volatility and growth holding other things constant.

B. Data

To assess whether exchange rate volatility affects economic growth, we need data on exchange rate volatility, growth, and a conditioning information set to control for other growth determinants.

Exchange rate volatility is constructed from monthly data as follows. Let s(t) equal the natural logarithm of the nominal exchange rate relative to the U.S. dollar in month t. Now, let $d(t) = [s(t) - s(t-1)]^2$. The panel data set uses five-year averages. Thus, exchange rate volatility is simply the average value of the d(t)'s over the specific five-year period.[6] While a case can be made for using nominal effective exchange rates, these data are not available prior to 1979 (which would make it impossible to use the econometric methods outlined above).

The average exchange rate volatility for the entire sample is 0.006 as shown in Table 1. Some countries experienced extremely volatile exchange rates vis-à-vis the dollar. For instance, Bolivia (1980-84), Nicaragua (1985-89), Peru (1985-89), and Uruguay (1970-74) all had exchange rate volatility above 0.10, which is about 17-fold above the sample mean. Mexico had few changes in its exchange rate over the three five-year periods composing 1960-1974. However, over the period 1975 to1979, exchange rate volatility rose to 0.005, and then doubled to 0.01 from 1980-84 during the onset of the

debt crisis. Since then, Mexican exchange rate volatility was 0.003 for both the1985-1989 and 1990-95 periods. Table 1 also shows a negative correlation between exchange rate volatility and economic growth.

Economic growth equals the annual growth rate of real per capita GDP. It is computed as log differences from the World Bank's World Development Indicators. There is considerable variation over the sample. Table 1 shows that the average growth rate for our sample was 1.6 percent per year with a standard deviation of 2.8. Japan grew at almost ten percent over the period 1965 to 1969, while Rwanda shrank at an annual rate of ten percent over the period 1990 to 1994. Mexico grew at greater than three percent per year for most of the 20 years running from 1960-80, but its real per capita GDP declined from 1980 to 95 at an average rate of about 0.45 percent per annum.

We use a fairly standard set of control variables in the growth regressions. Table 1 and the Appendices list summary statistics on these variables.

Initial income per capita equals the value of real per capita GDP (in U.S. dollars) measured during the first year of the corresponding five-year period. The initial income variable is used to capture the convergence effect predicted by many growth models.

Average years of schooling equals the average number of years of schooling in the population over 25 years old [Barro and Lee 1996]. Numerous models and empirical analyses stress the importance of schooling in economic development.

Government size equals government consumption expenditures as a share of GDP and is taken from the World Bank's World Development Indicators. We use this to gauge fiscal policy [Easterly and Rebelo 1993].

Inflation equals the average growth rate of the CPI.[7] Inflation is a general indicator of macroeconomic stability and may interfere with financial contracting as we discuss below [Fischer 1993; Huybens and Smith 1999]. An assortment of countries suffered with average annual inflation

rates of greater than 100 percent over some of the five-year periods in our sample, while others saw prices level over a five-year period.[8] While Mexico experienced low rates of inflation during the 1960s (below five percent per annum), inflation rose in the 1970s (to 11% (1970-74) and 19% (1975-79) respectively). With the debt crisis, inflation averaged about 50% per annum in the 1980s before falling to 16% over the 1990-94 period. The sample mean rate of inflation is 17.6%. Furthermore, inflation is extremely highly correlated with inflation variability (0.98) and highly correlated with exchange rate variability (0.77). Thus, it is important to control for inflation in assessing the independent effect of exchange rate volatility on growth.

Black market premium is the ratio of the black market exchange rate to the official rate minus one. The black market premium is frequently used as a general indicator of policy interventions in exchange markets since eliminating intervention eliminates the premium. Empirically, the black market premium is negatively linked with growth [Levine and Zervos 1993]. Moreover, Table 1 shows that the black market premium is highly correlated with exchange rate volatility (0.79). Thus, it is important to control for the black market premium in assessing the independent link between exchange rate volatility and growth.

Openness to trade is the sum of real exports plus imports as a percent of real GDP [World Development Indicators (World Bank)]. A long literature emphasizes the importance of openness to trade for economic development.

Private Credit equals real financial intermediary credits to the private sector as a percent of real GDP.[9] An extensive literature documents the close association between the level of financial development and economic growth.

Change in the terms of trade is the average annual change in the terms of trade. This is taken from the World Development Indicators (World Bank).

C. Exchange Rate Volatility and Growth: Results

The results indicate that there is *not* a robust, independent link between economic growth and exchange rate volatility. Table 2 provides regressions using the GMM system estimator. All of the regressions include initial income per capita and average years of schooling. Then, we use alternative combinations of the control variables listed above. Exchange rate volatility enters the growth regressions significantly in a variety of econometric specifications (see regressions (1), (2), and (3)). However, when we control for various combinations of the black market premium, government size, private credit, terms of trade changes, and inflation, exchange rate volatility no longer enters with a significant, negative coefficient. It is critical to emphasize that many different combinations of right-hand-side variables cause exchange rate volatility to enter insignificantly. It is not that exchange rate volatility is linked to one particular country characteristic. Rather, exchange rate volatility is a reflection of a whole range of economic growth determinants. Indeed, exchange rate volatility sometimes enters with a positive (though insignificant) coefficient, which emphasizes the ephemeral relationship between exchange rate volatility and growth.

The absence of a robust link between exchange rate volatility and growth is not due to mis-specification or outliers. The regressions satisfy the specification tests. There is no evidence of second order serial correlation and the regressions pass the Sargan specification test. It is also worth noting that many of the other regressors (initial income per capita, average years of schooling, openness to trade, private credit, change in the terms of trade, and inflation) enter significantly and with the expected signs. Furthermore, these results hold after eliminating observations of extreme exchange rate volatility (we identify these observations above). Using this smaller sample, however, did not alter our *inability* to identify a strong, negative link between exchange rate volatility and growth. Indeed, with these outliers omitted, exchange rate volatility enters either insignificantly or with a significant, *positive* coefficient.

Thus, the data are consistent with the view that exchange rate volatility does *not* represent an independent distortion. The data support the view that exchange rate volatility reflects policies, shocks, and distortions whose mainsprings must be sought elsewhere. Thus, the results imply that eliminating exchange rate volatility through dollarization will not stimulate economic growth in Mexico. To improve growth, Mexico should focus on improving its underlying policies, rather than on exchange rate volatility per se.

III. Inflation and Growth

A. Concepts

Proponents of dollarization also argue that by adopting the dollar, Mexico will reduce inflation and inflation variability with positive repercussions for economic growth. Inflation and inflation variability are closely correlated in our sample (0.98). It is impossible to distinguish the separate effects of each. Consequently, we use inflation as a joint measure of inflation and inflation variability.

Inflation and inflation variability may influence economic growth in a variety of ways. By distorting price signals and creating uncertainty, inflation and the accompanying variability may impede business transactions, shorten investment horizons and thereby lower the efficiency of economic activity. Also, inflation may intensify rent seeking, as agents shift from inherently productive endeavors to activities focused on profiting from inflation. Recently, theorists have focused on the financial sector in explaining how anticipated inflation might influence economic activity over relatively long-run horizons (such as five years). Huybens and Smith (1998) show that increases in the rate of inflation can aggravate credit market frictions with adverse implications for financial sector performance and long-run economic activity.[10] According to these theories, inflation hurts growth primarily by interfering with the efficient operation of the financial sector.

This section provides empirical evidence on whether -- *and how* -- inflation influences economic growth. Past work draws conflicting conclusions on the links between inflation and growth. Using a pure cross-section approach with data averaged over thirty years (1960-1989), Levine and Renelt (1992) do not find a strong link between inflation and growth. However, Bruno and Easterly (1998) and Fischer (1993) identify a negative inflation-growth relationship using higher frequency data, but without controlling for simultaneity bias. Easterly, Loayza, and Montiel (1997) find a strong negative relationship between inflation and growth using the *difference* GMM panel estimator to control for simultaneity bias. In this paper, we follow Boyd, Levine, and Smith (2000) in using the *system* GMM panel estimator to investigate the ties between inflation and growth. Recall from Section II, the *system* GMM panel estimator offers improvements in terms of consistency and efficiency over the *difference* estimator. Moreover, we control for a number of other country characteristics to assess whether there is an independent link running from inflation to growth. Given recent theories, we pay considerable attention to assessing whether inflation influences growth primarily by effecting financial sector performance.

B. Inflation and Growth: Results

There is *not* a robust, negative link between economic growth and inflation once we control for the level of financial development. Table 3 shows that inflation has a significant, negative relationship with long-run growth *except* when we control for financial development. Indeed, as long as we excluded financial development from the conditioning information set, we found a significant negative relationship between growth and inflation. However, when we control for financial development, inflation enters insignificantly *and* financial development enters significantly. The fragile growth-inflation link -- *when controlling for financial development* -- is not due to mis-specification or outliers. The regressions do not exhibit evidence of second order serial correlation, nor do they reject the Sargan

specification test. Also, we obtain the same results when excluding extreme inflation observations.[11] It should also be emphasized that there is a strong, robust link between financial development and economic growth. Thus, our findings are consistent with the following conclusion: dollarization will not materially accelerate growth by reducing the rate of inflation *unless* reducing inflation boosts financial development.

The accumulated results suggest an important next step. Inflation is significantly and negatively related to economic growth when controlling for other variables. Inflation is never significantly, negatively correlated with growth, however, when we control for the level of financial development. Recent theories foreshadow this conclusion. Theory suggests that inflation influences economic activity by interfering with the efficient operation of the financial system. According to these theories, inflation intensifies credit rationing with adverse effects on the quantity and quality of credit. Thus, theory suggests examining the inflation-finance link. Empirically, this channel is also particularly noteworthy. Financial development is robustly related to economic growth. The other growth determinants that we consider frequently enter the growth regression insignificantly. International trade, exchange rate volatility, and the black market premium all enter at least one growth regression insignificantly in those reported in Tables 2 and 3. The finance-growth link, however, remains positive and strong controlling for these other factors.[12] Thus, we do not examine all the possible routes via which inflation might influence growth. Rather, based on theory and evidence, we focus on a particularly attractive channel: financial development. We now empirically assess the impact of inflation on financial development.

V. The Impact of Inflation on Financial Sector Performance

A. Inflation and Financial Development: Results

Since we have already reviewed the theoretical reasons for believing that inflation hurts financial sector performance, we turn immediately to the empirical results. Now, the dependent variable is our measure of financial development, Private Credit. We use various combinations of control variables to assess the link between financial development and inflation. We continue to use the *system* GMM panel instrumental estimator to control simultaneity and country specific effects.

The results suggest a strong negative relationship between inflation and financial development. Table 4 summarizes the results. As shown, the negative finance-inflation relationship remains significant after controlling for an assortment of variables, including initial income, schooling, the black market premium, government size, openness to trade, changes in the terms of trade, and exchange rate volatility. We control for these variables since distortions and shocks emanating from fiscal, monetary, and international factors may influence the operation of financial markets. The regressions satisfy the specification test: there is no evidence of second order serial correlation and the regressions pass the Sargan specification test. Also, the inverse finance-inflation relationship is robust to the removal of the inflation outliers discussed above.[13] As in Boyd, Levine, and Smith (2000), we find a robust, negative relationship between the rate of inflation and financial sector performance.[14]

The data are consistent with the view that inflation reduction through dollarization can boost growth. The potential links in the policy chain are as follows: dollarization lowers inflation; lower inflation boosts financial development; and financial development accelerates economic growth. Boyd, Levine, and Smith (2000) and this paper show that by lowering the rate of inflation, dollarization can boost financial development. Moreover, Levine, Loayza, and Beck (2000) – using similar data and estimation techniques – shows that greater financial development accelerates economic growth. While

these links are not estimated as part of system, current research suggests a series of links running from dollarization to economic growth.

B. Economic Impact of Inflation on Growth via the Financial System

We now assess the economic magnitude of the policy chain running from dollarization to growth. These computations must be viewed critically and perhaps skeptically. We do not construct a structural model running from the exogenous component of inflation through financial development to economic growth. Rather, we estimate two separate equations: the first links the exogenous component of inflation with financial development; the second links the exogenous component of financial development with growth. Thus, the estimates do not account for the fully range of economic interactions. Nevertheless, we proceed in order to get a first order approximation of the growth impact, pending the development of a more elaborate model.

Consider the following. In regression (2) of Table 4 where the dependent variable is financial development, the coefficient on the rate of inflation is –1.6. By adopting the U.S. dollar, Mexico could hope to attain the same inflation rate as the United States. Over the 1960-95 period, Mexico had an inflation rate of 24.5% and the United States had an inflation rate of 5.5%. We illustrate the potential growth effects from dollarization using this large drop in the inflation rate from 24.5% to 5.5%. Holding other things constant, the change in the natural logarithm of Private Credit equals –1.6*{Ln(1.055) - Ln(1.245)}, which equals 0.265.[15]

Now, to estimate the effects on economic growth, we can use one of the growth regressions from Table 2 or 3 that includes Private Credit. Importantly, the point estimates of the impact of the natural logarithm of Private Credit on economic growth presented in Tables 2 and 3 are very similar to the wide array of estimates presented in Levine, Loayza, and Beck's (2000) extensive analysis of the finance-growth link. They also show that the panel GMM estimates give very similar parameter estimates to

those obtained from pure cross-country regressions. Using a parameter estimate of 2.1 on the natural logarithm of Private Credit in the growth regression (regression 6 of Table 2) suggests that dollarization would accelerate per capita economic growth by 0.56 (2.1*0.265) percent per annum. This extra growth implies that real per capita GDP would be about 18% higher after 30 years of dollarization.[16] These rough calculations focus *only* on one specific channel via which dollarization influences economic development: dollarization reduces inflation, which boosts financial development, which in turn accelerates long-run economic growth.

VI. Dollarization vs. Legal Reform

A. Issues

Our analysis suggests that dollarization can materially raise Mexico's rate of economic growth by boosting financial development. This raises a critical question: *Is dollarization the best way to boost financial development in Mexico?* This question has particular policy relevance because complete dollarization represents a major regime change. If Mexico can only implement one regime change during the next decade or so, then it should assess the growth effects of alternative regimes. Put bluntly, if Mexico only has the gumption for one monumental policy change to promote financial development and hence long-run growth, is dollarization the right one?

Influential research suggests that improvements in the legal system can substantially boost financial development [LaPorta, Lopez-de-Silanes, Shleifer, and Vishny 1997, 1998, 1999a,b; henceforth LLSV]. Since finance is a set of contracts, the legal environment influences financial development through a variety of channels. For example, LLSV (1998b) view corporate governance as a set of arrangements that protects outside investors in a firm from expropriation by firm insiders. Two critical mechanisms for protecting outsider investors – both creditors and minority shareholders – are through the formal legal codes that define the rights of outsiders and through the enforcement of those

laws. If the legal system effectively supports the rights of outsiders, then this eases the flow of saving to productive endeavors. Thus, cross-country differences in laws and their enforcement influence corporate governance and the efficient allocation of capital. Furthermore, when investors feel secure, they are willing to pay more for securities. This makes it easier for firms to raise funds [LLSV 1999b, p.17]. Thus, the legal system fundamentally influences the ability of the financial system to funnel society's savings to fruitful ends with material implications for long-run growth [Levine 1998, 1999; Levine, Loayza, and Beck 1999].

The purposes of this section are to (1) illustrate the growth dividends from important legal reforms and (2) compare them to the growth dividends from dollarization. Since we only have recent information on comparative legal system, we move from using panel data over the 1960-95 period to using a pure cross-sectional estimator over the 1980-95 period. Fortunately, the two econometric procedures produce very similar estimates of the impact of inflation on financial development. In comparing the growth dividends of dollarization vis-à-vis legal reforms, this subsection is more illustrative and less statistically rigorous than previous sections. Nonetheless, we believe the comparisons provide a useful framework for selecting among potential monumental policy reforms in Mexico.

B. The Legal Environment and Financial Development

We use the measure of the legal rights of outside investors developed by LLSV (1998). Specifically, LLSV assemble cross-country information on the legal rights of outside investors. We briefly review the nine underlying variables that compose the conglomerate index of outsider legal rights called **Outrights**.

Proxy equals 1 if shareholders can vote either by showing up in person, sending an authorized representative, or mailing in their vote. Proxy equals 0 if shareholders cannot vote by mail. This can

impede shareholder participation because they must either attend the meeting or go through the legal procedure of designating an authorized representative.

Cumulative equals 1 if the Company Law or Commercial Code allows shareholders to cast their votes for one candidate, and 0 otherwise. The ability to vote all one's shares for one candidate may make it easier for minority shareholders to put their representatives on boards of directors.

Blocked equals 1 if the Company Law or Commercial Code does not allow firms to require that shareholders deposit their shares prior to a General Shareholders Meeting, thus preventing them from selling those shares for a number of days, and 0 otherwise. When shares are blocked in this manner, the shares are kept in custody until a few days after the meeting. This practice prevents shareholders that do not bother to go through this arduous exercise from voting.

Minor equals 1 if the Company Law or Commercial Code grants minority shareholders either a judicial venue to challenge the management decisions or the right to step out of the company by requiring the company to purchase their shares when they object to certain fundamental changes, such as mergers, assets dispositions and changes in the articles of incorporation. The variable equals 0 otherwise.

Meeting equals 1 if the minimum percentage of ownership share capital that entitles a shareholder to call for an Extraordinary Shareholders' Meeting is less than 10 percent, and 0 otherwise. The minimum percentage of ownership share capital that entitles a shareholder to call for an Extraordinary Shareholders' Meeting ranges from one to 33 percent with a median of 10 percent. Mexico has the highest value in the sample of countries. Presumably, the harder it is for minority shareholders to call a meeting and contest management the less attractive it will be for agents to participate in equity markets.

Preempt equals 1 if shareholders have preemptive rights that can only be waived by a shareholders vote, and 0 otherwise. If the rights of shareholders can be altered without a full meeting,

then this represents less secure legal rights for outsider investors.

Autostay equals 1 if a country's laws do not impose an automatic stay on the assets of firms upon filing a reorganization petition, and equals 0 otherwise. The existence of an automatic stay might prevent creditors from gaining possession of collateral or liquidating a firm to meet a loan obligation.

Manages equals 1 if firm managers are prohibited from continuing to administer the firm's affairs pending the resolution of reorganization processes, and zero otherwise. In some countries, management stays in place until a final decision is made about the resolution of claims. In other countries, a team selected by the creditors replaces management. If management stays pending resolution, this implies less external creditor rights.

Secured1 equals 1 if secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm. Secured1 equals zero if non-secured creditors, such as the government or workers get paid before secured creditors.

Outrights equals the summation of these nine indicators of the legal rights of external investors.

Mexico ranks last in terms of the legal rights of external investors for 44 countries for which we have the data to conduct our analyses. Specifically, Outrights in Mexico is 1. Preempt equals one in Mexico, but the other indicators of legal rights are 0 in Mexico. No other country has Outrights equal to one. A few countries have Outrights equal to nine. Specifically, the United Kingdom's legal codes (as well as Hong Kong's legal codes) strongly emphasize the rights of outside investors, such that Outrights = 9. In the United States, Outrights = 6. The legal codes in the U.S. strongly support the rights of outside shareholders, with less emphasis on the rights of externals creditors.

Empirically, there is a close connection between the legal rights of outsiders and overall financial sector development. Consider the following ordinary least squares regressions (with heteroskedasticity-consistent standard errors) of Private Credit on Outrights, Inflation, and some control variables (CV).[17] This is a pure cross-country regression with data averaged over the period 1980-95 and one observation per country.

$$\text{Private Credit} = CV + \underset{(0.02)}{0.08}*[\text{Outrights}] - \underset{(0.02)}{1.1}*[\text{Inflation}]^{18}$$

P-values are given in parentheses. The R-squared is 0.73 and there are 44 observations.

The regression shows that Outrights is positively and significantly linked with Private Credit. Greater legal protection of outsider investors is positively associated with financial development. The regression also shows that the rate of inflation is significantly and negatively associated with financial development. The estimated coefficient on inflation (-1.1) from this cross-section regression over the 1980-95 period is not substantially different from the panel, GMM coefficient estimate over the 1960-95 period (-1.6) that we presented earlier. When we use instrumental variables to control for the potential endogeneity of the legal code index, OUTRIGHTS, the parameter estimates do not change substantially.[19]

Furthermore, we examined the results while controlling for the effectiveness with which laws are enforced. This is important since the legal rights of outside investors are only helpful to the extent that the legal system enforces those rights. Including a measure of the law and order tradition of the country (a) caused inflation to enter the financial development regression insignificantly while (b) OUTRIGHTS remained significant and of the same magnitude. Nonetheless, since the enforcement indicator did not enter this financial development regression significantly, we decided to work with the simple regression reported above.

C. Comparing the Effects of Legal Reform and Dollarization

Consider the following question: which has bigger growth effects, legal reforms that bring Mexican laws protecting investors to U.S. levels or dollarization that brings Mexican inflation rates to those of the U.S.? More specifically, we evaluate the growth effects from improving Mexico's protection of outside investors from 1 (Mexico's current level) to 6 (the U.S. level) and we compare this to lowering inflation from 24.5% (the long-run Mexican rate) to 5.5% (the long-run U.S. rate). To be consistent, we use the parameter estimate from the pure cross-country regression listed in the text above.

Legal reforms that take Mexico's protection of outside investors from its current level of 1 (Outrights=1) to the U.S. level of 6 (Outright=6) would boost the natural logarithm of Private Credit by 0.4 (=5*0.08), where 0.08 is the coefficient on the Outright in the regression provided in the text above. If we use the estimated impact of Private Credit on growth (regression 6 from Table 2), then we see that monumental legal reforms (that bring Mexico's investor right's protection to U.S. levels) produce 0.84 percentage points of extra growth per year [=0.4*2.1].

Also, note that the growth dividends from changing Mexico's laws regarding outside investors to United Kingdom levels are even greater. Moving Outright from 1 to 9 in Mexico would produce an estimated 0.64 rise in the natural logarithm of Private Credit. This translates into 1.34 extra percentage points of extra growth each year, which is a huge acceleration in growth.

The impact of dollarization is much smaller. Moving inflation from Mexico's 24.5% to 5.5% would boost the logarithm of Private Credit by 0.18 (=1.1*[Ln(1.245)-Ln(1.055)]), where 1.1 is the coefficient on Inflation in the regression provided in the text. Thus, the impact of legal reform on financial development (0.4) is more than double the impact dollarization (via a drop in the inflation rate) on financial development (0.18). In terms of growth, the drop in inflation produces 0.37 percentage points of extra growth per year. Considering the channel from dollarization through inflation through financial development to growth, we seen that dollarization *has less than half* the growth impact as legal reforms.

These estimates suggest that the growth dividends from fundamental legal reforms in Mexico are much greater than the growth effects from adopting the dollar. These estimates, however, must be viewed as purely illustrative. These examples assume a linear relationship between the legal system indicators and financial development. We do not find evidence of a nonlinear relationship when we entered a quadratic term. Nonetheless, the computations do rely on the linearity assumption holding over a wide range, i.e., moving from 1 to 6 or even 9 on the legal index scale. Furthermore, we do not consider alternative channels via which dollarization may influence growth. As emphasized in the introduction, dollarization may influence domestic policies and economic growth through a number of channels. For instance, dollarization may influence fiscal policy, financial integration, foreign direct investment, etc. All of these may influence economic growth. This paper focuses on inflation reduction and exchange rate volatility. The paper shows that there is not an independent link between growth and either exchange rate volatility or inflation. Inflation, however, influences financial development, with positive growth effects. For Mexico, however, the growth effects from lowering inflation to U.S. levels are not as great as improving the legal environment. Also, it is important to emphasize that we are evaluating the growth effects from non-marginal policy changes. Both dollarization and fundamental legal reforms are regime changes. Yet, regression elasticities represent the effects of marginal changes. Nonetheless, for Mexico, the estimated growth effects from legal reforms are substantially greater than those from lowering inflation.

VII. Conclusion

This paper evaluated the growth effects from two key elements of dollarization: exchange rate volatility and inflation. While there are many other factors associated with dollarization, proponents of dollarization advertise lower exchange rate volatility and less inflation as two key benefits. We use data on 73 countries over the period 1960-95 and new dynamic GMM panel procedures to compute the impact of inflation and exchange rate volatility on economic growth. The results help in assessing the likely impact of dollarization in Mexico.

The results indicate that exchange rate volatility does not enjoy an independent link with economic growth. While subject to an assortment of qualification, the findings suggest that exchange rate volatility reflects a myriad of domestic and international factors, rather than generating a new source of risk. Thus, our results imply that dollarization in Mexico will not materially influence growth simply by eliminating exchange rate volatility.

We also find that inflation does not enjoy an independent link with economic growth while controlling for the level of financial development.

We do, however, find that (a) inflation exerts a strong negative impact on financial development, and (b) financial development is robustly and positively associated with economic growth. Thus, the results indicate that inflation influences economic growth primarily by affecting financial development.

Our calculations suggest that dollarization could substantially raise economic growth in Mexico. We consider the case of reducing Mexico's inflation rate from its long-run average of 24.5 percent to the U.S. long-run average of 5.5 percent per year. This would accelerate per capita growth in Mexico by about 0.56 percentage points per year. This implies a 32 percent increase in Mexico's annual per capita growth rate, which averaged 1.74 percent over the period 1960-95.

Since a major route via which dollarization influences growth is by stimulating financial sector development, we assessed whether dollarization is the most effective means to promote financial sector

development in Mexico. We find that the answer is no. Fundamental legal reforms that strengthen the rights of investors would – by our rough calculations – increase growth by more than twice the amount produced by dollarization.

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Table 1. Summary Statistics

	Mean	Std. Dev.	Min. Value	Max. Value
Growth rate (in percent)	1.62	2.77	-10.02	9.86
Initial income per capita (thousands constant US$)	4,713.52	5,229.73	188.02	20,134.81
Average years of schooling	5.01	2.84	0.16	12.00
Black market premium (% over official rate)	0.63	5.93	-0.04	109.91
Government size (in percent of GDP) [1]	14.87	5.41	4.89	38.02
Openness to trade (in percent of GDP)[2]	55.82	29.15	11.26	180.09
Private credit (in percent of GDP)[3]	42.81	35.17	1.56	205.95
Change in terms of trade	-0.01	0.04	-0.18	0.15
Inflation rate (in percent)	17.59	33.06	-3.06	344.40
Exchange rate volatility[4]	0.01	0.03	0.00	0.46

Correlation Matrix

	Growth	Init. Inc. p/capita	Avg.years school	Black mkt premium	Gov. size	Openness to trade	Private credit	Change in TOT	Inflation	Exchange rate volat.
Growth	1.00									
Initial income per capita	0.11	1.00								
Average years of schooling	0.21	0.83	1.00							
Black market premium	-0.20	-0.08	-0.08	1.00						
Government size	-0.04	0.45	0.4	0.11	1.00					
Openness to trade	0.13	0.02	0.07	-0.07	0.23	1.00				
Private credit	0.19	0.76	0.63	-0.08	0.23	0.07	1.00			
Change in terms of trade	0.17	0.08	0.07	-0.19	-0.04	0.07	0.1	1.00		
Inflation	-0.29	-1.8	0.09	0.55	-0.05	-0.23	-0.26	-0.16	1.00	
Exchange rate volatility	-0.27	-0.10	-0.06	0.79	0.03	-0.13	-0.15	-0.24	0.77	1.00

1. Government consumption.
2. Exports plus imports.
3. Real financial intermediary credits to the private sector as a percent of GDP.
4. Squared difference of the natural log of the nominal exchange rate in period t and t-1.

Table 2: Growth and Exchange Rate Volatility

Dependent Variable: Real Per Capita GDP Growth

Conditioning information set	1	2	3	4	5	6	7
Constant	-1.634 (0.004)	4.496 (0.000)	-2.002 (0.103)	-1.902 (0.053)	2.369 (0.000)	0.823 (0.044)	0.095 (0.922)
Initial income per capita[1]	-0.023 (0.872)	-0.451 (0.000)	-0.548 (0.006)	0.113 (0.408)	-0.671 (0.000)	-0.799 (0.000)	-1.217 (0.000)
Average years of schooling[2]	3.126 (0.000)	2.660 (0.000)	4.098 (0.000)	2.143 (0.000)	3.871 (0.000)	1.186 (0.000)	2.282 (0.000)
Black market premium[2]		-0.569 (0.005)		-0.496 (0.000)	-0.335 (0.034)	-0.538 (0.001)	
Government size[1]			-1.517 (0.000)	-0.324 (0.170)			-1.351 (0.000)
Openness to trade[1]		2.283 (0.000)					0.175 (0.376)
Private credit[1]						2.087 (0.000)	1.952 (0.000)
Change in terms of trade		19.405 (0.000)		22.296 (0.000)	25.707 (0.000)	19.910 (0.000)	23.439 (0.000)
Inflation[2]			-3.569 (0.000)		-3.814 (0.000)		-0.839 (0.009)
Exchange rate volatility	-17.989 (0.000)	-5.978 (0.000)	-5.686 (0.000)	-1.296 (0.157)	1.544 (0.134)	0.924 (0.438)	2.052 (0.330)
Sargan test (p-value)[3]	0.203	0.358	0.153	0.294	0.191	0.368	0.738
Serial correlation test (p-value)[4]	0.509	0.74	0.609	0.832	0.762	0.935	0.960

Notes: Countries: 73. Observations: 359. Panel: 1960-95, 5-year periods. P-values in parentheses.

1. In the regression, this variable is included as Ln(variable).
2. In the regression, this variable is included as Ln(1 + variable).
3. The null hypothesis is that the instruments are not correlated with the residuals.
4. The null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation.

Table 3: Growth and Inflation

Dependent Variable: Real Per Capita GDP Growth

Conditioning information set	1	2	3
Constant	2.334	2.035	-0.513
	(0.007)	(0.002)	(0.772)
Initial income per capita[1]	-0.836	-0.680	-0.890
	(0.000)	(0.000)	(0.032)
Average years of schooling[2]	4.650	3.384	2.089
	(0.000)	(0.000)	(0.019)
Black market premium[2]		-0.064	
		(0.593)	
Government size[1]		-0.911	
		(0.000)	
Openness to trade[1]		0.772	
		(0.002)	
Private credit[1]			2.228
			(0.000)
Change in terms of trade		21.823	
		(0.000)	
Inflation[2]	-4.663	-3.401	0.819
	(0.000)	(0.000)	(0.196)
Sargan test (p-value)[3]	0.296	0.484	0.152
Serial correlation test (p-value)[4]	0.746	0.828	0.536

Notes: Countries: 73. Observations: 359. Panel: 1960-95, 5-year periods. P-values in parentheses.

1. In the regression, this variable is included as Ln(variable).
2. In the regression, this variable is included as Ln(1 + variable).
3. The null hypothesis is that the instruments are not correlated with the residuals.
4. The null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation.

Table 4: Finance, Inflation, and Exchange Rate Volatility

Dependent Variable: Private Sector Credit

Conditioning information set	1	2
Constant	-1.397 (0.000)	-0.158 (0.305)
Initial income per capita[1]	0.636 (0.000)	0.358 (0.000)
Average years of schooling[2]	-0.133 (0.129)	0.451 (0.000)
Black market premium[2]		0.000 (1.000)
Government size[1]		0.032 (0.512)
Openness to trade[1]		-0.011 (0.762)
Change in terms of trade		0.048 (0.724)
Inflation[2]	-1.857 (0.000)	-1.589 (0.000)
Exchange rate volatility		0.584 (0.387)
Sargan test (p-value)[3]	0.191	0.721
Serial correlation test (p-value)[4]	0.363	0.322

Notes: Countries: 73. Observations: 359. Panel: 1960-95, 5-year periods. P-values in parentheses.
1. In the regression, this variable is included as Ln(variable).
2. In the regression, this variable is included as Ln(1 + variable).
3. The null hypothesis is that the instruments are not correlated with the residuals.
4. The null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation.

Appendix: Table I. Summary Statistics

	Mean	Std. Dev.	Min. Value	Max. Value
Growth	1.616	2.771	-10.021	9.858
Initial income per capita[1]	7.699	1.334	5.237	9.910
Average years of schooling[2]	1.664	0.537	0.148	2.565
Black market premium[2]	0.184	0.419	-0.037	4.709
Government size[1]	-1.969	0.359	-3.019	-0.967
Openness to trade[1]	-0.717	0.542	-2.184	0.588
Private credit[1]	3.421	0.874	0.446	5.328
Change in terms of trade	-0.005	0.038	-0.178	0.152
Inflation[2]	0.140	0.184	-0.031	1.492
Exchange rate volatility	0.006	0.031	0.000	0.456

Correlation Matrix

	Growth	Init. Inc. p/capita[1]	Avg.years school [2]	Black mkt premium[2]	Gov. size[1]	Openness to trade[1]	Private credit[1]	Change in TOT	Inflation[2]	Exchange rate volat.
Growth	1.00									
Initial income per capita[1]	0.19	1.00								
Average years of schooling[2]	0.25	0.85	1.00							
Black market premium[2]	-0.36	-0.29	-0.28	1.00						
Government size[1]	-0.03	0.41	0.34	-0.02	1.00					
Openness to trade[1]	0.09	0.05	0.11	-0.17	0.24	1.00				
Private credit[1]	0.30	0.74	0.65	-0.39	0.36	0.13	1.00			
Change in terms of trade	0.18	0.08	0.06	-0.17	-0.03	0.08	0.10	1.00		
Inflation[2]	-0.31	-0.14	-0.07	0.51	-0.12	-0.28	-0.38	-0.15	1.00	
Exchange rate volatility	-0.27	-0.09	-0.04	0.63	0.02	-0.14	-0.23	-0.24	0.68	1.00

1. Ln(variable in Table 1), which represents the value included in the regression.
2. Ln(1 + variable in Table 1), which represents the value included in the regression.

Appendix: Table II. Summary Statistics by Country

Country	Growth			Inflation			Private Credit			Foreign Exchange Volatility		
	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.
ARG	0.95	1.34	2.57	80.00	49.74	68.89	15.69	15.94	1.67	0.0243	0.0103	0.0327
AUT	2.11	1.74	0.96	6.11	7.63	3.55	55.60	63.35	24.95	0.0004	0.0004	0.0003
AUT	2.84	3.30	1.28	4.19	3.81	1.61	66.23	68.15	22.41	0.0006	0.0008	0.0004
BEL	2.71	2.88	1.42	4.49	3.43	2.45	26.14	23.41	15.38	0.0005	0.0007	0.0004
BOL	0.74	1.41	2.14	41.54	15.75	69.08	13.47	9.82	10.88	0.0334	0.0006	0.0857
BRA	2.66	1.45	3.04	91.39	47.88	83.00	21.77	26.22	8.84	0.0147	0.0081	0.0185
CAF	-0.51	-0.88	1.21	4.19	6.60	5.16	8.04	8.06	2.86	0.0017	0.0007	0.0033
CAN	2.31	2.69	1.21	4.94	4.37	2.63	61.68	68.27	17.75	0.0001	0.0001	0.0000
CHE	1.48	1.94	1.49	3.72	3.17	1.74	142.03	119.06	38.38	0.0007	0.0009	0.0005
CHL	1.87	1.28	3.33	37.72	23.20	35.65	27.81	16.82	22.26	0.0116	0.0017	0.0272
CMR	0.36	0.90	4.45	8.74	10.04	2.82	20.25	19.90	5.33	0.0017	0.0007	0.0033
COL	2.35	2.63	0.99	17.75	20.15	5.30	21.11	19.76	6.54	0.0008	0.0004	0.0013
CRI	1.70	2.11	2.05	12.61	12.80	9.73	21.72	25.32	5.08	0.0016	0.0003	0.0033
CYP	5.87	4.94	3.72	4.49	4.63	2.87	62.63	55.82	23.03	0.0003	0.0004	0.0002
DEU	2.37	2.59	1.11	3.38	3.48	1.45	77.52	77.53	16.61	0.0006	0.0008	0.0004
DNK	2.37	2.23	1.07	6.22	6.42	2.83	42.44	41.69	4.55	0.0005	0.0006	0.0004
DOM	2.22	1.61	2.68	11.74	10.35	9.27	19.45	21.69	8.99	0.0038	0.0000	0.0085
DZA	0.52	1.99	2.60	11.84	9.77	7.47	40.51	42.21	15.48	0.0008	0.0001	0.0014
ECU	2.28	1.25	3.42	18.21	12.62	13.54	17.95	17.55	1.57	0.0018	0.0015	0.0020
EGY	2.99	3.14	2.95	9.74	12.11	5.80	22.87	21.54	5.78	0.0027	0.0006	0.0036
ESP	3.34	4.17	2.46	9.03	6.77	4.46	65.76	69.30	11.30	0.0005	0.0006	0.0004
FIN	2.67	3.00	1.90	6.60	5.09	3.29	52.30	43.65	18.30	0.0006	0.0005	0.0005
FRA	2.52	2.54	1.50	5.82	4.26	3.25	76.44	83.63	17.81	0.0005	0.0007	0.0004
GBR	1.95	1.91	0.65	7.09	5.76	4.12	47.18	28.19	37.70	0.0005	0.0005	0.0003
GHA	-0.49	0.15	1.99	28.12	26.32	17.72	5.26	4.48	2.50	0.0132	0.0045	0.0265
GMB	1.00	1.31	2.39	8.63	9.69	6.42	16.34	16.50	3.46	0.0014	0.0005	0.0017
GRC	3.44	3.00	2.63	11.22	12.98	6.66	37.12	38.73	8.51	0.0004	0.0002	0.0005
GTM	1.08	2.28	2.47	8.63	8.13	6.77	13.42	13.07	2.22	0.0023	0.0000	0.0060

Appendix: Table II. Summary Statistics by Country (continued)

Country	Growth			Inflation			Private Credit			Foreign Exchange Volatility		
	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.
HND	0.72	0.50	1.80	7.68	6.69	5.56	24.26	25.15	7.61	0.0008	0.0000	0.0019
HTI	-1.47	-1.56	3.57	8.68	7.81	6.92	7.85	10.87	4.29	0.0008	0.0000	0.0022
IDN	4.39	4.79	1.49	31.87	13.60	35.38	28.54	26.21	17.30	0.0012	0.0014	0.0010
IND	1.98	2.11	1.28	7.73	8.07	2.53	19.84	18.88	7.34	0.0008	0.0002	0.0012
IRL	3.65	3.36	1.16	7.46	5.15	4.71	49.64	47.74	15.50	0.0005	0.0005	0.0003
ISR	3.07	2.56	1.62	31.73	21.35	36.77	38.13	43.90	14.98	0.0033	0.0021	0.0038
ITA	3.01	2.88	1.63	8.14	5.52	4.73	59.07	58.80	9.20	0.0005	0.0006	0.0004
JAM	0.90	1.54	2.96	14.75	13.36	9.97	24.86	26.50	5.24	0.0016	0.0006	0.0018
JPN	4.57	3.44	3.16	4.83	5.32	3.36	130.40	125.97	49.31	0.0006	0.0008	0.0004
KEN	1.44	2.16	2.61	10.04	10.43	6.81	22.23	23.46	7.56	0.0007	0.0002	0.0012
KOR	6.77	6.66	1.78	10.01	9.32	4.55	65.48	61.37	27.93	0.0017	0.0001	0.0040
LKA	2.80	2.92	1.44	7.90	9.48	3.80	16.47	16.01	6.97	0.0008	0.0003	0.0013
LSO	3.69	4.97	2.80	12.71	12.55	0.55	12.92	14.49	4.92	0.0007	0.0002	0.0009
MEX	1.74	2.94	2.07	21.78	16.18	20.41	23.00	24.32	7.92	0.0029	0.0025	0.0036
MLT	6.35	6.98	2.76	3.44	3.00	2.22	43.97	40.53	24.04	0.0004	0.0004	0.0002
MUS	5.06	3.57	4.37	8.77	7.89	4.32	23.81	21.51	7.62	0.0004	0.0004	0.0003
MYS	4.24	3.81	1.37	3.41	4.24	2.29	48.07	36.46	34.81	0.0002	0.0001	0.0002
NER	-2.63	-2.08	3.85	5.72	6.31	5.47	12.65	11.55	3.22	0.0017	0.0007	0.0033
NIC	-1.32	-1.87	4.63	99.95	43.42	139.14	25.88	32.55	14.26	0.0766	0.0016	0.1688
NLD	2.30	2.21	1.10	4.28	4.09	2.39	88.12	86.79	34.05	0.0005	0.0008	0.0004
NOR	3.13	2.99	1.00	5.99	6.06	2.39	82.21	77.89	13.81	0.0004	0.0005	0.0003
NZL	1.26	1.25	1.19	7.61	8.94	4.51	37.97	29.17	20.71	0.0006	0.0008	0.0004
PAK	2.69	3.05	1.57	7.69	6.90	4.03	21.14	21.92	3.76	0.0010	0.0001	0.0024
PAN	2.40	3.88	3.03	2.98	1.60	2.73	41.07	47.09	17.39	0.0000	0.0000	0.0000
PER	0.61	2.03	2.62	60.16	40.87	75.69	13.27	13.51	4.10	0.0232	0.0027	0.0557
PHL	1.18	2.08	2.44	10.62	9.89	5.07	27.34	26.27	7.05	0.0011	0.0003	0.0012
PNG	1.73	1.54	2.90	7.26	6.89	2.33	20.58	20.57	6.54	0.0003	0.0004	0.0002
PRT	3.77	4.18	2.20	11.44	10.72	7.01	55.29	56.64	9.53	0.0005	0.0005	0.0004
PRY	1.98	1.30	2.94	12.44	13.71	7.70	14.69	15.49	4.60	0.0024	0.0000	0.0044

Appendix: Table II. Summary Statistics by Country (continued)

Country	Growth			Inflation			Private Credit			Foreign Exchange Volatility		
	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.	Mean	Median	St. Deviat.
RWA	-1.30	-1.71	5.49	9.22	8.52	7.59	5.57	5.86	3.48	0.0047	0.0004	0.0079
RSDN	0.06	-0.20	2.03	17.37	15.77	13.77	9.87	9.58	2.27	0.0139	0.0006	0.0292
SEN	-0.49	-0.31	1.10	6.58	6.59	4.87	26.29	25.96	8.66	0.0017	0.0007	0.0033
SLE	-0.86	0.13	2.48	24.29	13.12	22.84	5.21	5.84	1.66	0.0080	0.0004	0.0139
SLV	0.21	0.59	2.58	9.79	12.02	7.35	22.84	22.88	1.89	0.0009	0.0000	0.0023
SWE	2.00	1.76	1.50	6.32	6.02	2.48	90.13	82.72	24.93	0.0004	0.0004	0.0004
SYR	2.47	1.96	3.91	10.48	10.27	8.57	9.52	6.85	5.70	0.0026	0.0000	0.0069
TGO	0.53	1.35	4.39	7.17	9.18	3.81	21.88	24.00	5.15	0.0017	0.0007	0.0033
THA	5.19	5.07	2.01	5.20	4.69	2.99	47.28	42.14	31.47	0.0001	0.0000	0.0002
TTO	1.31	0.65	3.76	8.31	9.28	4.17	32.07	29.08	18.93	0.0006	0.0004	0.0005
URY	1.24	1.17	2.96	44.66	46.85	10.42	21.25	21.67	12.27	0.0337	0.0097	0.0672
USA	1.84	1.81	0.64	4.68	4.16	2.37	114.08	110.80	21.16	0.0000	0.0000	0.0000
VEN	-0.63	-0.28	1.62	13.83	10.40	14.41	33.57	30.38	14.76	0.0042	0.0007	0.0077
ZAF	0.51	0.52	1.83	9.09	10.67	4.68	74.93	66.35	20.82	0.0007	0.0002	0.0009
ZAR	-2.25	-2.02	1.97	87.73	44.11	126.85	3.96	3.34	3.25	0.0305	0.0087	0.0521
ZWE	0.62	0.29	2.42	11.09	10.81	7.83	24.96	25.61	3.78	0.0006	0.0004	0.0008

ENDNOTES

[1] Past researchers draw different conclusions about the relationship between inflation and growth because they use different samples, estimation periods, econometric techniques, and conditioning information sets [Bruno and Easterly (1998), DeGregorio (1992), Easterly, Loayza, and Montiel (1997), Fischer (1993), and Levine and Renelt (1992)]. The econometric procedures used in this paper ameliorate problems that have plagued past research. We also use data over an extensive sample period. Furthermore, we find that including financial intermediary development in the conditioning information critically influences the inferences that one draws on the inflation-growth relationship.

[2] See Beck, Levine, and Loayza (2000), Jayaratne and Strahan (1996), Levine (1998, 1999), Levine, Loayza, and Beck (2000), Levine and Zervos (1998), Neusser and Kugler (1998), Rajan and Zingales (1998), and Rousseau and Wachtel (1998).

[3] We also include time dummies to account for time-specific effects.

[4] This method, however, does not control for full endogeneity. We assume that the explanatory variables are only "weakly exogenous," which means that they can be affected by current and past realizations of the growth rate but must be uncorrelated with future realizations of the error term. Thus, the weak exogeneity assumption implies that future *shocks* to the dependent variable do not influence current values of the regressors. Note, weak exogeneity does not mean that economic agents do not consider expected future growth in their decisions; it just means that unanticipated, future shocks to growth do not influence current decisions. Also, we statistically assess the validity of the weak exogeneity assumption below.

[5] We are grateful to Stephen Bond for providing us with a program to apply his and Arellano's estimator to an unbalanced sample.

[6] The exchange rates are series rf from the International Financial Statistics (IMF), which is the market exchange rate.

[7] The Consumer Price Index is line 64 from the International Financial Statistics (IMF).

[8] Specifically, Argentina (1975-79; 1980-84; 1985-89), Bolivia (1980-84), Brazil (1985-89; 1990-94), Chile (1970-74), Israel (1980-84), Nicaragua (1985-89), and Peru (1985-89) had average inflation rates of greater than 100 percent per annum, while the Central African Republic (1985-89) and Niger (1985-89) saw prices decline over the corresponding five-year period.

[9] See Levine, Loayza, and Beck (2000) for a more complete description of the construction of Private Credit. The underlying data are from the International Financial Statistics (IMF).

[10] For instance, an increase in the inflation rate lowers real returns on a wide range of assets. The lower real returns reduce incentives to lend and increase incentives to borrow. This reduces the supply of credit while attracting lower quality borrowers into the pool of those seeking loans. The erosion in the quality of the pool of potential borrowers in conjunction with a fall in the quantity of loanable funds increases credit market frictions. Thus, inflation can produce greater credit rationing, resulting in fewer and less efficient loans.

[11] In the inflation outlier regressions, we omit Argentina (1975-79; 1980-84; 1985-89), Bolivia (1980-84), Brazil (1985-89; 1990-94), Chile (1970-74), Israel (1980-84), Nicaragua (1985-89), and Peru (1985-89) because they had average inflation rates of greater than 100 percent per annum, and we omit the Central African Republic (1985-89) and Niger (1985-89) because they experienced price level declines.

[12] We examined trade. After accounting for endogeneity, country-specific effects, and using a dynamic, panel specification, we do not find a robust link between trade and growth. This is shown in the existing tables. This does not necessarily contradict the Frankel and Romer findings (1999), where they examine the relationship between trade and the level of GDP per capita. They use instrumental variables, but they do not use a dynamic panel framework, nor do they control for a wide array of conditioning information. Furthermore, we estimated the effects of exchange rate volatility and inflation on trade. This link is not robust. Indeed, we had a very difficult time finding specifications in which the exogenous component of exchange rate volatility and inflation influenced international trade. This does not contradict Rose (2000) since he focuses on common currency areas, not on exchange rate volatility per se.

[13] The findings do not rule out reverse causation. That is, there is nothing in the econometrics that rejects the view that financial development influences the inflation rate. Rather, the results show that the negative link between finance and inflation growth is *not only* due to financial development influencing inflation; the strong negative relationship between financial intermediary development and inflation is at least partly explained by the effect of the exogenous component of inflation on financial development.

[14] Boyd, Levine, and Smith (2000) use the same system GMM panel techniques as in this paper. They use pure cross-sectional techniques to confirm the negative link between inflation and financial sector performance. Moreover, they use a broad array of financial sector performance indicators (including measures of equity market performance). They use a somewhat different econometric specification. Besides somewhat different control variables and samples, we take natural logarithms of the variables, while they focus on documenting the nonlinear relationship between inflation and financial sector performance.

[15] If we evaluate this at Mexico's average value of Private Credit over the sample period (1960-95) of 22.9, then dollarization implies an increase in Mexico's Private Credit ratio from 22.9 to 29.8 {after solving for x, Ln(x) – Ln(22.9) = 0.265}.

[16] Specifically, exp{0.0056*30} = 1.183

[17] The control variables are the logarithm of initial real per capita GDP, the logarithm of the average years of schooling, and the logarithm of the black market exchange rate premium.

[18] As above, in the regression Private Credit is entered as Ln(Private Credit) and inflation is entered as Ln(Inflation + 1).

[19] To examine the sensitivity of these results to possible simultaneity between financial development the legal rights of outside investors, we used instrumental variables for OUTRIGHTS. Specifically, we use legal origin dummy variables for countries with Common Law, French Civil Law, and German Civil Law legal origin to extract the exogenous component of OUTRIGHTS, where Scandinavian Civil Law countries represent fourth legal family. As shown by LLSV (1998) and Levine, Loayza, and Beck (2000), countries with different legal origins tend to adopt different legal protection of outsiders. The reasons underlying these differences are explained in LLSV (1999b). The results are not changed much. The coefficient on OUTRIGHTS rises to 0.10, while the coefficient on inflation becomes –1.0.