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ABSTRACT

In this paper, we document the fact that countries that have experienced occasional financial crises have, on average, grown faster than countries with stable financial conditions. We measure the incidence of crisis with the skewness of credit growth, and find that it has a robust negative effect on GDP growth. This link coexists with the negative link between variance and growth typically found in the literature. To explain the link between crises and growth we present a model where weak institutions lead to severe financial constraints and low growth. Financial liberalization policies that facilitate risk-taking increase leverage and investment. This leads to higher growth, but also to a greater incidence of crises. Conditions are established under which the costs of crises are outweighed by the benefits of higher growth.

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1 Introduction

Over the last two decades, countries that have experienced financial crises have on average grown faster than countries with stable financial conditions. For this reason, we investigate the possibility that the financial liberalization policies that made possible crises in countries with weak institutions also, and more importantly, relaxed financial bottlenecks and increased growth.

We use the *skewness* of real credit growth to measure the incidence of financial crises. Crises happen only *occasionally* and during a crisis there is a large and abrupt downward jump in credit growth. Such negative outliers tilt the distribution of credit growth to the left. Thus, in a long enough sample, crisis prone economies tend to exhibit lower skewness than economies with stable financial conditions.[1]

We choose not to use the *variance* to capture the uneven progress associated with financial fragility because high variance captures not only rare, large and abrupt contractions, but also frequent and symmetric shocks. Thus, unlike skewness, variance is not a good instrument to distinguish safe paths from the risky paths associated with infrequent systemic crises.[2]

We estimate a set of regressions that include the three moments of credit growth in standard growth equations. We find a negative link between per-capita GDP growth and skewness of real credit growth. This link is robust across alternative specifications and is independent of the negative effect of variance on growth typically found in the literature.

Thailand and India illustrate the choices available to countries with weak institutions. While India followed a path of slow but steady growth, Thailand experienced high growth, lending booms and crisis (see Figure 1). GDP per capita grew by only 99% between 1980 and 2001 in India, whereas Thailand's GDP per capita grew by 148%, despite the effects of a major crisis.[3]

The link between skewness and growth is economically important. Our benchmark estimates indicate that about a third of the growth difference between India and Thailand can be attributed

[1] Financial crises are typically preceded by lending booms. Since credit growth does not experience sharp jumps during the boom and crises happen only *ocassionally,* the distribution of credit growth along a boom-bust cycle is characterized by negative outliers, i.e., it exhibits negative skewness. In other words, credit contractions are clustered farther away from the mean that credit expansions.

[2] We follow here the finance litterature that relates the negative skewness in stock returns with the incidence of stock market crashes.

[3] This fact is more remarkable given that in 1980 India's GDP was only about one fifth of Thailand's.

to systemic risk taking. Needless to say this finding *does not* imply that financial crises are good for growth. It suggests that undertaking systemic risk has led to higher growth, but as a side-effect, it has also led to *occasional* crises.

Our sample consists of eighty three countries for which data is available over the period 1960-2000. Although there is a significant negative link between skewness and growth in this large set, the strength of this link varies across different subsets of countries. In particular, this link is strongest across the set of countries with weak institutions, but functioning financial markets. By contrast, countries that have experienced either severe wars or large terms of trade deteriorations typically exhibit negative skewness and low growth. In that set, negative skewness is induced by events other than endogenous systemic risk.

In our model economy skewness is exogenous to growth. However, to address potential remaining endogeneity we estimate an instrumental variables regression, where we use a financial liberalization index to instrument for skewness. As we explain below, under our theoretical mechanism, this index is correlated with risk taking and does not have another independent effect on growth.

In order to investigate the robustness of our findings we consider several estimation techniques and perform several tests. In particular, we estimate the impact of skewness on growth both in cross section and panel regressions using different estimators consistent with alternative treatments of unobserved effects. We also test for robustness against potential outliers and extended sets of control variables.

To explain these results we develop a model in which the interaction of *weak institutions* and *financial liberalization* promotes risk-taking, fast growth and occasional crises. Weak institutions are reflected in imperfect contract enforceability, which generates borrowing constraints as agents cannot commit to repay debt. This financial bottleneck leads to low growth because investment is constrained by firms' cash-flow.

When the government promises (either explicitly or implicitly) to bailout debtors in case of a systemic financial crisis, financial liberalization may induce agents to coordinate in undertaking insolvency risk. Since taxpayers will repay lenders in the eventuality of a systemic crisis, risk taking reduces the effective cost of capital and allows borrowers to attain greater *leverage*. Greater leverage allows for greater investment, which leads to greater future cash flow, which in turn will lead to more investment and so on. This is the leverage effect through which systemic risk increases investment and growth along the no-crisis path. Risk taking, however, also leads to aggregate financial fragility and to occasional crises.

Crises are costly. Widespread bankruptcies entail severe deadweight losses. Furthermore, the resultant collapse in cash-flow depresses new credit and investment, hampering growth. Can systemic risk taking increase long-run growth by compensating for the effects of enforceability problems? Yes. When contract enforceability problems are severe –so that borrowing constraints arise, but not too severe –so that the leverage effect is strong, a risky economy will, on average, grow faster than a safe economy even if crisis costs are large.[4]

This mechanism explains why the negative link between skewness and growth is strongest across countries with a middle degree of contract enforceability that we find in the data. It also shows how financial liberalization leads to higher growth: by encouraging risk-taking financial liberalization eases financial bottlenecks.

Notice that our results do not require that *high* variance technologies have a *higher* expected return than *low* variance technologies. Because higher average growth derives from an increase in borrowing ability due to the undertaking of systemic risk, our argument does not depend on the existence of a 'mean-variance' channel.

Systemic risk depends on the existence of bailout guarantees for firms caught up in a financial crisis. These guarantees must be funded by domestic taxation and result in the *redistribution* of resources from taxpayers to credit constrained firms. We show that when taxpayers benefit from the production of financially constrained firms, this redistribution can be to the mutual benefit of both parties. The funding of the guarantees relaxes the financial bottlenecks, which in turn increases the present value of taxpayers' income net of taxes.

Importantly, systemic risk is not always growth enhancing and socially efficient. In particular, if institutions are strong, there are no financial bottlenecks to begin with. If institutions are too weak, the leverage effect is too small to compensate for the costs of crises.

This paper is structured as follows. Section 2 presents the empirical analysis. Section 3 rationalizes the link between growth and crises. Section 4 analyzes the financing of the guarantees. Section 5 presents a literature review. Finally, Section 6 concludes.

[4] This result does not apply to developed economies with strong institutions.

2 Crises and Growth: The Empirical Link

Here, we investigate whether countries with risky paths that have experienced financial crises have grown faster, on average, than other countries. We also investigate whether this link is stronger in countries with weak institutions and in those that are financially liberalized.

We use the skewness of real credit growth to measure the incidence of financial crises.[5] Crises happen only occasionally and during a crisis there is a large and abrupt downward jump in credit growth. Such negative outliers tilt the distribution of credit growth to the left. Thus, in a long enough sample, crisis prone economies tend to exhibit lower skewness than economies with stable financial conditions. Notice that when there are no other major shocks, crisis countries exhibit strictly negative skewness.

Before we proceed, four comments are in order. First, occasional crises are associated not only with lower skewness, but also with higher *variance* –the typical measure of volatility in the literature. We choose not to use the variance to identify risky paths that lead to *rare, large and abrupt* busts because high variance may also reflect other shocks, that could either happen more frequently or be symmetric. These other shocks might be exogenous or might be self-inflicted by, for instance, bad economic policy. Since there is an abundance of these other shocks in the sample, the variance is not a good instrument to distinguish safe paths from risky paths associated with financial crises.

Second, typically crises are preceded by lending booms. During a lending boom there are positive growth rates that are above normal. However, they are not positive outliers because the lending boom takes place for several years, and in a given year, it is not as large in magnitude as the typical bust. Only a large positive one-period jump in credit would create a positive outlier in growth rates.[6] Thus, boom-bust cycles typically generate negative, not positive, skewness.

Third, in principle, the sample measure of skewness can miss cases of risk taking that have not yet led to crisis. This omission, however, would make it more difficult to find a negative relationship

[5] Skewness is a measure of *asymmetry of the distribution* of a series around its mean and is computed as $S = \frac{1}{n}\sum_{i=1}^{n}\frac{(y_i-\overline{y})^3}{\nu^{3/2}}$, where $\bar{y}$ is the mean and ν is the variance. The skewness of a symmetric distribution, such as the normal distribution, is zero. Positive skewness means that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail.

[6] For instance, Thailand experienced a lending boom for almost all of the sample period and most of the distribution is centered around a very high mean.

between growth and realized skewness.[7]

Fourth, we acknowledge that negative skewness can also be caused by forces other than systemic risk. To generate skewness these forces, however, must lead to abrupt and large falls in aggregate credit. In our empirical analysis, we control explicitly for the two exogenous events that we would expect to lead to a comparably large fall in credit: severe wars and large deteriorations in terms of trade.

Skewness presents advantages over more elaborate financial crises indicators because it is parsimonious, objective and captures the real effects of crises on credit growth. Importantly, it does not require the dating of financial crises. To illustrate how occasional crises reduce skewness Table C1 considers the major systemic banking crises over the period 1980-2000. For each country, we compute two skewness measures: one over the complete sample period, and another excluding crisis years. The difference, which reflects the impact of crises on skewness, is negative in sixteen out of the eighteen crisis countries.[8]

To illustrate how skewness is linked to growth, the kernel distributions of credit growth rates for India and Thailand are given in Figure 2.[9] India, the safe country, has a lower mean and is quite tightly distributed around the mean –with skewness close to zero. Meanwhile, Thailand, the risky fast-growing country, has a very asymmetric distribution and is characterized by a much larger negative skewness.[10]

[7] Since crises are rare events, in a short sample period not all risky lending booms need to end in a bust (see Gourinchas et. al (2001) and Tornell and Westermann (2002)).

[8] The list of crises and the dates are obtained from Caprio et.al. (2003). Crises reported are systemic banking crises with output losses in our sample of 58 countries.

[9] The simplest nonparametric density estimate of a distribution of a series is the histogram. The histogram, however, is sensitive to the choice of origin and is not continuous. We therefore choose the more illustrative kernel density estimator, which smoothes the bumps in the histogram (see Silverman 1986). Smoothing is done by putting less weight on observations that are further from the point being evaluated. The Kernel function by Epanechnikov is given by: $\frac{3}{4}(1-(\Delta B)^2)I(|\Delta B|\leq 1)$, where ΔB is the growth rate of real credit and I is the indicator function that takes the value of one if $|\Delta B|\leq 1$ and zero otherwise. The bandwidth, h, controls for the smoothness of the of the density estimate. The larger is h, the smoother the estimate. For comparability, we choose the same h for both graphs.

[10] The Jarque-Bera test rejects the null hypothesis that the sample observations for Thailand come from a normal distribution (which has zero skewness), with a p-value of 0.0003. This hypothesis is not rejected for India (p-value of 0.5452). Furthermore, following Bekaert and Harvey (1997), we compute the mean, variance and skewness in a joint GMM system where standard errors are corrected for serial correlation using the Newey-West procedure. The

2.1 Regression Analysis

Our data set consists of all countries for which data is available in the World Development Indicators for the period 1960-2000.[11] Out of this set of eighty three countries we identify eleven as severe war cases and fourteen as having experienced a large terms of trade deterioration.[12]

We estimate the impact of negative skewness on growth in a cross section regression, in a panel regression with pooled generalized least squares estimators, and in a dynamic panel using general method of moments methods. We address the issue of potential endogeneity with a two-stage least squares regression, where we instrument skewness with a financial liberalization index. We test the robustness of our findings to potential outliers and additional control variables. Finally, we consider other specifications of the panel regression that include fixed effects, random effects and time effects.

In the first set of equations we estimate, we include the three moments of credit growth in a standard growth equation

$$\Delta y_{it} = \lambda y_{i0} + \gamma' X_{it} + \beta_1 \mu_{\Delta B,it} + \beta_2 \sigma_{\Delta B,it} + \beta_3 S_{\Delta B,it} + \varepsilon_{it}, \tag{1}$$

where Δy_{it} is the average growth rate of per-capita GDP; y_{i0} is the initial level of per capita GDP; X_{it} is secondary schooling; $\mu_{\Delta B,it}$, $\sigma_{\Delta B,it}$ and $S_{\Delta B,it}$ are the mean, standard deviation and skewness of the growth rate of real bank credit to the private sector, respectively. We do not include investment in (1) as we expect the three moments of credit growth, our variables of interest, to affect GDP growth through higher investment.

First, we estimate a standard cross-section regression by OLS. In this case 1980 is the initial year and the moments of credit growth are computed over the period 1981-2000. Then, we estimate a panel regression using generalized least squares. We consider two non-overlapping windows (1981-

null hypothesis of zero skewness can be rejected for Thailand (p-value=0.03), but not for India (p-value=0.18). Both series have 85 quarterly observations.

[11] Although we focus on the period 1980-2000, we need the earlier data as some of the regressions require differencing the data as well as the use of lagged values.

[12] The severe war cases are: Algeria, Congo, El Salvador, Guatemala, Iran, Nicaragua, Peru, Philippines, Sierra Leone, South Africa and Uganda. Large terms of trade deterioration cases - annual fall of more than 30% in a single year - are: Cote d'Ivoire, Algeria, Ecuador, Egypt, Ghana, Haiti, Pakistan, Sri Lanka, Nigeria, Syria, Togo, Trinidad and Tobago, Venezuela and Zambia. A detailed description of how these countries were identified is given in the appendix.

1990 and 1991-2000), and use two sets of credit growth moments, one for each window.

Table 1 reports the estimation results for the set of 58 countries that excludes cases of war and terms of trade deteriorations. We find that, after controlling for the standard variables, the mean of the growth rate of credit has a positive effect on long-run GDP growth. This has already been established in the literature.[13] What we establish is that negative skewness –a risky growth path– accompanies high GDP growth rates. Skewness enters with negative point estimates of -0.40 and -0.30 in the cross-section and panel regressions, respectively. These estimates are significant at the 5% level.

Are these estimates economically meaningful? To address this question consider India and Thailand over the period 1980-2000. India has near zero skewness, and Thailand a skewness of about minus one. A parameter estimate of -0.40 implies that a reduction in skewness (from 0 to -1), increases the average long-run GDP growth rate 0.40% per year. Notice that after controlling for the standard variables Thailand grows about 1% more per year than India. Thus, about 40% of this growth differential can be attributed to systemic risk taking, as measured by the skewness of credit growth. Over the course of twenty years this 0.40% per year amounts to a level difference of 16% in per-capita GDP.

Next, consider the variance of credit growth. Consistent with the literature, the variance enters with a negative sign and it is significant at the 5% level in both regressions.[14] We can interpret the negative coefficient on variance as capturing the effect of 'bad volatility' generated by, for instance, procyclical fiscal policy. Meanwhile, the negative coefficient on skewness captures the 'good volatility' associated with the type of risk taking that eases financial constraints and increases investment.

Figure 3 depicts the marginal effect of each moment of credit growth on per-capita GDP growth for our sample of countries.[15] It is evident that higher per-capita GDP growth is associated with (a) a higher mean growth rate in credit, (b) lower variance and (c) lower skewness. In other words, high per-capita GDP growth is associated with a risky path that is punctuated by occasional crises.

Although we control for the main determinants of economic growth, there can in principle be

[13] See for instance Levine et. al. (2000).

[14] Ramey and Ramey (1995) find that fiscal policy induced volatility is bad for economic growth.

[15] In each graph, the residuals are computed from a cross-section regression that includes all variables except the variable on the horizontal axis.

other unobserved fixed country characteristics and time effects. In order to address this issue, we follow Arellano and Bond (1991) and Blundell and Bond (1997), who employ a dynamic panel regression, to estimate the following equation:

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

where $y_{i,t}$ is the logarithm of real per capita GDP, X_{it} is the set of explanatory variables excluding initial income and including a time dummy, η_i is the country-specific effect, and $\varepsilon_{i,t}$ is the error term. The differenced equation has the form:

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + \varepsilon_{i,t} - \varepsilon_{i,t-1}.$$

By construction, the new error term $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$ is correlated with the lagged dependent variable $(y_{i,t-1} - y_{i,t-2})$. To correct for this correlation we use a GMM system estimator with lagged values as internal instruments.[16] The results are reported in column (3) of Table 1. As we can see, the three moments of credit remain significant at the 5% level.

2.2 Country Groupings

As we have discussed in the Introduction and will show formally in the model of Section 3, the mechanism that links negative skewness and growth is strongest in countries with a middle degree of contract enforceability (MEC). In these countries the undertaking of systemic risk relaxes borrowing constraints and increases growth. By contrast, in countries with high enforceability (HEC), agents have easy access to external finance, so growth is determined by investment opportunities not borrowing constraints. At the other extreme, in countries with low enforceability (LEC) borrowing constraints are too severe. Thus, the increase in leverage induced by risk taking is so small that it is not reflected in a significant increase in growth.

We use the rule of law index of Kaufman and Kraay (2003) to determine the HEC set. We classify as HEC countries with an index greater than 1.3. From the remaining countries we define LEC countries as those whose stock market turnover relative to GDP was less than one percent in 1999. We take the nonexistence of an organized stock market as an indicator that contract

[16] The system estimator corrects for the potential imprecision of the difference estimator. The estimation procedure is valid only under the assumption of weak exogeneity of the explanatory variables. That is, they are assumed to be uncorrelated with future realizations of the error term.

enforceability problems are very severe. This criterion selects nineteen HEC, twenty two MEC and seventeen LEC countries.

As a first pass, Table 2 compares the moments of credit growth across the three country groups. We observe three striking facts: First, HECs don't exhibit negative skewness. Second, while both LECs and MECs have negative skewness, the latter have a lower skewness. Interestingly, MEC credit grows almost twice as fast as that of LECs (7.7 percent vs. 4.2 percent). Third, variance is highest in LECs and lowest in HECs. Since both groups have a lower growth than MECs, there is no obvious linear relationship between variance and growth.

In order to capture more formally these differences, we add to our benchmark regression – column (2) in Table 1– an interaction dummy that equals one if a country is an MEC and zero otherwise. This dummy is interacted with the three moments of credit growth. Tables 4a and 4b show that, consistent with the prediction of the model, the effect of risk taking on growth is strongest across MEC countries. In that set a one unit reduction in skewness enhances growth by 0.622% and only by 0.138% in the other countries.[17] This finding means that the growth enhancing effect of systemic risk is more than three times higher in MEC countries.[18]

The impact of variance on growth does not seem to differ between MECs and other countries, as the interaction dummy for variance is not significant. Meanwhile, the effect of mean credit growth is substantially more important in MECs. It is more than three times as high in MECs than in other countries.

We would like to emphasize that the negative link between skewness and growth remains significant and quantitatively similar when we run the regression only with the MEC set, as shown in column (2). This shows that the link between negative skewness and growth is not driven by the difference between country groups. There exists a trade-off between smoothness and growth across the MEC set, as illustrated by the example of India and Thailand above.

Financial liberalization

[17] The estimate 0.622% is the sum of the coefficient on skewness and that on skewness interacted with the MEC dummy.

[18] As a robustness check we use an income per-capita threshold –$17,500 in 2000– to define the HEC set. With the exception of three countries, the countries selected are the same as those selected by the rule of law criterion. Sign and significance levels remain the same, and point estimates are very similar.

As we have discussed, the mechanism that links growth to crises requires not only weak institutions, but also policy measures that are conductive to the emergence of systemic risk. Financial liberalization can be viewed as such a policy measure. In non-liberalized economies, regulations do not permit agents to take on significant risk.

To capture the fact that the interaction of weak institutions with liberalization is key, we classify our data in country-years that are liberalized and those that are not liberalized. Table 3 shows that negative skewness as well as high mean growth rates are associated with financial liberalization. This indicates that in the presence of weak institutions, liberalization has facilitated systemic risk taking and has led to both higher mean credit growth and occasional crises.

To capture this difference more formally we introduce a liberalization dummy that equals one for decades in which a country was liberalized, and zero for decades in which it was not.[19,20] Tables 4a and 4b show a significant difference in the effect of skewness between liberalized and not liberalized countries. In non-liberalized countries, the skewness coefficient is positive and insignificant, while in liberalized countries it is negative and significant. This suggests that the risk-taking mechanism we described is present only in liberalized economies. We can also see in column (3) of Table 4a that the liberalization dummy enters positively and is significant. This indicates that the effect of skewness is independent of other effects that liberalization might have on growth through other channels.[21]

Wars and terms of trade deteriorations

We should not expect the negative link between skewness and growth to exist when skewness is generated by wars or terms of trade deteriorations. These shocks are exogenous and do not reflect the relaxation of financial bottlenecks induced by systemic risk. Nevertheless, to investigate whether the effect of negative skewness on growth is observed in an unconditional sample, we estimate the panel regression including all 83 countries for which we have available data. Column (4) in Table 4a shows that indeed skewness enters negatively and remains statistically significant, although the magnitude of the point estimate is reduced from -0.302 in the benchmark regression

[19] See the appendix for a description of how the liberalization index is constructed.

[20] Country-decades where there was a transition from closed to open were dropped from this regression. Fifteen observations where dropped from the sample in this way.

[21] For an extensive empirical treatment of financial liberalization dummies in growth regressions see Beckaert, et.al. (2004).

to -0.216.

In column (5), we include an interaction dummy that equals one for countries that have experienced either wars or large terms of trade deteriorations. As expected, the negative link between skewness and growth is reversed for this set of countries.[22]

2.3 Instrumental Variables Estimation

In our model economy, the risk-taking mechanism that generates skewness is exogenous to growth.[23] Thus, there is no reverse causality from mean growth to the asymmetric shape of the credit growth distribution. Nevertheless, in order to overcome potential remaining endogeneity we use an index of financial liberalization to instrument for skewness. In the presence of contract enforceability problems, financial liberalization permits the undertaking of systemic risk, which both relaxes borrowing constraints and leads to occasional crises. Thus, in our model economy financial liberalization is correlated with negative skewness, but it does not have another independent effect on growth, making it an appropriate instrument.

Column (1) in Table 5 displays the estimates of the second stage of a two-stage least squares regression. We can see that skewness is statistically significant and has a point estimate which is even greater than the one from our benchmark regression. Furthermore, the mean remains significant and of similar magnitude, but variance is no longer statistically significant. Column (3) shows that in the first stage, there is a significant negative link between financial liberalization and skewness.[24] The result in the first stage is consistent with the well documented fact that financial liberalization has been followed by boom-bust cycles.[25]

Regressions (1) and (3) estimated by GMM are given in column (2) (second stage) and (4) (first stage). They lead to qualitatively similar results as the two-stage least squares regression.

Finally, we acknowledge that there may be other independent channels through which financial

[22] The sum of the coefficient on skewness and that on skewness interacted with the dummy is positive and statistically significant. A Wald test indicates that this sum is statistically significant.

[23] Risk taking allows agents to attain greater leverage, which increases investment and growth. Risk taking, however, also implies that crises will occur occasionally. Since there is no reversed impact of growth on crisis, there is also no causal impact of growth on skewness, making skewness a valid right hand side variable.

[24] However, as the F-statistic has only a value of 5.02, it must be considered only a weak instrument according to the standard reference value of 10 in the literature.

[25] Kaminsky-Reinhart (1998), Kaminsky and Schmukler (2003)

liberalization affects growth that we have not accounted for in the model. We are nevertheless confident that favouring the emergence of systemic risk is an important channel through which financial liberalization can affect growth.

2.4 Robustness

Here, we show that the negative link between skewness and growth is robust to the elimination of extreme observations, to the introduction of more control variables, and to alternative specifications of the panel regression.

There are no statistical outliers in our regressions in the sense that a country's residual deviates by more than two standard deviations from the mean. Nevertheless, to see whether extreme observations have an influence on our results we exclude, from our benchmark panel-regression, the countries with the three largest and three lowest residuals both individually and collectively. The countries with the largest positive residuals are China, Korea and Botswana. Those with the most negative residuals are Jordan, Niger and Papua New Guinea. As Table 6 shows, the exclusion of these extreme observations does not change our results. In particular, the coefficient on skewness is negative and significant at the 5% level. The point estimates range between -0.24 and -0.32, which are quite similar to our benchmark estimate of -0.30.

In Table 7 we add to our benchmark regression several control variables commonly used in the empirical growth literature: the government share in GDP, life expectancy, inflation and the terms of trade growth. The addition of these variables does not impact the estimates of the three moments of credit growth.

Table 8a shows that our benchmark panel regression provides qualitatively the same results when estimated with fixed effects, random effects and time effects. Table 8b shows that this robustness also largely exists in the full set of 83 countries. The only exception is that skewness is not statistically significant in the random effects model.

2.5 Overlapping Panel Methodology

Throughout the paper, the panel regressions are estimated using two non-overlapping ten-year windows: 1981-1990 and 1991-2000. Two potential limitations of this procedure are the limited number of observations in our panel, and the arbitrary division of the time intervals. Beckaert, Harvey and Lundblad (2001) –henceforth BHL– propose a methodology that addresses these issues by exploiting the information in overlapping cross-sectional time series.

We implement the estimation strategy proposed by BHL by constructing a panel of ten-year overlapping windows starting with the period 1981-1990 and rolling it forward to the period 1991-2000. Thus, each country has eleven ten-year overlapping windows. Hence, this procedure generates a data set of 638 observations.[26]

Using overlapping windows introduces a moving average component in the residuals. BHL address this problem by estimating parameters with a generalized method of moments and by adjusting standard-errors using a cross-sectional extension of Hansen and Hodrick (1980) that deals with the moving average structure of the residuals.[27] Following BHL we consider the following regression specification.[28]

$$\Delta y_{i,t,t+10} = \beta' x_{i,t} + \varepsilon_{i,t,t+10} \qquad t = 1980, ..., 1990,\ i = 1, ..., 58, \tag{2}$$

where $\Delta y_{i,t,t+10}$ is the ten-year average of per-capita GDP annual growth rate, and $x_{i,t}$ is a set of predetermined regressors. In the baseline estimation, this set includes the logged per-capita GDP for 1980, secondary schooling and the three moments of real credit growth.[29]

Table 9 reports the estimation results. In Column (1), the choice of the weighting matrix makes the estimation equivalent to pooled OLS with a correction for the moving average component in the residuals. Column (2) reports the estimation results using a more general GMM specification that allows for temporal, as well as cross-sectional heteroskedacity, and accommodates for seeming unrelated regression effects. Columns (3) and (4) include a time trend and an extended set of control variables. They are estimated using the same methods as Columns (1) and (2), respectively. As we can see, the use of overlapping windows confirms our findings and generates a range of estimates that is consistent with our non-overlapping panel regressions. In particular, the skewness of credit growth enters negatively and significantly at the 5% level in all regressions. The point estimates range between -0.26 and -0.42, while our benchmark estimate is -0.30.

[26] We use the sample of 58 countries to meet the requirement of a balanced panel.

[27] See BHL for the derivation of GMM estimator and the alternative speficication of the weighting matrix. Notice that when the Hansen-Hodrick estimator results in a non-invertible weighting matrix, the Newey-West (1987) estimator is used instead.

[28] We are specially grateful to Geert Bekaert, Campbell Harvey and Christian Lundblad for having shared their code with us.

[29] These variables are predertermined because they are computed over the ten-year interval $[t-10, t]$.

In sum, our findings show that countries that followed a risky credit path have on average grown faster than countries with stable credit conditions. These results *do not* imply that crises are good for growth. They say that undertaking credit risk has led to higher growth, but as a side-effect, it has also led to *occasional* crises. This link between skewness and growth is robust and quite stable across alternative sets of countries and specifications. Furthermore, this effect is independent of the negative effect of variance on growth.

3 Model

Here, we formalize the argument presented in the Introduction and show that it is internally consistent. The link between growth and propensity to crisis derives from the fact that risk taking allows financially constrained firms attain greater leverage. Furthermore, the model allows us to determine when systemic risk is growth enhancing and when it is socially efficient.

We consider an 'Ak' growth model with uncertainty. During each period the economy can be either in a good state ($\Omega_t = 1$), with probability u, or in a bad state ($\Omega_t = 0$). To allow for the endogeneity of systemic risk we assume that there are two production technologies: a safe one and a risky one. Under the safe technology, production is *perfectly uncorrelated* with the state, while under the risky one the correlation is perfect. For concreteness, we assume that the risky technology has a return $\Omega_{t+1}\theta$, and the safe return is σ

$$q_{t+1}^{safe} = \sigma I_t^s, \qquad q_{t+1}^{risky} = \begin{cases} \theta I_t^r & \text{prob } u, \quad u \in (0,1) \\ 0 & \text{prob } 1-u \end{cases} \tag{3}$$

where I_t^s is the investment in the safe technology and I_t^r is the investment in the risky one.[30]

Production is carried out by a continuum of firms with measure one. The investable funds of a firm consist of its cash flow w_t plus the one-period debt it issues b_t. Since the firm promises to repay next period $b_t[1+\rho_t]$, the firm's time t budget constraint and time $t+1$ profits are, respectively

$$w_t + b_t = I_t^s + I_t^r \tag{4}$$

$$\pi_{t+1} = \max\{q_{t+1} - b_t[1+\rho_t],\ 0\} \tag{5}$$

The debt issued by firms is acquired by international investors that are competitive risk-neutral agents with an opportunity cost equal to the international interest rate $1+r$.

[30] Since we will focus on symmetric equilibria, we will not distinguish individual from aggregate variables.

In order to generate both borrowing constraints and systemic risk we follow Schneider and Tornell (2004) and assume that firm financing is subject to two credit market imperfections: contract enforceability problems and systemic bailout guarantees. We model the first imperfection by assuming that firms are run by overlapping generations of managers who live for two periods and cannot commit to repay debt. In the first period of her life, a manager makes investment and diversion decisions. In the second period of her life she receives a share e of profits and consumes. For concreteness, we make the following assumption.

Contract Enforceability Problems. If at time t the manager incurs a non-pecuniary cost $h \cdot e \cdot [w_t + b_t]$, then at $t+1$ the firm will be able to divert all the returns provided it is solvent.

The representative manager's goal is to maximize next period's expected payoff net of diversion costs. We model the second imperfection by introducing an agency that grants bailouts when there is a systemic default, but not when there is an idiosyncractic default.

Systemic Bailout Guarantees. The bailout agency pays lenders the outstanding debts of all defaulting firms if and only if a majority of firms becomes insolvent (i.e., $\pi_t \leq 0$).

Bailouts are financed by taxing the consumers, who own the firms. Consumers are infinitely lived, and can borrow and lend at the world interest rate. During every period the representative consumer receives dividends from firms, pays taxes, and consumes. Thus, he solves the following problem

$$\max_{\{c_j\}_{j=0}^{\infty}} E_t \sum_{j=0}^{\infty} \delta^{t+j} v(c_{t+j}), \quad \text{s.t.} \quad E_t \sum_{j=0}^{\infty} \delta^{t+j} [d_{t+j} - c_{t+j} - \tau_{t+j}] \geq 0, \quad \delta := \frac{1}{1+r}$$

We impose the condition that the sequence of taxes is such that the bailout agency breaks even

$$E_0 \sum_{j=0}^{\infty} \delta^j \left\{ [1 - \xi_{j+1}][b_j[1 + \rho_{j+1}] + a_{j+1}] - \tau_{j+1} \right\} = 0, \tag{6}$$

where $\xi_{t+1} = 1$ if $\pi_{t+1} > 0$, and zero otherwise.

Since guarantees are systemic, the decisions of managers are interdependent and are determined in the following credit market game. During each period, every young manager proposes a plan $P_t = (I_t^r, I_t^s, b_t, \rho_t)$ that satisfies budget constraint (4). Lenders then decide whether to fund these plans. Finally, young managers make investment and diversion decisions.

If the firm is solvent at $t+1$ ($\pi_{t+1} > 0$) and no diversion scheme is in place, the old manager receives $e\pi_{t+1}$ and consumers receive a dividend $d_{t+1} = [d-e]\pi_{t+1}$. In contrast, if the firm is solvent and there is diversion, the old manager gets eq_{t+1}, consumers get $[d-e]q_{t+1}$ and lenders receive the bailout if any is granted. Finally, under insolvency consumers and old managers get nothing, while lenders receive the bailout if any is granted. The problem of a young manager is then to choose an investment plan P_t and a diversion strategy η_t to solve:

$$\max_{P_t,\eta_t} \; E_t\xi_{t+1}\{[1-\eta_t]\pi_{t+1} \;+\; \eta_t[q_{t+1} - h[w_t + b_t]]\}e \quad \text{s.t. } (4),$$

where $\eta_t = 1$ if the manager has set up a diversion scheme, and zero otherwise, and ξ_{t+1} is defined in (6).

To sharpen the argument we assume that crises have very steep costs: in case of insolvency all output is lost in bankruptcy procedures. In order to restart the economy in the wake of a systemic crisis we assume that if a firm is insolvent, it receives an aid payment from the bailout agency (a_t) that can be arbitrarily small. Thus, a firm's cash-flow evolves according to

$$w_t = \begin{cases} [1-d]\pi_t & \text{if } \; \pi_t > 0 \\ a_t & \text{otherwise} \end{cases} \tag{7}$$

To close the model we assume that in the initial period cash flow is $w_0 = [1-d]w_{-1}$, dividends are $d_0 = [d-e]w_{-1}$ and the old managers' payment is ew_{-1}.

3.1 Discussion of the Setup

We have considered a very stylized model to capture the essential features of the mechanism through which policies that permit systemic risk taking lead to faster growth in economies where weak institutions give rise borrowing constraints. An attractive feature of this setup is that the mechanism is transparent and the results depend on just two parameters: the degree of contract enforceability h, and the likelihood of crisis $1-u_{t+1}$.

In our setup, there are two states of nature and agents' choice of production technology determines whether or not systemic risk arises. This setup is meant to capture more complicated situations, like for instance, the oft-cited phenomenon of currency mismatch whereby systemic risk is endogenously generated through risky debt denomination.

To make clear that the positive link between growth and systemic risk in our mechanism does *not* derive from the assumption that risky projects have a greater mean return than safe ones, we restrict the risky technology to have a *lower* expected return ($u\theta$) than the safe one

$$1 + r \leq u\theta < \sigma < \theta \tag{8}$$

Two comments are in order. First, the condition $u\theta < \sigma$ implies that the moral hazard induced by the guarantees supports lending to inefficient projects. Nevertheless, due to the leverage effect, an equilibrium with risky projects can be socially efficient –as shown by Proposition 4.1. Second, in our simple set-up relaxing $1 + r \leq u\theta$ could lead to growth-enhancing systemic risk, but such an equilibrium would be socially inefficient. This condition could be relaxed in a more complicated set-up with externalities. For instance, in the two-sector framework of Ranciere, Tornell and Westermann (2003), greater leverage in the constrained sector has a positive externality on the unconstrained sector.

The mechanism that links growth and the propensity to crisis requires that both borrowing constraints and systemic risk arise simultaneously in equilibrium. In most of the literature there are models with either borrowing constraints or excess risk, but not both. As Schneider and Tornell (2004) show, in order to have both borrowing constraints and risk-taking, enforceability problems must interact with systemic guarantees. If only enforceability problems were present, agents would be overly cautious and the equilibrium would feature borrowing constraints, but no risk taking. If only guarantees were present, there would be no borrowing constraints and risk-taking would not be growth enhancing.

Notice that the two distortions act in opposite directions, and in general, neutralize each other. Propositions 3.1-4.1 demonstrate that systemic risk is growth enhancing and socially efficient only when institutions are weak, but not too weak. In our setup countries with weak institutions have a low level of contract enforceability h. More specifically we will assume throughout the paper that enforceability problems are 'severe'

$$0 \leq h < u[1 + r] \tag{9}$$

This condition is necessary for borrowing constraints to arise in equilibrium. Lenders are willing to lend up the point where borrowers do not find it optimal to divert. If (9) did not hold, the expected debt repayment in a risky equilibrium would be lower than the diversion cost $h[w_t + b_t]$ for all levels of b_t. Thus, lenders would be willing to lend any amount.

We have assumed that guarantees are systemic. If instead institutions were so weak that bailouts were granted whenever there was an individual default, borrowing constraints would not arise because lenders would always be repaid (by taxpayers).

Our setup makes it difficult to prove that systemic risk is growth enhancing and socially efficient. First, we have assumed that there are 100% bankruptcy costs (in case of a crisis all output is lost). Second, in the wake of crisis cash-flow of firms collapses (it equals the tiny aid payment a_t). Since the production technology is linear, this collapse in cash-flow reduces the level of output permanently.

Consumers do not play a central role. They are simply a device to transfer fiscal resources from firms to the bailout agency. We will use the consumers to show that the fiscal costs of the guarantees can be lower than the benefits. The assumption that consumers can borrow and lend at the world interest rate can be relaxed if we assume instead that the bailout agency has access to an international lender of last resort. In this case the bailout agency would repay the international loan from taxes levied in good times.

3.2 Equilibrium Risk Taking

In this subsection, we characterize the conditions under which borrowing constraints and systemic risk can arise simultaneously in a symmetric equilibrium.

Let us define a *systemic crisis* as a situation where a majority of firms go bust, and let us denote the probability that this event occurs next period by $1 - u_{t+1}$. Then, a plan $(I_t^r, I_t^s, b_t, \rho_t)$ is part of a symmetric equilibrium if it solves the representative manager's problem, taking u_{t+1} and w_t as given.

The next proposition characterizes symmetric equilibria at a point in time. It makes three key points. First, binding borrowing constraints arise in equilibrium only if contract enforceability problems are severe ($h < \bar{h}$). In this case a financial bottleneck arises as investment is constrained by cash flow. Second, systemic risk taking eases, but does not eliminate, borrowing constraints and allows firms to invest more than under perfect hedging. This is because systemic risk taking allows agents to exploit the subsidy implicit in the guarantees via a lower expected cost of capital. Third, systemic risk may arise endogenously only if bailout guarantees are present. Guarantees, however, are not enough. It is also necessary that a majority of agents coordinate in taking on risk, and that contract enforceability problems are not 'too severe' ($h > \underline{h}$). If h were too small, taking on risk would not pay because the increase in leverage would be too small.

Proposition 3.1 (Symmetric Credit Market Equilibria (CME)) *Borrowing constraints arise if and only if the degree of contract enforceability is not too high: $h < u_{t+1}\delta^{-1}$. If this condition holds, credit and investment are*

$$b_t = [m_t - 1]w_t, \qquad I_t^r + I_t^s = m_t w_t, \qquad \textit{with} \;\; m_t = \frac{1}{1 - u_{t+1}^{-1} h\delta}. \tag{10}$$

- *There always exists a 'safe' CME in which all firms only invest in the safe technology and a systemic crisis next period cannot occur: $u_{t+1} = 1$.*
- *There also exists a 'risky' CME in which $u_{t+1} = u$ and all firms only invest in the risky technology if and only if $h > \underline{h}(u)$, where $\underline{h}(u)$ is given by (19).*

The intuition is the following. Given that all other managers choose a *safe plan*, a manager knows that no bailout will be granted next period. Since the expected return of the safe technology is greater than that of the risky technology (i.e., $\sigma > u\theta$), she will choose a safe plan. Since the firm will not go bankrupt in any state and lenders must break even, the interest rate that the manager has to offer satisfies $1 + \rho_t = 1 + r$. It follows that lenders will be willing to lend up to an amount that makes the no diversion constraint binding: $(1 + r)b_t \leq h(w_t + b_t)$. By substituting this borrowing constraint in the budget constraint we can see that there is a financial bottleneck: investment equals cash-flow times a multiplier ($I_t^s = m^s w_t$, where $m^s = (1 - h\delta)^{-1}$).[31]

Consider now the risky equilibrium. Given that all other managers choose a *risky plan*, a young manager expects a bailout in the bad state, but not in the good state. Since lenders will get repaid in full in both states, the interest rate that allows lenders to break-even is again $1 + \rho_t = 1 + r$. It follows that the benefits of a risky plan derive from the fact that, from the firm's perspective, expected debt repayments are reduced from $1 + r$ to $[1 + r]u$, as the bailout agency will repay debt in the bad state. A lower cost of capital eases the borrowing constraint as lenders will lend up to an amount that equates $u[1 + r]b_t$ to $h[w_t + b_t]$. Thus, investment is higher than in a safe plan. The downside of a risky plan is that it entails a probability $1 - u$ of insolvency. Will the two benefits of a risky plan –more and cheaper funding– be large enough to compensate for the cost of bankruptcy

[31] This is a standard result in the macroeconomics literature on credit market imperfections –e.g. Bernanke et. al. (2000) and Kiyotaki and Moore (1997).

in the bad state? If h is sufficiently high, expected profits under a risky plan exceed those under a safe plan: $u\pi^r_{t+1} > \pi^s_{t+1}$.

3.3 Long Run Growth

We have loaded the dice against finding a positive link between growth and systemic risk. First, we have restricted the expected return on the risky technology to be lower than the safe return ($\theta u < \sigma$). Second, we have allowed crises to have large financial distress costs as cash-flow collapses in the wake of crisis and the aid payment (a_t) can be arbitrarily small. Since the production technology is linear, this fall in cash-flow reduces the level of output permanently: crises have long-run effects.

Here we investigate whether, in the presence of borrowing constraints, systemic risk can be growth-enhancing by comparing two symmetric equilibria: safe and risky. In a safe(risky) equilibrium every period agents choose the safe(risky) plan characterized in Proposition 3.1. We ask whether average long-run growth in a risky equilibrium is higher than in a safe equilibrium.

The answer to this question is not straightforward because an increase in the probability of crisis ($1 - u_{t+1}$) has opposing effects on long-run growth. One the one hand, a greater $1 - u_{t+1}$ increases investment and growth along the lucky no-crisis path by increasing the subsidy implicit in the guarantee and allowing firms to be more leveraged. On the other hand, a greater $1 - u_{t+1}$ makes crises more frequent, which reduces average long-run growth.

In a safe symmetric equilibrium, crises never occur –i.e., $u_{t+1} = 1$ in every period. Thus, cash flow dynamics are given by $w^s_{t+1} = [1 - d]\pi^s_{t+1}$, where profits are $\pi^s_{t+1} = [\sigma - h]m^s w_t$. It follows that the long-run annual growth rate, g^s, is given by

$$1 + g^s = [1 - d][\sigma - h]m^s \qquad\qquad m^s = \frac{1}{1 - h\delta} \tag{11}$$

Since $\sigma > 1 + r$, the lower h, the lower growth. Consider now a risky symmetric equilibrium. Since firms use the risky technology during every period t, there is a probability u that they will be solvent at $t + 1$ and their cash-flow will be $w_{t+1} = [1 - d]\pi^r_{t+1}$, where $\pi^r_{t+1} = [\theta - u^{-1}h]m^r w_t$. However, with probability $1 - u$ firms will be insolvent at $t + 1$ and their cash flow will equal the aid payment from the bailout agency: $w_{t+1} = a_{t+1}$. We parametrize a_{t+1} as follows

$$a_{t+1} = \alpha(1 - d)(\theta - u^{-1}h)m^r w_t, \qquad \alpha \in (0, 1) \tag{12}$$

The expression multiplying α is the cash-flow that the firm would have received had no crisis occurred. Clearly, the smaller α, the greater the financial distress costs of crises. Since crises can occur in consecutive periods, growth rates are independent and identically distributed over time. Thus, the long-run mean annual growth rate is given by

$$E(1+g^r) = u\gamma^n + (1-u)\gamma^c, \qquad \begin{array}{l} \gamma^n = [1-d][\theta - u^{-1}h]m^r, \\ \gamma^c = \alpha\gamma^n \end{array} \qquad m^r = \frac{1}{1-u^{-1}h\delta} \tag{13}$$

The following proposition compares the mean growth rates in (11) and (13).

Proposition 3.2 (Long-run Growth) *Consider an economy where crises have arbitrarily large financial distress costs ($\alpha \to 0$).*

- *Systemic risk arises in equilibrium and increases average long-run growth if and only if contract enforceability problems are severe, but not too severe: $h \in (\underline{h}, u\delta^{-1})$, where $\underline{h}$ is uniquely defined by (19).*
- *The greater h, within the range $(\underline{h}, u\delta^{-1})$, the greater the growth enhancing effects of systemic risk.*

A shift from a safe to a risky equilibrium increases the likelihood of crisis from 0 to $1-u$. This shift results in greater leverage ($\frac{b_t^r}{w_t} - \frac{b_t^s}{w_t} = m^r - m^s$), which increases investment and growth in periods without crisis. This is the leverage effect. However, this shift also increases the frequency of crises and the associated collapse in cash flow and investment, which is bad for growth. This proposition states that the leverage effect dominates the crisis effect if the degree of contract enforceability is high enough, but not too high. If h is high enough, the undertaking of systemic risk translates into a large increase in leverage, which compensates for the potential losses caused by crises. If h were excessively high, there would be no borrowing constraints to begin with and risk taking would not enhance growth.

An increase in the degree of contract enforceability –a greater h within the range $(\underline{h}, u\delta^{-1})$– leads to higher profits and growth in both risky and safe economies. An increase in h can be seen as a relaxation of financial bottlenecks that allows greater leverage in both economies. However, such an institutional improvement benefits more the risky economy as the subsidy implicit in the guarantee amplifies the effect of better contract enforceability.

Notice that the threshold $\underline{h}$ in Propositions 3.1 and 3.2 is the same. This implies that whenever risk taking is individually optimal it is also growth enhancing. Observe, however, that systemic risk and higher growth need not be socially efficient. We will come back to this issue in Section 4.

Figure 4 illustrates the limit distribution of growth rates by plotting different paths of w_t corresponding to different realizations of the risky growth process. This figure makes clear that greater long-run growth comes at the cost of occasional busts. We can see that over the long-run most of the risky paths outperform the safe path, except for a few unlucky risky paths. If we increased the number of paths, the cross section distribution would converge to the limit distribution.

The choice of parameters used in the simulation depicted in Figure 4 is detailed in Appendix B. The probability of crisis (4.18%) corresponds to the historical probability of falling into a systemic banking crisis in our sample of countries over 1980-2000. The financial distress costs are set to 50%, which is a third more severe than our empirical estimate derived from the growth differential between tranquil times and a banking crisis. The degree of contract enforceability is set just above the level necessary for risk-taking to be optimal (h =0.5). Finally, the mean return on the risky technology is 2% below the safe return. Nevertheless, growth in the risky equilibrium is on average 3% higher than in the safe equilibrium.

Figure 5 plots the difference in log w_t of risky and safe economies for varying degrees of contract enforceability. As we can see, an increase in the degree of contract enforceability increases the growth benefits from risk taking. Figure 6 plots the difference in log w_t for different financial distress costs. Recall that if risk-taking is optimal, it is also growth enhancing for any arbitrarily large financial distress cost. Less severe distress costs evidently improve the average long-run growth in the risky equilibrium. Notice that the upper curve is computed with the value of financial distress costs estimated from our sample of 83 countries over 1980-2000 ($\alpha = 0.8$).

3.4 From Model to Data

The equilibrium of the model implies a negative link between skewness and growth, and it identifies the set of countries over which our mechanism is at work. We consider each in turn.

Skewness and Growth

In a risky equilibrium, firms face endogenous borrowing constraints, and so credit is constrained by cash flow. Since along a no-crisis path cash flow accumulates gradually, credit grows fast but only *gradually*. In contrast, when a crisis erupts there are widespread bankruptcies, cash flow collapses and credit falls abruptly. The upshot is that in a risky equilibrium the growth rate can take on two values: low in the crisis state (g^c), or high in the lucky no crisis state (g^n).

Empirically, financial crises are rare events.[32] In terms of the model, this fact means that the probability of the bad state $1-u$ is rather small, and in particular less than a half. This implies that the low growth rate realizations (g^c) are farther away from the mean than the high realizations (g^n). Thus, in a long enough sample, the distribution of growth rates in a risky equilibrium is characterized by negative outliers and is negatively skewed. In contrast, in the safe equilibrium there is no skewness as there is no uncertainty in the growth process.[33] Since risk taking is optimal whenever it is growth enhancing (by Propositions 3.1 and 3.2), it follows that there is a negative link between mean long-run growth and skewness.

Quality of Institutions and Policy Environment

Our argument has two empirical implications that underlie the country grouping criterion and the instrument selection in Section 2. First, our model predicts that on average we should observe a stronger link between systemic risk and higher long-run growth in countries with a middle degree of institutional quality than in other groups of countries. Second, our model predicts that this link should be stronger in the set of financially liberalized countries.

The model emphasizes two key aspects of the quality of institutions. The first aspect has to do with the degree of contract enforceability h. On the one hand, borrowing constraints arise in equilibrium only if contract enforceability problems are 'severe': $h < \bar{h}$. Otherwise, borrowers would always find it profitable to repay debt. On the other hand, risk taking is individually optimal and systemic risk is growth enhancing only if $h > \underline{h}$. Only if h is large enough can risk taking induce a big enough increase in leverage to compensate for the distress costs of crises. It follows that a positive link between systemic risk and long-run growth exists only in the set of countries where contract enforceability problems are severe, but not too severe: $h \in (\underline{h}, \bar{h})$.

The second aspect of the quality of institutions is the generosity of the guarantees. If institutions are *so weak* that a bailout is granted whenever there is an isolated default –because authorities

[32] In the set of countries we consider, the probability of crises is around 4%.

[33] In this argument we have used the fact that in our setup two crises can occur in consecutive periods. However, a similar argument could be made if a crisis were followed by a recovery during which another crisis could not happen (see Ranciere, Tornell and Westermann (2003)). In that setup no-crisis times are more frequent that crisis times.

cannot withstand the political or corruption pressures, the mechanism does not work. Instead, there would be a collusion between politically connected lenders and borrowers to run and finance unproductive projects and extract taxpayers' money through bailout guarantees.[34] Institutions must be sufficiently strong so that bailouts are granted only in case of a systemic crisis.[35]

Consider next the policy environment. The moderately weak institution framework we have described above is not sufficient to generate systemic risk. Proposition 3.1 implies that the presence of policies that liberalize financial markets and allow agents to take on systemic risk is necessary. The key for the risk-growth link is the combination of moderately weak institutions with financial liberalization.

4 Financing of the Guarantees

The existence of systemic risk and high average growth rates depend on systemic guarantees, which are funded domestically via lump-sum taxes on consumers. Here, we consider an economy with severe contract enforceability problems, and ask whether the expected value of the dividend stream net of taxes is greater in a risky than in a safe equilibrium. That is, we ask whether taxpayers will be made strictly better off by financing the bailout guarantees. By fully accounting for the costs and benefits associated with the financing of the guarantees, we can assess when systemic risk is not only growth enhancing, but also socially efficient. Notice that our setup is biased against the efficiency of guarantees: the risky technology is restricted to have a lower expected return than the safe technology, there is no externality associated with higher investment, and during a crisis all output is lost in bankruptcy procedures and cash-flow collapses. This means that all the social gains from risk taking come from the ability to attain greater leverage.

To simplify notation we set, without loss of generality, the interest rate r to zero.[36] Thus, the expected present value of the representative consumer's net income is

$$Y = E_0 \sum\nolimits_{j=0}^{\infty} [d_j - \tau_j], \tag{14}$$

where the dividend d_j equals $[d - e]\pi_j$ in periods without a crisis and zero otherwise, and the

[34] This phenonenon has been described by Faccio (2004) and Khawaja and Mian (2004).

[35] If the decision to finance the guarantees involved an international financial institution, its monitoring capacity would be part of the insitutional environment.

[36] We ensure that the sums below converge by setting d sufficiently high.

sequence of taxes $\{\tau_j\}$ satisfies the bailout agency's break-even constraint (6). In a safe equilibrium taxes are always zero because insolvencies never occur. Since during every period $t \geq 1$ profits are $\pi_j^s = [\sigma - h]m^s w_{j-1}$ and initially $d_0 = [d-e]w_{-1}$ and $w_0 = [1-d]w_{-1}$, in the safe equilibrium (14) becomes

$$Y^s = \sum\nolimits_{j=0}^{\infty} [d-e]w_{j-1} = \frac{d-e}{1-\gamma^s} w_{-1}, \qquad \gamma^s = 1 + g^s \tag{15}$$

Consider next the risky equilibrium. When a crisis erupts the bailout agency pays lenders the debt they were promised (b_{j-1}) and gives firms a small amount of seed money (a_j). To ensure that the bailout agency breaks even consider a tax sequence in which, during each period, taxes equal the bailout payments. This sequence is feasible because taxpayers have access to complete financial markets. It follows that the expected present value of the taxpayer's net income is

$$\begin{aligned} Y^r &= E_0 \sum_{j=0}^{\infty} \left\{ [d-e]\pi_j^r \xi_j - [b_{j-1} + a_j][1-\xi_j] \right\} \qquad (16) \\ &= \frac{d - e[1-(1-u)\alpha\gamma^n] - [1-u][(m^r-1)(1-d) + \alpha\gamma^n]}{1-\gamma^r} w_{-1}, \quad \gamma^r = [u + (1-u)\alpha]\gamma^n \end{aligned}$$

where $\xi_j = 0$ if there is a crisis at time j. The first two terms in the numerator represent the average dividend, while the third term represents the average tax, which covers the seed money given to firms $\alpha\gamma^n w_{t-1}$ and the debt that has to be repaid to lenders. The latter equals the leverage times the reinvestment rate $\frac{b_{t-1}}{w_{t-1}} \frac{w_{t-1}}{\pi_{t-1}} w_{t-1} = (m^r - 1)(1-d)w_{t-1}$.[37]

The next proposition states that if enforceability problems are not too severe, the fiscal costs of crises are outweighed by the benefits of greater growth.

Proposition 4.1 (Financing the Guarantees and Social Efficiency) *If the manager's payout rate e is small enough, there exists a unique threshold for the degree of contract enforceability $h^{**} < u$, such that the expected present value of taxpayers' net income is greater in a risky economy than in a safe one for any aid policy $\alpha \in (0,1)$ if and only if $h > h^{**}$.*

To get further insight into social efficiency consider the excess social return of firms when the

[37] The term $-e[1-(1-u)\alpha\gamma^n]w_{t-1}$ reflects the fact that during no crisis times the old manager gets a share e of w_t, while in a crisis she gets nothing. This is as if, with probability $1-u$, the old manager does not get $ew_t = e\alpha\gamma^n w_{t-1}$.

manager's share e tends to zero. Rewrite (15) and (16) as follows

$$\begin{aligned} Y^s - w_{-1} &= (1-d)(\sigma-1)m^s \frac{w_{-1}}{1-\gamma^s} = (1-d)(\sigma-1)\sum_{t=0}^{\infty} I_t^s \\ Y^r - w_{-1} &= (1-d)(u\theta-1)m^r \frac{w_{-1}}{1-\gamma^r} = (1-d)(u\theta-1)E_0\sum_{t=0}^{\infty} I_t^r \end{aligned}$$

We can interpret $Y^i - w_{-1} = R^i m^i \frac{w_{-1}}{1-\gamma^i}$ as the expected excess social return of a firm. This excess return has three components: the static return (R^i); the leverage ($m^i - 1$); and the mean growth rate of cash-flow (γ^i). Since we have imposed the condition $u\theta < \sigma$, the following trade-off arises. Projects have a higher rate of return in a safe economy that in a risky one ($R^s > R^r$), but leverage and scale are smaller ($m^s < m^r$). In a risky economy, the subsidy implicit in the guarantees attracts projects with a lower return but permits greater scale by relaxing borrowing constraints. This relaxation of the financial bottleneck is dynamically propagated ($\gamma^r > \gamma^s$). If h is high enough, greater leverage and growth compensate for the costs of crises. Thus, when contract enforceability problems are of limited severity, the excess return in the risky economy is greater than in the safe economy.

Is systemic risk socially efficient whenever it is growth enhancing? The answer is no. When financial crises are very costly, social efficiency depends on our measure of the weakness of institutions, as the next Corollary shows.

Corollary 4.1 (Growth vs. Efficiency) *If crises have large distress costs, the social efficiency threshold h^{**} is greater than the risk-taking (and growth-enhancing) threshold $\underline{h}$. In this case systemic risk is growth enhancing but socially inefficient if $h \in (\underline{h}, h^{**})$.*

We have seen that systemic risk is growth enhancing whenever it is individually optimal (Propositions 3.1 and 3.2). When the financial distress costs of crises are large, there is a range for the degree of contract enforceability in which risk taking is individually optimal ($h > \underline{h}$), but not socially efficient ($h < h^{**}$). When $h \in (\underline{h}, h^{**})$ the leverage gains obtained by firms are big enough to justify individual risk-taking, but are not big enough to compensate for the social costs of financial crises.

The reason for this gap is the following. The social cost of borrowing is identical in safe and risky economies. However, while in the former the individual firm internalizes 100% of the debt costs, in a risky economy the individual firm internalizes only a share u of the debt costs and taxpayers cover the rest. As a result, risk taking might be individually optimal, even if it is not socially efficient. To see when this is the case consider the ratio of excess social returns

$$\frac{Y^r - w_{-1}}{Y^s - w_{-1}} = \frac{E\pi^r}{\pi^s} \cdot k, \qquad k := \frac{u\theta - 1}{\sigma - 1} \frac{\sigma - h}{u\theta - h}$$

The k ratio is smaller than one because $\sigma > \theta u$ and $h < u$. Since at the threshold $\underline{h}$ expected profits in both economies are equal ($E\pi^r = \pi^s$), the social return is greater in the safe economy. The leverage effect implies that $E\pi^r$ grows faster with h than π^s. Hence, when h is high enough the risky-safe leverage gap more than compensates for the social cost of crises and $Y^r > Y^s$.

We want to emphasize that our results do not imply that guarantees are always socially efficient. In addition to Corollary 4.1, we have seen that in the absence of a mechanism to relax borrowing constraints, bailout guarantees are unambiguously bad. This occurs if either h is too high, so that borrowing constraints do not arise, or h is too low, so that there is no significant increase in leverage.[38]

The funding of the guarantees can be interpreted as a *redistribution* from the financially unconstrained to the financially constrained agents in the economy. On the one hand, taxpayers benefit from the guarantees because higher mean growth means higher dividend growth. On the other hand, taxpayers bear the fiscal costs associated with the risk taking that permits constrained agents to exploit the subsidy implicit in the guarantees.

5 Related Literature

Most of the empirical literature on financial liberalization and economic performance focuses either on growth or on financial fragility and excess volatility. Beckaert, Harvey and Lundblad (2004) find a robust and economically important link between stock market liberalization and growth, while Henry (2002) finds similar evidence by focusing on private investment.[39] Kaminsky and Reinhart (1998) and Kaminsky and Schmukler (2002) show that the propensity to crises and stock market volatility increase in the aftermath of financial liberalization. Our findings help to integrate these contrasting views.

[38] This is consistent with the view that in developed economies it might not be justified to subsidize risk-taking.

[39] In contrast, the evidence on the link between capital account liberalization and growth is mixed. See Eichengreen and Leblang (2003) and Prasad et.al. (2003).

A novelty of this paper is to use skewness to analyze economic growth. In the finance literature, skewness of stock market returns plays an important role –e.g., Beckaert and Harvey (1997), Kraus and Litzenberger (1976), Harvey and Siddique (2000) and Veldkamp (2004). This paper borrows from the finance literature the idea that variance is not sufficient to characterize risk when the distribution of stock returns is asymmetric.

In our empirical analysis, the negative link between skewness and growth coexists with the negative link between variance and growth identified by Ramey and Ramey (1995). The contrasting growth effects of different sources of risk are also present in Imbs (2004), who finds that aggregate volatility is bad for growth, while sectorial volatility is good for growth.

A key result of this paper is that a bailout policy that discourages hedging can be efficient as it induces a redistribution from non-constrained to constrained agents. Tirole (2003) and Tirole and Pathak (2004) reach a similar conclusion in a different set up. In their framework, a country pegs the exchange rate as a means to signal a strong currency and attract foreign capital. Thus, it must discourage hedging and withstand speculative attacks in order for the signal to be credible.

By focusing on the growth consequences of imperfect contract enforceability, this paper is connected with the growth and institutions literature pioneered by North (1981). For instance, Acemoglu et.al. (2003) show that better institutions lead to higher growth, lower variance and less frequent crises. In our model, better institutions also lead to higher growth, and it is never optimal for countries with strong institutions to undertake systemic risk. Our contribution is to show how systemic risk can enhance growth by counteracting the financial bottlenecks generated by weak institutions.

Obstfeld (1994) demonstrates that financial openness increases growth if international risk-sharing allows agents to shift from safe to risky projects. In our framework, the growth gains are obtained by letting firms take on more risk and attain greater leverage.

The cycles in this paper are different from schumpeterian cycles in which the adoption of new technologies and the cleansing effect of recessions play a key role –e.g., Aghion and Saint Paul (1998), Caballero and Hammour (1994) and Schumpeter (1934). Our cycles resemble Juglar's credit cycles in which financial bottlenecks play a dominant role. Juglar (1862, 1863) characterized asymmetric credit cycles along with the periodic occurrence of crises in France, England, and United States during the nineteen century.

Our model is related to Ranciere, Tornell and Westermann (2003) who consider two productive sectors: a tradables sector with access to international financial markets that uses inputs from the constrained nontradables sector. Greater investment by the latter benefits the former through cheaper inputs. That paper uses the framework of Schneider and Tornell (2004) to generate systemic risk via currency mismatch. It also generates several of the stylized facts associated with recent boom-bust cycles. The present one-sector model is not designed to generate such stylized facts. The gain is that the link between systemic risk and growth is transparent.

The growth enhancing effect of systemic risk shares some similarities with the role of bubbles in Olivier (2000) and Ventura (2004). In these papers, bubbles can foster growth by encouraging investment. The idea that introducing a new distortion counteracts the effects of an existing distortion is also present in our approach as systemic guarantees relax financial bottlenecks. However, our results do not exploit any form of dynamic inefficiency and our risky equilibria are sustainable over the infinite horizon. Finally, the mechanism we present is reminiscent of the literature on risk as a factor of production as Sinn (1986) and Konrad (1992).

6 Conclusions

We have found a robust link between systemic risk and growth: fast growing countries tend to experience occasional crises. In order to uncover this link it is essential to distinguish booms punctuated by rare abrupt busts from other up-and-down patterns that are more frequent or symmetric. Both lead to higher variance, but only the former leads to lower skewness. This is why we use the skewness of credit growth, not the variance, to capture the volatility generated by crises.

Our empirical findings shed light on two contrasting views of financial liberalization. In one view, financial liberalization induces excessive risk-taking, increases macroeconomic volatility and leads to more frequent crises. In another view, liberalization strengthens financial development and contributes to higher long-run growth. Our findings indicate that, while liberalization does lead to risk taking and occasional crises, it also raises growth rates –even when the costs of crises are taken into account.

We explain this empirical relationship by developing a theoretical mechanism based on the existence of financial bottlenecks in countries with weak institutions. Policies that permit systemic risk taking allow financially constrained firms to attain greater leverage, which leads to greater investment and growth along a path without crises. If this leverage effect is strong enough, the gains from larger investment will dominate the losses from occasional financial crises.

The bailout guarantees that support the systemic risk have fiscal costs. Thus, higher growth need not be socially efficient. We show that, in economies with weak institutions, if the leverage effect is strong enough and the economy as a whole benefits from the production of credit constrained firms, the redistribution implicit in the guarantees is socially efficient.

In principle, an alternative policy is for a planner to make direct transfers to credit constrained firms. Such policies –in vogue a few decades ago– have often failed. In contrast, our decentralized mechanism uses the monitoring capacity of the financial system to make implicit transfers via the guarantees, while maintaining lenders' incentives to screen borrowers' projects. There is an important caveat: systemic risk is not beneficial in every economy with weak institutions. In particular, the degree of contract enforceability must be high enough that risk-taking translates into a sufficiently high increase in leverage. Furthermore, a strong enough regulatory framework must be in place to avoid practices that simply mask corruption and to withstand pressures to grant a bailout whenever an individual firm defaults. The design of systemic bailout policies is an important area for future research.

This paper contributes to the discussion of whether financial liberalization should be implemented before other reforms have been implemented. While the first best is to implement judicial reform and improve the quality of institutions, if such reforms are not feasible, financial liberalization and an increase in risk taking appear to improve economic growth rates even after the effects of crises have been taken into account.

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Appendix A: Proofs

Proof of Proposition 3.1. We will compare the payoffs of a safe plan ($I_t^r = 0$) and a risky plan ($I_t^s = 0$). In a safe plan with no-diversion the firm will be solvent in both states. Thus, the entrepreneur offers $1+\rho_t = 1+r$, and the no-diversion condition is $b_t(1+r) \leq h(w_t+b_t)$. It follows that $I_t^s = m^s w_t$ and $b_t = [m^s - 1]w_t$, with $m^s = \frac{1}{1-h\delta}$.

In a risky plan with no-diversion the firm will be solvent only in the good state. Thus, the interest rate must satisfy $u(1+\rho_t)b_t + (1-u_{t+1})(1+\rho_t)b_t = (1+r)$. If a bailout is expected ($u_{t+1} = u$), then $1+\rho_t = 1+r$ and the no-diversion condition is $ub_t(1+r) \leq h(w_t+b_t)$. It follows that $I_t^r = m^r w_t$ and $b_t = [m^r - 1]w_t$, with $m^r = \frac{1}{1-h\delta u^{-1}}$. If no bailout is expected ($u_{t+1} = 1$), then $1+\rho_t = u^{-1}(1+r)$ and the no-diversion condition is $ub_t(1+r) \leq h(w_t+b_t)$. It follows that expected payoffs are

$$\pi_{t+1}^s = [\sigma - h]m^s; \qquad E_t(\pi_{t+1}^r|BG) = [\theta u - h]m^r, \qquad E_t(\pi_{t+1}^r|\text{no } BG) = [\theta u - h]m^s$$

If all other entrepreneurs choose the safe plan, no bailout is expected. Since $\theta u < \sigma$, it follows that $[\theta u - h]m^s < [\sigma - h]m^s$. Thus, the entrepreneur will strictly prefer the safe plan. Hence, there always exists a safe symmetric equilibrium. If all other entrepreneurs choose the risky plan, a bailout is expected in the bad state. Thus, an entrepreneur will strictly prefer a risky plan if and only if

$$0 \leq Z(h)w_t := E_t(\pi_{t+1}^r|BG) - \pi_{t+1}^s = \frac{\theta u - h}{1-h\delta u^{-1}}w_t - \frac{\sigma - h}{1-h\delta}w_t \tag{17}$$

It follows from (8) and (9) that $Z(h)$ has three properties: $Z(0) = u\theta - \sigma < 0$, $\lim_{h\to u\delta^{-1}} Z(h) = \infty$ and

$$\frac{\partial Z(h)}{\partial h} = \left(\frac{1}{1-u^{-1}h\delta}\right)^2 (\delta\theta - 1) - \left(\frac{1}{1-h\delta}\right)^2 (\delta\sigma - 1) > 0 \tag{18}$$

It follows that there exists a unique threshold $\underline{h} \in (0, u\delta^{-1})$ such that $E_t(\pi_{t+1}^r) > \pi_{t+1}^s$ for all $h \in (\underline{h}, u\delta^{-1})$. Hence, a risky symmetric equilibrium exists if and only if $h \in (\underline{h}, u\delta^{-1})$, where

$$\underline{h} = \frac{\sigma - \theta u^2}{2(1-u)} - \frac{\left[(\sigma - \theta u^2)^2 - 4u\delta^{-1}(1-u)(\sigma - \theta u)\right]^{1/2}}{2(1-u)} \tag{19}$$

Proof of Proposition 3.2. The mean annual long-run growth rate is given by $E(1+g^r) = \lim_{T\to\infty}\left[E_t \prod_{i=t+1}^T (1+g_i^r)\right]^{1/T}$. The expression in (13) follows from the fact that the probability of crisis is independent across time. Comparing (11) and (13) we have that

$E(1+g^r) > (1+g^s)$ for any $\alpha > 0$ if and only if $E\pi^r > \pi^s$, which is equivalent to $h > \underline{h}$ (defined in (19)). The second part of the proposition follows from $\partial Z(h)/\partial h > 0$ as shown in (18).

Proof of Proposition 4.1. We start by deriving $Y^r = E_0 \sum_{t=0}^{\infty} y_t$ in closed form. Without loss of generality consider a tax sequence in which, during each period, taxes equal the bailout payment. It then follows that the representative consumer's net income in crisis and no-crisis times (y_t^c and y_t^n) are, respectively

$$\begin{aligned} y_t^c &= -b_{t-1} - a_t = -(m^r - 1)w_{t-1} - \alpha\gamma^n w_{t-1} = -w_t \left[1 + \frac{m^r - 1}{\alpha\gamma^n}\right] \\ y_t^n &= (d-e)\pi_t = \frac{d-e}{1-d} w_t \end{aligned}$$

To derive the third equality in y_t^c notice that if there is a crisis at t, then $w_t = a_t = \alpha\gamma^n w_{t-1}$. Next, notice that the process $\frac{y_{t+1}}{y_t}$ follows a four-state Markov chain with transition matrix Φ

$$\Delta = \begin{pmatrix} \delta^{nn} := \frac{y_{t+1}^n}{y_t^n} = (1-d)(\theta - \frac{h}{u})m^r \;\; := \gamma^n \\ \delta^{nc} := \frac{y_{t+1}^c}{y_t^n} = -[\alpha\gamma^n + m^r - 1]\frac{1-d}{d-e} \\ \delta^{cn} := \frac{y_{t+1}^n}{y_t^c} = -\gamma^n \left[1 + \frac{m^r - 1}{\alpha\gamma^n}\right]^{-1} \frac{d-e}{1-d} \\ \delta^{cc} := \frac{y_{t+1}^c}{y_t^c} = \alpha\gamma^n \end{pmatrix}, \qquad \Phi = \begin{pmatrix} u & 1-u & 0 & 0 \\ 0 & 0 & 1-u & u \\ 0 & 0 & 1-u & u \\ u & 1-u & 0 & 0 \end{pmatrix} \tag{20}$$

To obtain (20) note that if there is no crisis at t, $\frac{w_t}{w_{t-1}} = \gamma^n$, while if there is a crisis at t, $\frac{w_t}{w_{t-1}} = \alpha\gamma^n$. We will obtain Y^r by solving the following recursion

$$\begin{aligned} V(y_0, \delta_0) &= E_0 \sum_{t=0}^{\infty} y_t = y_0 + E_0 V(y_1, \delta_1) \\ V(y_t, \delta_t) &= y_t + E_t V(y_{t+1}, \delta_{t+1}) \end{aligned} \tag{21}$$

Consider the following guess: $V(y_t, \delta_t) = y_t v(\delta_t)$, with $v(\delta_t)$ an undetermined coefficient. Substituting this guess into (21) and dividing by y_t, we get $v(\delta_t) = 1 + \delta E_t(\delta_{t+1} v(\delta_{t+1}))$. Combining this condition with (20), it follows that $v(\delta_{t+1})$ satisfies

$$(v_1, v_2, v_3, v_4)' = (1,1,1,1)' + \Phi(\delta^n v_1, \delta^{nc} v_2, \delta^c v_3, \delta^{cn} v_4)'$$

Notice that $v_1 = v_4$ and $v_2 = v_3$. Thus, the system collapses to two equations: $v_1 = 1 + u\delta^{nn} v_1 + (1-u)\delta^{nc} v_2$ and $v_2 = 1 + (1-u)\delta^{cc} v_2 + u\delta^{cn} v_1$. The solution is

$$v_1 = \frac{1 - (1-u)(\delta^c - \delta^{nc})}{(1 - u\delta^n)(1 - (1-u)\delta^c) - (1-u)u\delta^{cn}\delta^{nc}} = \frac{1 - (1-u)\frac{1}{d-e}[(1-e)\alpha\gamma^n + (m^r - 1)(1-d)]}{(1 - u\gamma^n)(1 - (1-u)\alpha\gamma^n) - (1-u)u\alpha(\gamma^n)^2}$$

To derive the second equation substitute $\delta^{cn}\delta^{nc} = \alpha\,(\gamma^n)^2$ and $\delta^c - \delta^{nc} = \frac{1}{d-e}[(1-e)\alpha\gamma^n + (m^r - 1)(1-d)]$. This solution exists and is unique provided $1 - u\gamma^n - (1-u)\alpha\gamma^n > 0$. We can always ensure that this condition holds by setting d large enough. Next, notice that since there cannot be a crisis at $t = 0$, the state at $t = 0$ is v_1. Therefore, $V(y_0, \delta_0) = v_1 y_0^n$. Substituting $y_0^n = dw_{-1}$ and simplifying the denominator of v_1 we get (16).

We determine the threshold h^{**} in three steps. First, we show that $\frac{dY^r}{de} - \frac{dY^s}{de} < 0$ for all $h > \underline{h}$, where $\underline{h}$ is the risk-taking threshold defined in (19). Setting $w_{-1} = 1$, we have that

$$\frac{dY^r}{de} - \frac{dY^s}{de} = -\frac{1-(1-u)\alpha\gamma^n}{1-\gamma^r} + \frac{1}{1-\gamma^s} = -\frac{u\gamma^n}{1-\gamma^r} + \frac{\gamma^s}{1-\gamma^s} < 0 \;\Leftrightarrow\; h > \underline{h}$$

To establish the inequality note that $h > \underline{h} \Leftrightarrow \gamma^r > u\gamma^n > \gamma^s \Leftrightarrow \frac{u\gamma^n}{1-\gamma^r} > \frac{\gamma^s}{1-\gamma^s}$. It follows that if $h > \underline{h}$ there exists an interval $(0, \varepsilon)$ for e on which $Y^r > Y^s$ only if $(Y^r - Y^s)|_{e=0} > 0$. Second, set $e = 0$ and rewrite (15) and (16) as follows

$$Y^s = 1 + \frac{(1-d)(\sigma-1)}{1-h-(1-d)(\sigma-h)}, \quad Y^r = 1 + \frac{(1-d)(u\theta-1)}{1-u^{-1}h-(1-d)(\theta-u^{-1}h)[u+\alpha(1-u)]}$$

There exists an upper bound $h' = \frac{1-(1-d)[u+\alpha(1-u)]\theta}{1-(1-d)[u+\alpha(1-u)]} \cdot u$, such that $\lim_{h\to h'} Y^r(h) = \infty$. Notice that: (i) $Y^s(h') < \infty$; (ii) $h' < u$, so borrowing constraints arise for any $h < h'$; (iii) $h' > \underline{h}$, so a risky equilibrium exists in a neighborhood of h'. Next, notice that Y^r and Y^s are strictly increasing in h. Thus, if $e = 0$, there exist a unique threshold $h'' < h'$ such that $Y^r \geq (<) Y^s \Leftrightarrow h \geq (<) h''$

$$h'' = \frac{(1-\theta\,(1-d)\,U)\,(\sigma-1) - (1-\sigma\,(1-d))\,(u\theta-1)}{-d\,(u\theta-1) - u^{-1}((1-d)\,U-1)\,(\sigma-1)}, \quad U = u + \alpha(1-u)$$

Finally, since an RSE exists for all $h \in (\underline{h}, u)$, by Proposition 3.1, and $(Y^r - Y^s)|_{e=0} > 0 \Leftrightarrow h > h''$, it follows that the threshold in Proposition 4.1 is $h^{**} > \max\{h'', \underline{h}\}$.

Proof of Corollary (4.1). Let $\alpha \to 0$ and rewrite the excess returns ratio as

$$\frac{Y^r - w_{-1}}{Y^s - w_{-1}} = k(h) \cdot \frac{E\pi_r}{\pi_s} \cdot \frac{1-(1-d)\pi_s}{1-(1-d)E\pi_r}, \qquad k(h) = \frac{u\theta-1}{u\theta-h}\frac{\sigma-h}{\sigma-1} \tag{22}$$

Notice that $k(h) < 1$ because $1 < u\theta < \sigma$ and $0 < h < u < 1$, and recall that $h = \underline{h} \Leftrightarrow E\pi_r = \pi_s$. Therefore, (22) implies that if $\alpha \to 0$ and $h = \underline{h}$, risk-taking translates into a social loss if $h = \underline{h}$. Since $Y^r - Y^s$ is increasing in h, it follows that $\underline{h} < h^{**}$ if $\alpha \to 0$. That is, the treshold level for efficiency gains ($Y^r > Y^s$) is above the treshold for optimal risk-taking ($E\pi_r > \pi_s$).

Appendix B: Simulations

The behavior of the model economy is determined by seven parameters: $\theta, \sigma, d, r, u, \alpha, h$. We set the probability of crisis $(1-u)$ equal to the historical probability of systemic banking crisis. Using the survey of Caprio and Klingebiel (2003) we find that $1-u = 4.18\%$ across our sample of 83 countries over 1980-2000.[40,41] Since in our model $\alpha = \frac{1+\text{growth lucky times}}{1+\text{growth crisis times}}$, we estimate α using the following algorithm. First, we average over all systemic banking crises in our sample the minimum annual growth rate during each crisis: we obtain $g_c = -7.23\%$ with a standard deviation of $\sigma_{g_c} = 5.83\%$. Second, we compute the average growth rate over non-crisis years: $g_n = 1.43\%$ with a standard deviation $\sigma_{g_n} = 4.11$. Third, we consider a drop from a boom $(g_n + 2\sigma_{g_n})$ to a severe bust $(g_c - 2\sigma_{g_c})$ and obtain $\alpha = 0.79$. In our benchmark simulation, we set α even more conservatively $\alpha = 0.5$. The interest rate r, is set to the average Fed funds rate during the nineties: 5.13%.

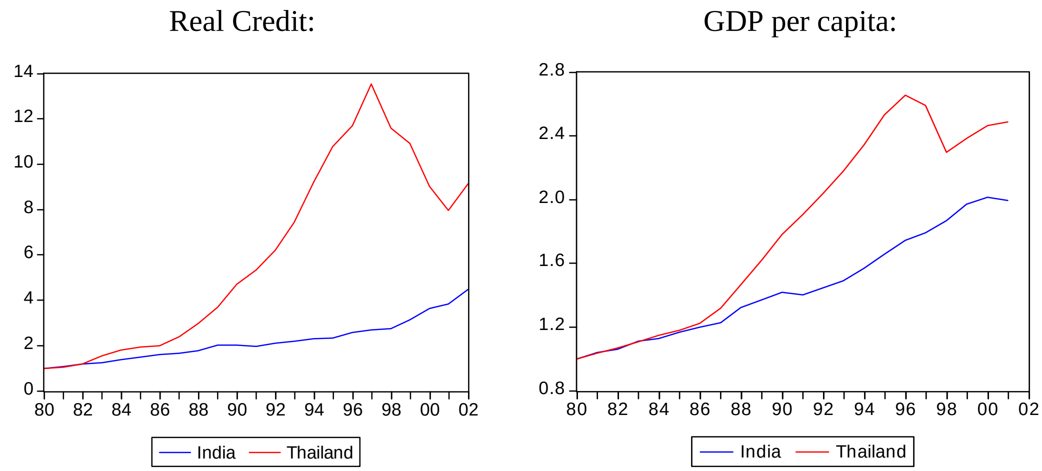
Given the values of r and u, we determine the range for the degree of contract enforceability h over which risky and safe equilibria exist: $h \in (\underline{h} = 0.48,\ u\delta^{-1} = 1.006)$. In our benchmark simulation, we set $h = 0.5$. Finally, the technological parameters (θ,σ) and the payout rate d do not have an empirical counterpart and are irrelevant for the existence of equilibria. We set $d = 10\%$ and the return to the safe technology to 10% ($\sigma = 1.1$). We then set $\theta = 1.12$ so as to satisfy the restriction $1 + r < \theta u < \sigma < \theta$. The following table summarizes the parameters used in our benchmark simulation presented in Figure 4.

Parameters	baseline value
Safe Return	$\sigma = 1.10$
Risky High Return	$\theta = 1.12$
World Interest Rate	$r = 0.0513$
Dividend Rate	$d = 0.10$
Financial Distress Costs	$\alpha = 0.50$
Probability of crisis	$1 - u = 0.0418$
Degree of Contract Enforceability	$h = 0.50$

[40] Caprio and Klingbiel define a systemic banking crises as a situation where the aggregate losses of the banking sector exhaust the aggregate capital of the banking sector. If we use the banking crisis index of Von Hagen and Ho (2004), based on money market pressure for a sample of 47 countries, we find $1 - u = 0.06$.

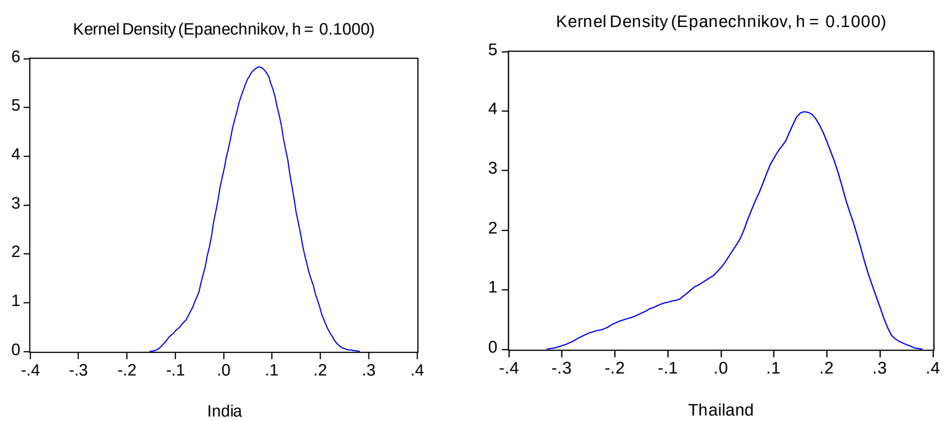
[41] If we consider currency crises, which are more frequent and generally less cosly, we find $1 - u = 8.75\%$.

Figure 1: Safe vs. risky growth path: a comparison of India and Thailand



Note: The values for 1980 are normalized to one. The figures display annual credit and per-capita GDP series.

Figure 2: Distributions and Kernel Densities of Real Credit Growth



	India	Thailand
Mean	0.066	0.102
Std. Dev.	0.050	0.117
Skewness	-0.286	-1.026

Note: the moments of real credit growth are computed using quarterly data from 1980:1 to 2002:1.

Figure 3a: Growth residuals vs. mean of credit growth

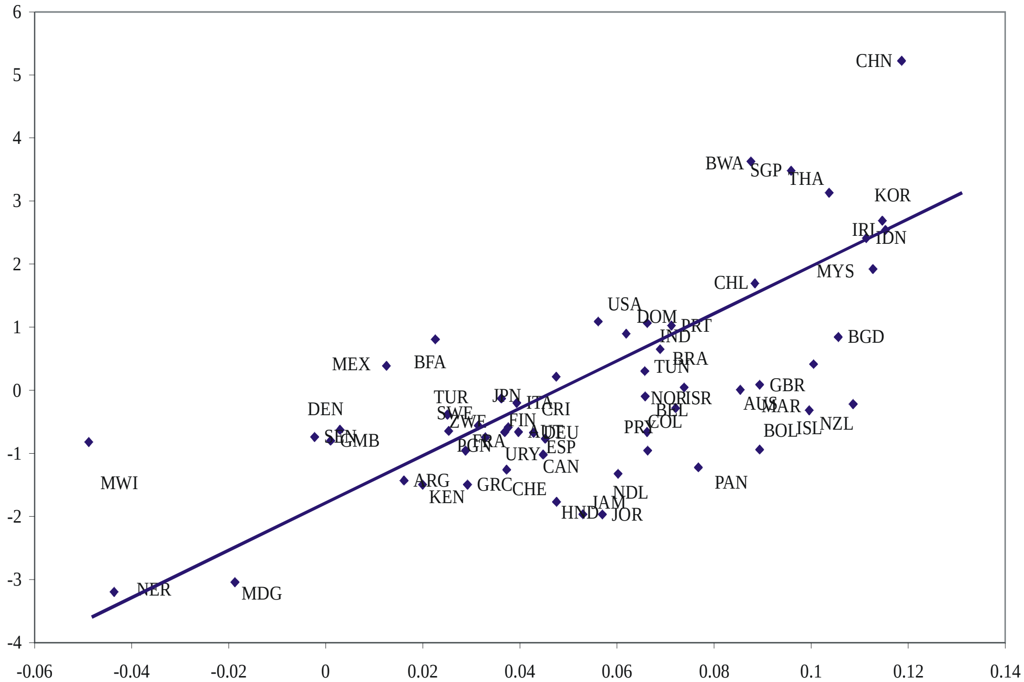


Figure 3b: Growth residuals vs. variance of credit growth

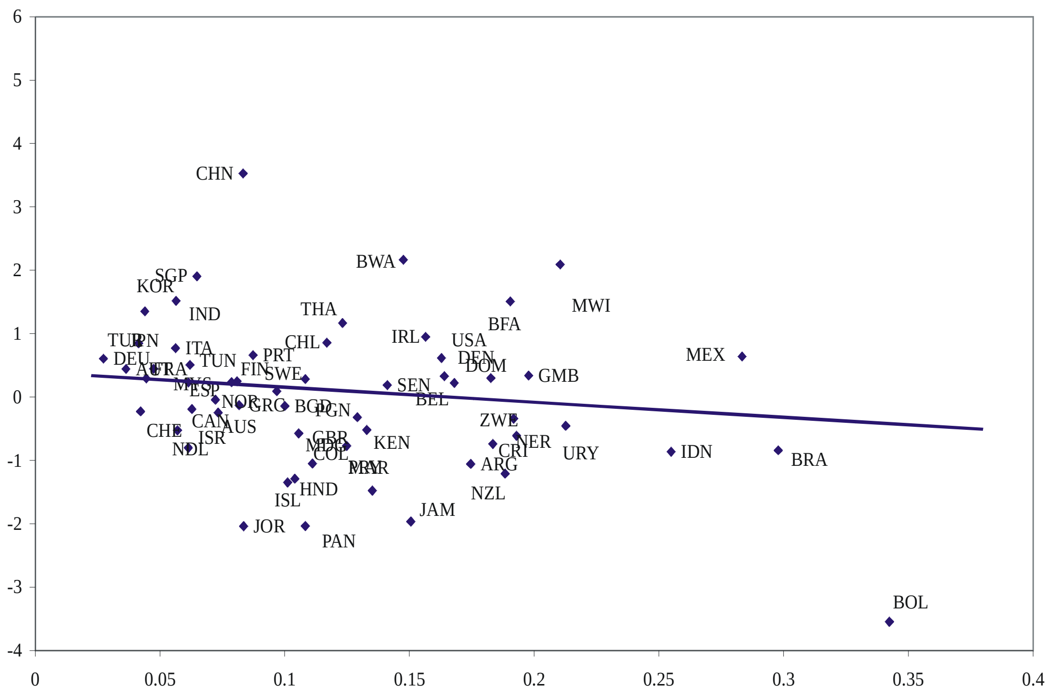
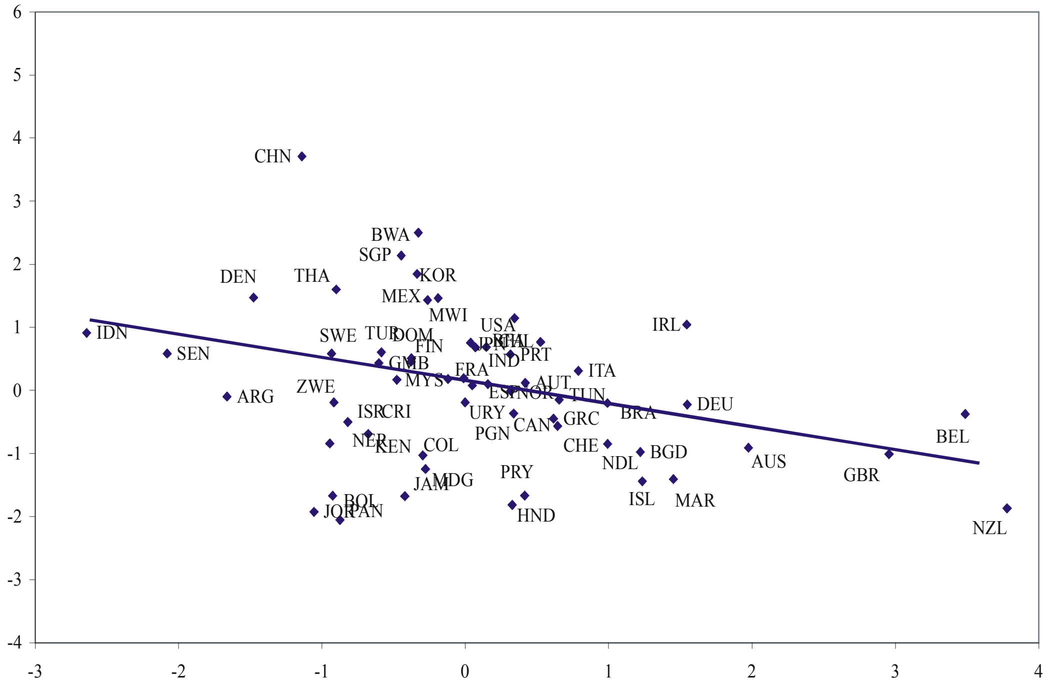
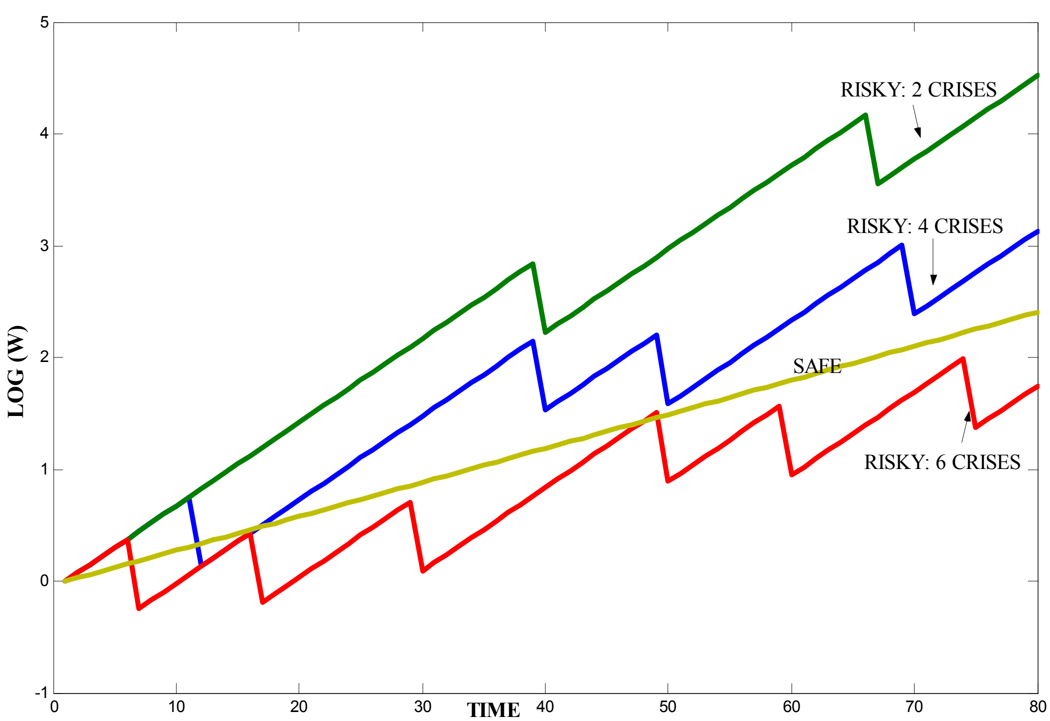


Figure 3c: Growth residuals vs. skewness of credit growth



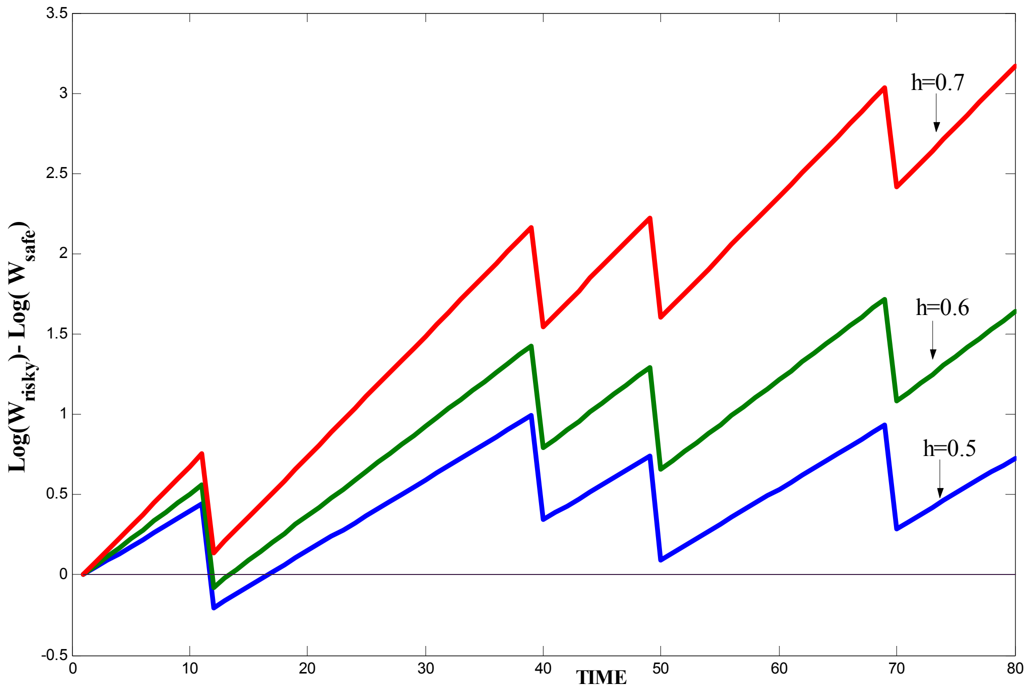
Note: The vertical axis in each graph shows the residuals of the cross section regression, given in Table 1, leaving out the mean, variance and skewness of real credit growth, respectively. The horizontal axis shows the three moments of real credit growth.

Figure 4: Long Run Growth



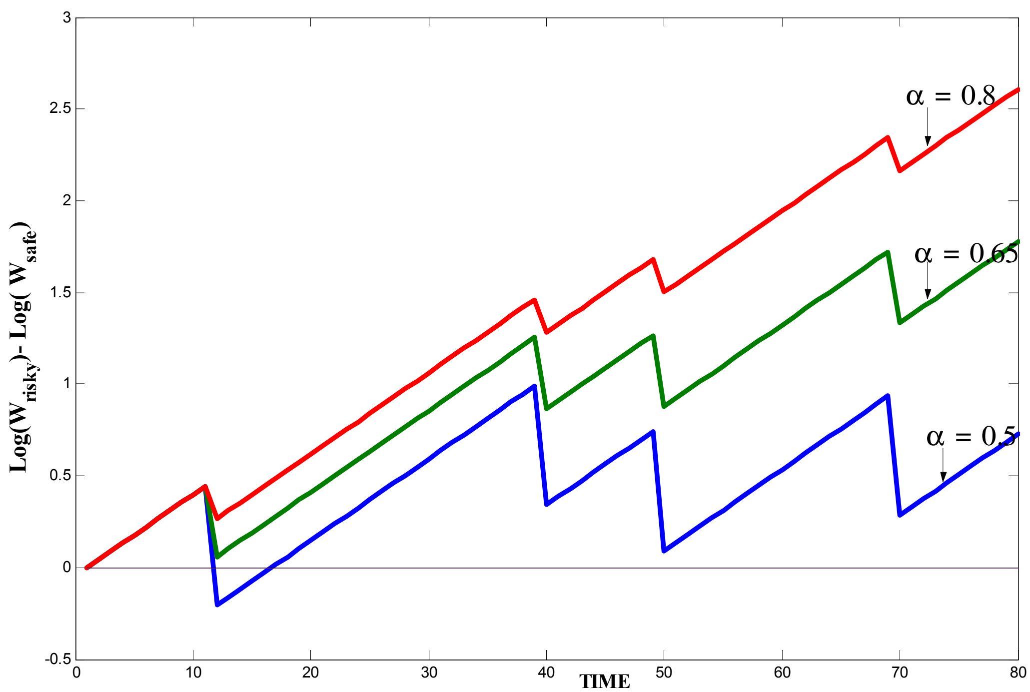
$$parameters: \sigma = 1.10 \quad \theta = 1.12 \quad r = 0.051 \quad d = 0.10 \quad \alpha = 0.5 \quad 1 - u = 0.0418 \quad h = 0.5$$

Figure 5: Risky vs. Safe: The Role of Contract Enforceability



$parameters: \sigma = 1.10 \quad \theta = 1.12 \quad r = 0.051 \quad d = 0.10 \quad \alpha = 0.5 \quad 1-u = 0.0418$

Figure 6: Risky vs. Safe: Financial Distress Costs



$parameters: \sigma = 1.10 \quad \theta = 1.12 \quad r = 0.051 \quad d = 0.10 \quad h = 0.5 \quad 1-u = 0.0418$

Table 1: Skewness and Growth

Dependent variable: Real per capita GDP growth

	(1) [a] Cross section OLS	(2) [b] Panel GLS	(3) [c] Panel GMM System Estimator
Initial per capita GDP	-0.463	-0.263**	-0.157
	(0.356)	(0.122)	(0.172)
Secondary schooling	0.020	0.020**	0.139**
	(0.020)	(0.006)	(0.274)
Credit growth, mean	0.161**	0.178**	0.147**
	(0.049)	(0.010)	(0.017)
Credit growth, variance	-0.045**	-0.044**	-0.064**
	(0.023)	(0.0089	(0.007)
Credit growth, skewness	-0.406**	-0.302**	-0.204**
	(0.194)	(0.052)	(0.084)
# of observations	58	114	114

a) Regression 1 is estimated by OLS
b) Regression 2 is estimated by pooled GLS from a panel of non-overlapping 10 year windows. The Durbin Watson Test for this regression is 1.88.
c) Regression 3 is a panel regression with non-overlapping 10 year windows using the GMM System Estimator The Sargan Test (p-value) is 0.609.
Note: Standard errors are reported in parentheses; ** denotes significance at 5% level, *denotes significance at 10% level.

Table 2: Moments of Credit Growth for different country groups:

	HEC Countries	MEC Countries	LEC Countries
Mean	0.031	0.077	0.042
Std. Dev.	0.091	0.145	0.174
Skewness	0.526	-1.441	-0.677

Note: HEC, MEC and LEC denote high, low and middle enforceability of contracts, respectively. The entries in the table are computed using country-years within each group.

Table 3: Moments of Credit Growth Before and After Financial Liberalization

	Country-years that are liberalized	Country-years that are closed
Mean	0.067	0.034
Std. Dev.	0.130	0.170
Skewness	-0.707	0.049

Note: The sample is partitioned into two country-years groups: liberalized and non-liberalized

Table 4a: Country Groups

Dependent variable: Real per capita GDP growth

	Sample of 58 countries without wars or large terms of trade deteriorations			Sample of all 83 countries	
	(1)	(2)	(3)	(4)	(5)
	MEC vs. HEC and LEC	MEC only	Liberalized vs. Non Liberalized	All Countries	All Countries
Initial per capita GDP	0.009	-0.550**	-0.650**	-0.191**	-0.505**
	(0.106)	(0.33)	(0.112)	(0.081)	(0.092)
Secondary schooling	0.013**	0.012**	0.021**	0.029**	0.034**
	(0.005)	(0.001)	(0.005)	(0.004)	(0.005)
Credit growth, mean	0.089**	0.243**	0.112**	0.135**	0.193**
	(0.012)	(0.036)	(0.037)	(0.009)	(0.007)
Credit growth, variance	-0.031**	-0.041**	-0.017	-0.009**	-0.039**
	(0.01)	(0.024)	(0.018)	(0.001)	(0.007)
Credit growth, skewness	-0.138**	-0.410**	0.3	-0.216**	-0.341**
	(0.052)	(0.183)	(0.216)	(0.041)	(0.049)
Credit growth, mean *MEC	0.233**				
	(0.035)				
Credit growth, variance *MEC	0.02				
	(0.019)				
Credit growth, skewness *MEC	-0.484**				
	(0.159)				
Credit growth, mean *Liberalized			0.005		
			(0.042)		
Credit growth, variance * Liberalized			-0.022		
			(0.022)		
Credit growth, skewness *Liberalized			-0.580**		
			(0.229)		
Credit growth, mean *WAR/TOT					-0.102**
					(0.02)
Credit growth, variance *WAR/TOT					0.030**
					(0.007)
Credit growth, skewness *WAR/TOT					0.433**
					(0.162)
MEC	-0.710**				
	(0.34)				
Liberalized			2.165**		
			(0.519)		
WAR/TOT					-1.296**
					(0.271)
# of observations	114	46	101	166	166

Note: This table reports the results of the benchmark regression (regression (2) in Table 1) for different country groups. Regression (1) includes an interaction dummy that takes dummy that takes a value of 1 if the country is an MEC according to the "Rule of Law" index of Kaufman and Kraay, and zero otherwise. Regression (2) includes the middle enforceability countries only. Regression (3) includes an interaction dummy that takes a value of 1 if a country has liberalized and zero otherwise. Regression (4) includes all 83 countries in the sample. In regression (5), we include an interaction dummy for countries with wars and large term of trade deteriorations. The dates and a description of the construction of the liberalization index are given in the appendix.

Table 4b: Summary of Credit Moment Coefficients in Different Country Groups

	Mean	Variance	Skewness
MEC Countries	0.322**	-0.011**	-0.622**
HEC and LEC Countries	0.089**	-0.031**	-0.138**
Difference	0.233**	0.02	-0.484**
Financially Liberalized	0.117**	-0.039**	-0.28**
Non Financially Liberalized	0.112**	-0.017	0.3
Difference	0.005	-0.022	-0.58**
War/TOT Countries	0.091**	-0.009**	0.092**
Non War/TOT Countries	0.193**	-0.039**	-0.341**
Difference	-0.102**	0.03**	0.433**

Note: The coefficients for MEC, financial liberalized and War/ToT countries correspond to the sum of interacted and non-interacted coefficients in Table 4a. Significance levels are derived from Wald Tests (Ho: sum of interacted and non-interacted coefficients equals zero).

Table 5: Endogeneity

Second stage	(1)	(2)	First stage	(3)	(4)
	Panel IV	Panel GMM		Panel IV	Panel GMM
Dependent variable: Real per capita GDP growth	(Lib)	(Lib)	Dependent variable: Skewness	(Lib)	(Lib)
Initial per capita GDP	-0.393	-0.393	Initial per capita GDP	0.119	0.119
	(0.286)	(0.304)		(0.156)	(0.164)
Secondary schooling	0.034**	0.034**	Secondary schooling	0.010	0.010
	(0.015)	(0.017)		(0.008)	(0.009)
Credit growth, mean	0.250**	0.250**	Credit growth, mean	0.078**	0.078**
	(0.053)	(0.060)		(0.019)	(0.021)
Credit growth, variance	-0.021	-0.021	Credit growth, variance	0.010	0.010
	(0.024)	(0.033)		(0.013)	(0.012)
Credit growth, skewness	-1.330**	-1.330**	Liberalization	-1.020**	-1.020**
	(0.626)	(0.666)		(0.345)	(0.331)
# of observations	99	99		99	99

Note: The instrument for skewness is the liberalization index. Regressions (1) and (2) show the second stage of the regression, regressions (3) and (4) the first stage, estimated with OLS and GMM, respectively. We performed a regression-based Hausman test, where we include the residual of the 1st stage regression in the main regression equation. Since the coefficient on this residual is not significant - with a p-value of 0.107-, we conclude that OLS is a consistent estimator for skewness. Note however that the F-statistic for the first stage of the regression is only 5.03.

Table 6: Outliers

Dependent variable: Real per capita GDP growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Excluded Countries	Jordan	Niger	Papua-NG	Botswana	Korea	China	All Outliers
Initial per capita GDP	-0.338**	-0.276**	-0.174	-0.421**	-0.158	-0.068	-0.148
	(0.117)	(0.114)	(0.122)	(0.114)	(0.122)	(0.122)	(0.116)
Secondary schooling	0.024**	0.019**	0.016**	0.029**	0.015**	0.012**	0.015**
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)
Credit growth, mean	0.174**	0.172**	0.174**	0.178**	0.170**	0.168**	0.144**
	(0.010)	(0.010)	(0.013)	(0.010)	(0.011)	(0.012)	(0.013)
Credit growth, variance	-0.045**	-0.047**	-0.043**	-0.040**	-0.043**	-0.037**	-0.041**
	(0.008)	(0.006)	(0.009)	(0.008)	(0.008)	(0.007)	(0.007)
Credit growth, skewness	-0.320**	-0.288**	-0.342**	-0.292**	-0.274**	-0.248**	-0.244**
	(0.050)	(0.037)	(0.058)	(0.055)	(0.050)	(0.049)	(0.047)
# of observations	112	112	113	112	112	112	103

Note: There are no statistical outliers in our benchmark regression (regression [2] in table 1), in the sense that one of the residuals is more that 2 standard deviations away from the mean. In regressions (1)-(3), we individually exclude the countries with the larges country-decade residuals from the regression. In regressions (4)-(6), we individually exclude the countries with the lowest country-decade residuals. In regression (7), we exclude all countries with extreme observations.

Table 7: Extended set of control variables

Dependent variable: Real per capita GDP growth

	(1)	(2)	(3)	(4)
Initial per capita GDP	-0.257**	-0.265**	0.000	-0.011
	(0.122)	(0.122)	(0.140)	(0.143)
Secondary schooling	0.020**	0.021**	0.009	0.009
	(0.006)	(0.006)	(0.007)	(0.006)
Government share	-0.038**	-0.038**	-0.041**	-0.037**
	(0.014)	(0.014)	(0.014)	(0.012)
Life Expectancy		0.016	-0.002	0.003
		(0.076)	(0.073)	(0.007)
Inflation			-0.017**	-0.016**
			(0.003)	(0.002)
Terms of trade growth				0.064
				(0.052)
Credit growth, mean	0.171**	0.172**	0.165**	0.162**
	(0.011)	(0.011)	(0.014)	(0.013)
Credit growth, variance	-0.053**	-0.053**	-0.019**	-0.088**
	(0.008)	(0.008)	(0.009)	(0.017)
Credit growth, skewness	-0.254**	-0.258**	-0.242**	-0.245**
	(0.060)	(0.060)	(0.065)	(0.066)
# of observations	114	114	114	114

Note: In regressions (1)-(4) we add standard control variables used in the empirical growth literature to our benchmark regression (regression (2) in Table 1).

Table 8a: Alternative estimation techniques for set of Non-War/non-TOT countries

Dependent variable: Real per capita GDP growth

	(2) Panel Pooled GLS (Benchmark)	(2) Panel Fixed Effects GLS	(3) Panel Random Effects GLS	(4) Benchmark with time dummy
Initial per capita GDP	-0.263**	-3.479**	-0.217	-0.243**
	(0.122)	(0.082)	(0.253)	(0.129)
Secondary schooling	0.020**	0.038**	0.018*	0.019**
	(0.006)	(0.002)	(0.013)	(0.007)
Credit growth, mean	0.178**	0.061**	0.154**	0.160**
	(0.010)	(0.002)	(0.027)	(0.011)
Credit growth, variance	-0.044**	-0.038**	-0.041**	-0.045**
	(0.008)	(0.001)	(0.019)	(0.008)
Credit growth, skewness	-0.302**	-0.077**	-0.254*	-0.226**
	(0.052)	(0.013)	(0.141)	(0.057)
# of observations	114	114	114	114

Table 8b: Alternative estimation techniques for the set of 83 countries

Dependent variable: Real per capita GDP growth

	(2) Panel Pooled GLS (Benchmark)	(2) Panel Fixed Effects GLS	(3) Panel Random Effects GLS	(4) Benchmark with time dummy
Initial per capita GDP	-0.191**	-3.465**	-0.239	-0.192**
	(0.081)	(0.118)	(0.202)	(0.080)
Secondary schooling	0.029**	0.043**	0.028**	0.029**
	(0.004)	(0.002)	(0.010)	(0.004)
Credit growth, mean	0.135**	0.065**	0.119**	0.136**
	(0.009)	(0.003)	(0.016)	(0.010)
Credit growth, variance	-0.009**	-0.009**	-0.009**	-0.009**
	(0.001)	(0.000)	(0.002)	(0.001)
Credit growth, skewness	-0.216**	-0.044**	-0.109	-0.203**
	(0.041)	(0.014)	(0.122)	(0.036)
# of observations	166	166	166	166

Table 9: Overlapping Panel Regressions

Dependent variable: Real per Capita GDP growth

	(1)	(2)	(3)	(4)
Constant	4.633**	3.420**	4.794**	3.231**
	(0.896)	(0.108)	(0.932)	(0.056)
Initial per capita GDP	-0.766**	-0.526**	-0.727**	-0.420**
	(0.152)	(0.018)	(0.148)	(0.008)
Secondary schooling	0.052**	0.038**	0.052**	0.035**
	(0.008)	(0.001)	(0.008)	(0.001)
Real Credit Growth, Mean	0.070**	0.122**	0.069**	0.126**
	(0.016)	(0.002)	(0.015)	0.002
Real Credit Growth, Variance	0.006	-0.014**	0.001	-0.019**
	0.011	(0.001)	(0.01)	(0.001)
Real Credit Growth, Skewness	-0.271**	-0.418**	-0.258**	-0.404**
	(0.097)	(0.011)	(0.08)	(0.007)
Time trend			0.024*	0.055*
			(0.018)	0.002
Government share			-0.043**	-0.0497**
			(0.018)	(0.001)
Inflation			-0.001	0.0006
			(0.001)	(0.001)
# of observations	638	638	638	638

Note: All regressions are estimated using a two-step pooled GMM estimator proposed by Beckaert, Harvey and Lundblad (2001). In Columns (1) and (3), the choice of the weighting matrix makes the estimation equivalent to pooled OLS with a correction for a moving average MA(9) component in the residuals. In Columns (2) and (4), the weighting matrix allows us to correct for heteroskedascticity across countries and accross time as well as for SUR effects.

Appendix C.

Table C1: Systemic Banking Crises and Skewness of Real Credit Growth

country	Banking Crises Years*	Lowest Credit Growth During Crisis	Skewness Credit Growth All Years	Skewness Credit Growth Tranquil Times	Difference in Skewness
Argentina	1980-1982	0.00	-1.66	-0.44	-1.22
Argentina	1989-1990	-0.55	"	"	"
Argentina	1995	-0.03	"	"	"
Brazil	1990	-0.38	0.99	1.14	-0.15
Chile	1981-1983	-0.12	0.52	0.83	-0.31
Colombia	1982-1987	0.01	-0.29	-0.42	0.13
Costa Rica	1994-1995	-0.20	-0.48	-0.67	0.19
Finland	1991-1994	-0.12	-0.37	-0.06	-0.31
Indonesia	1997-2000	-0.83	-2.64	0.88	-3.52
Jamaica	1996-2000	0.01	-0.42	-0.17	-0.25
Kenya	1992-1995	-0.38	-0.68	0.25	-0.93
Korea, Rep.	1997-2000	0.04	-0.26	-0.08	-0.18
Mexico	1994-2000	-0.49	-0.19	0.00	-0.19
Malaysia	1997-2000	-0.02	-0.01	0.10	-0.11
Niger	1983-1990	-0.19	-0.94	-0.82	-0.12
Norway	1990-1993	-0.07	0.32	0.41	-0.09
Panama	1988-1989	-0.23	-0.92	-0.07	-0.85
Sweden	1991-1994	-0.26	-0.93	0.22	-1.15
Thailand	1997-2000	-0.19	-0.90	-0.70	-0.20
Uruguay	1981-1984	-0.47	0.05	1.11	-1.06
Average			-0.49	0.08	-0.57
Average All Sample			*0.09*		

** Systemic Banking Crises with Output Loss in our sample of 58 countries over 1980-2000*

Source: Caprio, Klingebiel, Laeven and Noguera (2003) http://www1.worldbank.org/finance/html/database_sfd.html

Table C2: Definitions and Sources of Variables in Regression Analysis

Variable	Definition and Construction	Source
GDP per capita	Ratio of total GDP to total population. GDP is in 1985 PPP-adjusted US$.	World Development Indicators (2003).
GDP per capita growth	Log difference of real GDP per capita.	World Development Indicators (2003).
Initial GDP per capita	Initial value of ratio of total GDP to total population. GDP is in 1985 PPP-adjusted US$.	World Development Indicators (2003).
Education	Ratio of total secondary enrollment, regardless of age, to the population of the age group that officially corresponds to that level of education.	World Development Indicators (2003).
Real Credit Growth	Log difference of real domestic bank credit claims on private sector	Author's calculations using data from IFS - line 22d -, and publications of Central Banks. The method is based on Beck, Demiguc-Kunt and Levine (1999). Domestic Bank Credit Claims are deflated with the end of year CPI Index. Data available at http://www.econ.upf.edu/crei/romain.ranciere/data.xls
Term of Trade Growth	Growth rate of the Terms of Trade Index . Terms of Trade index shows the national accounts exports price index divided by the imports price index with a 1995 base year	World Development Indicators (2003).
Government Share	Ratio of government consumption to GDP.	World Development Indicators, The World Bank (2003).
CPI	Consumer price index at the end of year (1995 = 100)	Author's calculations with data from IFS.
Inflation rate	Annual % change in CPI	Author's calculations with data from IFS.
Life Expectancy	Life Expectancy at Birth	World Development Indicators (2003).

Table C3: Definitions and Sources of Variables used in Country Grouping and Simulation

Criteria	Definition and Construction	Source
Systemic Banking Crises	Annual Dummy Variable with Value 1 if the country experience a systemic banking crisis, 0 otherwise	Author's calculations using data from Caprio et. al. (2003)
Severe War Episode	Countries that have an (estimated average number of violent deaths/average population) *100 above 0,005 for two consecutive years	Heidelberg Institute of International Conflict Research (HIIK)
Large Term of Trade Deterioration	Experience of a 30% or larger drop in a single year in the terms of trade index (*see definition of Term of Trade Index table A*)	World Development Indicators (2003).
Contract Enforceability	Countries are ranked according to their Kaufman and Kraay Index of the "Rule of Law". Countries with a value of more than 1.3 are classified as HECs. On the lower bound, we classified countries with a stock market turnover to GDP ratio of less than 1% as a criterion as LECs. The remaining countries are classified MECs	Kaufman and Kraay (2003), Demirguc-Kunt and Levine (2002)
Financial Liberalization Index	See below	See below

Financial Liberalization Index

It is a de facto index that signals the year when a country has liberalized. We construct the index by looking for trend-breaks in financial flows. We identify trend-breaks by applying the CUSUM test of Brown et. al. (1975) to the time trend of the data. This method tests for parameter stability based on the cumulative sum of the recursive residuals. To determine the date of financial liberalization we consider net cumulative capital inflows (KI).[1] An MEC or LEC is financially liberalized (FL) at year *t* if: (i) KI has a trend break at or before *t* and there is at least one year with a KI-to-GDP ratio greater than 5% at or before *t*, or (ii) its KI-to-GDP ratio is greater than 10% at or before *t*, or (iii) the country is associated with the EU. The 5% and 10% thresholds reduce the possibility of false liberalization and false non-liberalization signals, respectively.[2]

When the cumulative sum of residuals starts to deviate from zero, it may take a few years until this deviation is statistically significant. In order to account for the delay problem, we choose the year where the cumulative sum of residuals deviates from zero, provided that it eventually crosses the 5% significance level. The FL index does not allow for policy reversals: once a country liberalizes it never becomes close thereafter. Since our sample period is 1980-2000, we consider that our approach is the correct one to analyse the effects of liberalization on long-run growth and financial fragility.[3]

[1] We compute cumulative net capital inflows of non-residents since 1980. Capital inflows include FDI, portfolio flows and bank flows. The data series are from the IFS: lines 78BUDZF, 78BGDZF and 78BEDZ. For some countries not all three series are available for all years. In this case, we use the inflows to the banking system only, which is available for all country-years.

[2] All HECs have been financially liberalized through our sample period.

[3] If after liberalization a country suffers a sharp reversal in capital flows (like in a financial crisis), it might exhibit a second breakpoint. In our sample, however, this possibility is not present: the trend breaks due to crises are never large enough to show up in significant CUSUM test statistics.

Table C4: Country Groupings

Country	Severe War Episode	Large Terms of Trade Deterioration	Degree of Contract Enforceability*	Financial Liberalization**
Argentina			M	1991
Australia			H	always
Austria			H	always
Belgium			H	always
Burkina Faso			L	never
Bangladesh			M	never
Bolivia			L	always
Brazil			M	1992
Botswana			L	never
Canada			H	always
Switzerland			H	always
Chile			M	always
China			M	1991
Cote d'Ivoire		X		
Congo, Rep.	X	X		
Colombia			L	1991
Costa Rica			L	always
Germany			H	always
Denmark			H	always
Dominican Republic			L	1996
Algeria	X	X		
Ecuador		X		
Egypt, Arab Rep.		X		
Spain			M	always
Finland			H	always
France			H	always
United Kingdom			H	always
Ghana		X		
Gambia, The			L	never
Greece			M	always
Guatemala	X			
Honduras			L	never
Haiti		X		
Indonesia			M	1989
India			M	never
Ireland			H	always
Iran	X	X		
Iceland			H	always
Israel			M	1990
Italy			M	always
Jamaica			L	1994
Jordan			M	1989
Japan			H	always
Kenya			L	1993
Korea, Rep.			M	1985
Sri Lanka		X		
Morocco			M	never
Madagascar			L	never
Mexico			M	1989
Malawi			L	never
Malaysia			M	always
Niger			L	never
Nigeria	X	X		
Nicaragua		X		
Netherlands			H	always
Norway			H	always
New Zealand			H	always
Pakistan		X		
Panama			L	1990
Peru	X			
Philippines	X			
Papua New Guinea			L	never
Portugal			M	1986
Paraguay			L	never
Senegal			L	1997
Singapore			H	always
Sierra Leone	X	X		
El Salvador	X			
Sweden			H	always
Syrian Arab Republic		X		
Togo		X		
Thailand			M	1988
Trinidad and Tobago		X		
Tunisia			M	never
Turkey			M	always
Uganda	X	X		
Uruguay			M	1989
United States			H	always
Venezuela, RB		X		
South Africa	X			
Congo, Dem. Rep.	X	X		
Zambia		X		
Zimbabwe			M	never

* L,M,H denotes low, middle and high contract enforceability in the 58 countries sample

**year if any denotes the year of financial liberalization in the 58 countries sample