Unpublished Appendix to "Systemic Crises and Growth"

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A. 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 a systemic banking crisis. Using the crisis index of Caprio and Klingebiel [2003] we find that $1-u = 4.13$ *percent* across our sample of 83 countries over the period 1981-2000.[57] Since in our model $\alpha = \frac{\text{1+growth lucky times}}{\text{1+growth crisis times}}$, we estimate α using the following algorithm. First, we find the minimum annual growth rate during each systemic banking crisis in our sample and then we average these growth rates: we obtain $g_c = -7.23$ *percent* with a standard deviation of $\sigma_{g_c} = 5.83$ *percent*. Second, we compute the average growth rate in non-crisis years: $g_n = 1.43$ *percent* 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 at $\alpha = 0.5$. The interest rate r, is set to the average Fed funds rate during the nineties: 5.13 *percent*.

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 $d = 10$ *percent* and the return to the safe technology to 10 *percent* $(\sigma = 1.1)$. 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 II.

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	$1 - u = 0.0413$
Degree of Contract Enforceability	$h = 0.50$

[57] If we use the banking crisis index of Detriagache and Demirguc-Kunt, we find $1 - u = 3.94\%$.

B. Proofs

Proof of Proposition 1. Consider three plans: A 'safe plan' where there is no-diversion and the firm will be solvent in both states; a 'risky plan' where there is no-diversion and the firm will be solvent in the good state but not in the bad state; and a 'diversion plan' where the firm never repays debt. In a safe plan, the entrepreneur offers $1+\rho_t = 1+r$, and lenders lend up to $b_t(1+r) \leq h(w_t+b_t)$ in order to deter diversion, i.e., $q_{t+1} - b_t(1+r) \geq q_{t+1} - h(w_t+b_t)$. Let s be the share of available funds ($w+b = m^j w$) invested in the risky technology and $1-s$ the share invested in the safe technology $s \in [0,1]$. It follows that in a safe plan, expected profits are (wlog set $w_t = 1$):

$$
\begin{aligned}
\text{good state} \quad &: \quad \pi^s_{t+1} = [s\theta + (1-s)\sigma]m^s - \delta^{-1}(m^s - 1) = \{[s\theta + (1-s)\sigma] - h\}\, m^s, \\
\text{bad state} \quad &: \quad \pi^s_{t+1} = \{(1-s)\sigma - h\}\, m^s, \quad \text{with } m^s = \frac{1}{1-h\delta}, \\
E\pi^s_{t+1} \quad &= \quad \{su\theta + (1-s)\sigma - h\}\, m^s = \{[s(u\theta - \sigma) + \sigma] - h\}\, m^s.
\end{aligned}
$$

A plan is safe because profits are positive in both states, and therefore a plan is safe when $s < 1 - \frac{h}{\sigma}$. Since $u\theta < \sigma$, the best safe plan sets $s = 0$.

In a risky plan, the interest rate must satisfy $u(1+\rho_t)b_t + (1-\zeta_{t+1})(1+\rho_t)b_t = (1+r)$. If a bailout is expected ($\zeta_{t+1} = u$), then $1+\rho_t = 1+r$ and the borrowing constraint is $ub_t(1+r) \leq h(w_t+b_t)$. If no bailout is expected ($\zeta_{t+1} = 1$), then $1+\rho_t = u^{-1}(1+r)$ and the borrowing constraint is $b_t(1+r) \leq h(w_t+b_t)$. It follows that:

$$
\begin{aligned}
\text{good state} \quad &: \quad \pi^r_{t+1} = [s\theta + (1-s)\sigma]m^r(\zeta_{t+1}) - [m^r(\zeta_{t+1}) - 1]\delta^{-1}, \\
\text{bad state} \quad &: \quad \pi^r_{t+1} = 0, \qquad \text{with } m^r(\zeta_{t+1}) = (1 - h\delta\zeta^{-1}_{t+1})^{-1}, \\
E\pi^r_{t+1} \quad &= \quad \{u[s\theta + (1-s)\sigma] - h\}m^r(\zeta_{t+1}).
\end{aligned}
$$

A plan is risky because the firm is insolvent in the bad state, and therefore a plan is risky provided $s > 1 - \frac{h}{u\sigma}$. Since $\theta > \sigma$, the best risky plan sets $s = 1$ if $\zeta_{t+1} = u$.

Consider a diversion plan. Since a firm must be solvent to divert, the promised repayment is never set greater than $L_{t+1} \leq q_{t+1}$. Since lenders will get repaid only if a bailout will be granted, they only lend up to $b_t \leq (1-\zeta_{t+1})(1+r)^{-1}L_{t+1}$. Thus, in a diversion plan $b_t = m^d w_t$, with $m^d(\zeta_{t+1}) = [1 - (1-\zeta_{t+1})\delta\theta]^{-1}$. It follows that young managers' expected payoffs under a safe, risky and diversion plan are, respectively:

$$
(19) \quad S_{t+1} = [d-\tau][\sigma-h]m^s w_t, \; R_{t+1} = [d-\tau][\theta u-h]m^r(\zeta_{t+1})w_t, \; D_{t+1} = [d-\tau][\theta u-h]m^d(\zeta_{t+1})w_t.
$$

In a safe symmetric CME, all firms choose a safe plan, and no bailout is expected. In a risky symmetric CME, all firms choose a risky plan, and a bailout is expected in the bad state. To show that there always exists a safe symmetric CME note that if all other managers choose the safe plan, no bailout is expected next period (i.e., $\zeta_{t+1} = 1$). Thus, $m^d(\zeta_{t+1} = 1) = 1$ and $m^r(\zeta_{t+1} = 1) = m^s$. Since $\theta u < \sigma$, (19) implies that if all other managers choose a safe plan, the manager strictly prefers the safe plan over the other two plans. Next, consider a risky symmetric CME. If all other managers choose the risky plan, a bailout will be granted in the bad state. Since $m^r(\zeta_{t+1} = u) = (1 - h\delta u^{-1})^{-1}$, the manager prefers a risky over a safe plan if and only if

$$0 \leq E_t\pi^r_{t+1} - \pi^s_{t+1} = \frac{\theta u - h}{1 - h\delta u^{-1}} w_t - \frac{\sigma - h}{1 - h\delta} w_t := Z(h)w_t. \tag{20}$$

It follows from (7) and (8) that $Z(h)$ has three properties: $Z(0) = u\theta - \sigma < 0$, $\lim_{h\to u\delta^{-1}} Z(h) = \infty$ and $\frac{\partial Z(h)}{\partial h} = \left(\frac{1}{1-u^{-1}h\delta}\right)^2 (\delta\theta - 1) - \left(\frac{1}{1-h\delta}\right)^2 (\delta\sigma - 1) > 0$. Thus, for any $u < 1$ there exists a unique threshold $\underline{h} \in (0, u\delta^{-1})$ such that $E_t\pi^r_{t+1} > \pi^s_{t+1}$ for all $h \in (\underline{h}, u\delta^{-1})$, where $\underline{h}$ is given by (9).

Next, a risky plan is preferred to a diversion plan if and only if $0 < R_{t+1} - D_{t+1} = [\theta u - h][m^r - m^d]$, which is equivalent to: (a) $[1 - u]\theta < u^{-1}h$. The question is whether (a) can hold simultaneously with (b) $h < \bar{h} := u\delta^{-1}$ and (c) $u\theta > \delta^{-1}$. For large enough u, (a) holds for any θ and any $h < \bar{h}$. Meanwhile, for $u \leq 0.5$ (a)-(c) cannot hold simultaneously. Thus, a risky plan is preferred to a diversion plan if and only if u is large enough (in particular, $u > 0.5$). Summing up, a risky CME exists if and only if $h > \underline{h}$ and u is large enough, so a risky plan is preferred to a safe and a diversion plan, respectively.

Distortionary taxes. In this case the expected payoff of a non-diverting manager is $[d - \tau^{old}]u[q_{t+1} - L_{t+1}]$, while that of a diverting manager is $d[uq_{t+1} - h(w_t + b_t)]$. If $\tau^{old} \in [0, dh/u\theta]$, the borrowing constraint and the expected payoff of a risky plan are

$$b_t \leq [m^r - 1]w_t, \quad E(\pi^r_{t+1})[d - \tau^{old}] = [u\theta - h]dm^r w_t, \quad m^r = \frac{1}{1 - \frac{\delta}{u}\frac{dh - u\theta\tau^{old}}{d - \tau^{old}}}.$$

The payoff of diversion is the same as in the benchmark case. It follows that a risky plan is preferred to a diversion plan if and only if $\tau < dh/u\theta$ and $m^r > m^d \Leftrightarrow [1 - u]\theta < \frac{1}{u}\frac{dh - u\theta\tau}{d - \tau}$. This condition holds for large enough u.□

Proof of Proposition 2. The mean annual long-run growth rate is given by $E(1 + g^r) = \lim_{T\to\infty}\left[E_t \prod_{i=t+1}^{T}(1 + g^r_i)\right]^{1/T}$. The expression in (13) follows from the fact that the probability of crisis is independent across time. Comparing (12) and (13) we have that $E(1 + g^r) > (1 + g^s)$ for any $\alpha \in (0, 1)$ if and only if $E\pi^r > \pi^s$, which is equivalent to $h > \underline{h}$ (defined in (9)). Part (2) follows from $\partial Z(h)/\partial h > 0$. The sign of this derivative is established in the proof of Proposition 1.

To prove the fundability of the guarantees, it suffices to show that in a risky equilibrium the present value of pre-tax dividends during solvent times ($d\pi_t \equiv y^n_t$) is greater than the bailout costs ($L_t - a_t \equiv y^c_t$) for all $\alpha \in (0, 1)$. In this case there exists a tax rate $\tau < d$ such that (6) holds.

Notice that

$$y_t^c \equiv -\frac{b_{t-1}}{\delta} - a_t = -\frac{(m^r-1)}{\delta} w_{t-1} - \alpha\gamma^n w_{t-1} = -w_t\left[1+\frac{m^r-1}{\alpha\delta\gamma^n}\right],$$
$$y_t^n \equiv d\pi_t = \frac{d}{1-d} w_t.$$

Next, we obtain $Y^r \equiv E_0 \sum_{t=0}^{\infty} \delta^t y_t$, where $y_t = y_t^n$ under solvency and $y_t = y_t^c$ otherwise. To compute this expectation, consider the process $\frac{y_{t+1}}{y_t}$, which follows a four-state Markov chain with transition matrix Φ

$$(21) \qquad \Delta = \begin{pmatrix} \varrho^{nn} := \frac{y_{t+1}^n}{y_t^n} = (1-d)(\theta - \frac{h}{u})m^r \;:= \gamma^n \\ \varrho^{nc} := \frac{y_{t+1}^c}{y_t^n} = -\alpha\gamma^n[1+\frac{m^r-1}{\alpha\delta\gamma^n}]\frac{1-d}{d} \\ \varrho^{cn} := \frac{y_{t+1}^n}{y_t^c} = -\gamma^n\left[1+\frac{m^r-1}{\alpha\delta\gamma^n}\right]^{-1}\frac{d}{1-d} \\ \varrho^{cc} := \frac{y_{t+1}^c}{y_t^c} = \alpha\gamma^n \end{pmatrix}, \qquad \Phi = \begin{pmatrix} u & 1-u & 0 & 0 \\ 0 & 0 & 1-u & u \\ 0 & 0 & 1-u & u \\ u & 1-u & 0 & 0 \end{pmatrix}.$$

To obtain (21), 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:

$$(22) \qquad V(y_0,\varrho_0) = E_0 \sum_{t=0}^{\infty} \delta^t y_t = y_0 + \delta E_0 V(y_1,\varrho_1), \quad V(y_t,\varrho_t) = y_t + \delta E_t V(y_{t+1},\varrho_{t+1}).$$

Consider the following conjecture: $V(y_t,\varrho_t) = y_t v(\varrho_t)$, with $v(\varrho_t)$ an undetermined coefficient. Substituting this conjecture into (22) and dividing by y_t, we get $v(\varrho_t) = 1 + \delta E_t(\varrho_{t+1} v(\varrho_{t+1}))$. Combining this condition with (21), it follows that $v(\varrho_{t+1})$ satisfies

$$(v_1,v_2,v_3,v_4)' = (1,1,1,1)' + \delta\Phi(\varrho^{nn}v_1, \varrho^{nc}v_2, \varrho^{cc}v_3, \varrho^{cn}v_4)'.$$

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

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

To derive the second equality substitute $\varrho^{cn}\varrho^{nc} = \alpha(\gamma^n)^2$, $\varrho^{cc}-\varrho^{nc} = [\alpha\gamma^n + \delta^{-1}(m^r-1)(1-d)]d^{-1}$ and simplify the denominator. This solution exists and is unique provided $1-\delta u\gamma^n - \delta(1-u)\alpha\gamma^n \equiv 1-\delta\gamma^r > 0$. Since this expression is strictly decreasing in α, it follows that $1-\delta\gamma^r > 0$ for all $\alpha \in (0,1)$ if and only if $1-\delta u\gamma^n > 0$, which holds if and only if d is high enough:

$$(23) \qquad 1-\delta(1-d)\frac{\theta - hu^{-1}}{1-\delta hu^{-1}} > 0 \quad \Longleftrightarrow \quad d > \underline{d} := \frac{\theta-\delta^{-1}}{\theta - hu^{-1}}.$$

The lower bound $\underline{d}$ is less than one for any $h < \bar{h} \equiv u\delta^{-1}$ because $\theta - \delta^{-1} < \theta - hu^{-1}$. Next, notice that since there cannot be a crisis at $t = 0$, the state at $t = 0$ is v_1. Therefore, $V(y_0, \varrho_0) = v_1 y_0^n$. Substituting $y_0^n = dw$, we get:

$$
\begin{aligned}
Y^r &= \tfrac{d-(1-u)[\delta\alpha\gamma^n+(m^r-1)(1-d)]}{1-\delta\gamma^r} w & \gamma^r &= u\gamma^n - (1-u)\alpha\gamma^n \\
&= w + \tfrac{(1-d)(\delta\theta u-1)m^r}{1-\delta\gamma^r} w, & \gamma^n &= [1-d][\theta - u^{-1}h]m^r
\end{aligned} \quad . \tag{24}
$$

In the first line, the first term in the numerator represent the average dividend, while the second term represents the average bailout, 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 $\frac{b_{t-1}}{w_{t-1}} \frac{w_{t-1}}{\pi_{t-1}} w_{t-1} = \delta^{-1}(m^r - 1)(1-d)w_{t-1}$. To prove part (3) note that the numerator in the second line is positive because $d \in (0,1)$ and $\theta u \geq \delta^{-1}$ by assumption (7). The denominator is positive because $d > \underline{d}$.□

Proof of Corollary 1. We just need to find conditions under which $Y^r > Y^s$. First, we know from the proof of Proposition 2 that Y^r converges and is given by (24) if $d > \underline{d}$ and $h > \underline{h}$. Second, in a safe equilibrium there is no systemic risk and there are no bailouts. Thus, $Y^s = \sum_{t=0}^{\infty} \delta^t d\pi_t^s$. If $\delta(1-d)(\sigma - h)m^s \equiv \delta\gamma^s < 1$, this sum converges to

$$
Y^s = \frac{dw}{1-\delta\gamma^s} = w + \frac{(1-d)(\delta\sigma - 1)m^s}{1-\delta\gamma^s} w, \quad \gamma^s \equiv (1-d)(\sigma - h)m^s.
$$

Recall that a risky equilibrium exists only if $h > \underline{h}$, in which case $\gamma^s < \gamma^r$. Since $\delta\gamma^r < 1$ for any $d > \underline{d}$, it follows that Y^s converges whenever a risky equilibrium exists and Y^r converges. As a third step we find the values of h for which $Y^r > Y^s$ for any $\alpha \in (0,1)$. Since Y^r is increasing in α (by (24)), it suffices to compare $\lim_{\alpha \to 0} Y^r$ with Y^s. It follows that for any $\alpha \in (0,1)$

$$
Y^r > Y^s \iff h > \widehat{h} \equiv \frac{d(\sigma - u\theta)}{\left(\frac{1}{u} - 1\right)(\sigma\delta - 1) + \delta d(\sigma - u\theta)} < \frac{\delta}{u}. \tag{25}
$$

To show that $\widehat{h} < \bar{h} \equiv \delta u^{-1}$ notice that $\widehat{h}\delta u^{-1} < 1$ if and only if $(\sigma\delta - 1) > d(\sigma\delta - u\theta\delta)$, which is true because $d \in (0,1)$ and $\theta u \geq \delta^{-1}$ by assumption (7).□

Derivation of (14) and the other Moments of Credit Growth. The mean of credit growth is $\mu = u\log(\gamma^n) + (1-u)\log(\alpha\gamma^n) = \log(\gamma^n) + (1-u)\log(\alpha)$. The variance is given by

$$
var = u(\log(\gamma^n) - \mu)^2 + (1-u)(\log(\alpha\gamma^n) - \mu)^2 = (\log(\alpha))^2 u(1-u).
$$

Skewness and kurtosis are given by $M^j = \left[u(\log(\gamma^n) - \mu)^j + (1-u)(\log(\alpha\gamma^n) - \mu)^j\right] var^{-j/2}$, $j =$

$3, 4$. Thus,

$$
\begin{aligned}
sk &= u\left[\frac{(1-u)\log(\alpha)}{[(u)(1-u)]^{1/2}\log(\alpha)}\right]^3 + (1-u)\left[\frac{-u\log(\alpha)}{[(u)(1-u)]^{1/2}\log(\alpha)}\right]^3 \\
&= u\frac{(1-u)^{\ 3}}{[(u)(1-u)]^{3/2}} - (1-u)\frac{(u)^{\ 3}}{[(u)(1-u)]^{3/2}} = \left(\frac{1-u}{u}\right)^{1/2} - \left(\frac{u}{1-u}\right)^{1/2},
\end{aligned}
$$

$$
\begin{aligned}
kur &= u\left[\frac{(1-u)\log(\alpha)}{[(u)(1-u)]^{1/2}\log(\alpha)}\right]^4 + (1-u)\left[\frac{-u\log(\alpha)}{[(u)(1-u)]^{1/2}\log(\alpha)}\right]^4 \\
&= u\left(\frac{1-u}{u}\right)^2 + (1-u)\left(\frac{u}{1-u}\right)^2 = \frac{3u^2-3u+1}{u(1-u)} = \frac{1}{u(1-u)} - 3.
\end{aligned}
$$

Hence, excess kurtosis is $ek = kur - 3 = \frac{1}{u(1-u)} - 6$. Skewness is negative if crises are less frequent than booms $(u > 1/2)$. Furthermore, negative skewness and excess kurtosis are large when crises are rare events. In contrast, the variance is maximized when crises are as frequent as booms $(u = 1/2)$.

Proof of Proposition 3. We prove this proposition by comparing three plans: safe, risky and diversion. In a safe plan the firm invests in the safe technology and it repays debt in both states. In a risky plan, the firm invests in the risky technology and repays debt if it is solvent. In a diversion plan, the firm does not repay debt in any state.

Consider the best safe plan. The borrowing constraint is as in the Ak setup: $b_t \leq (m^s - 1)w_t$. It follows from (16) that for any $w < \hat{I}/m$ the marginal return on investment $g'(I)$ is greater than the return on saving $1 + r$. Thus, it is optimal to borrow up to the limit and not to save (it does not pay to borrow in order to save as both have the same interest rate). Hence, investment is the same as that in the Ak setup. For $w \geq \hat{I}/m$ the firm invests $\hat{I}$ and only borrows $\hat{I} - w$, so the borrowing constraint does not bind. For $w \geq \hat{I}$ it saves $w - \hat{I}$ and does not borrow. Since $\delta^{-1}b_t = \delta^{-1}(m-1)w_t = hmw$, in the best safe plan profits are

$$
\pi^s(w) = \begin{cases} g(wm) - hmw & \text{if } w < \hat{I}/m \\ g(\hat{I}) - \delta^{-1}(\hat{I} - w) & \text{if } w \geq \hat{I}/m \end{cases}. \tag{26}
$$

Consider a risky plan. If a bailout is expected in the bad state but not in the good state, lenders set $\rho = r$ and lend up to $b_t \leq (m^r - 1)w_t$. For $w < \tilde{I}/m^r$ it is optimal to borrow up to the limit and not to save. For $w \in [\tilde{I}/m, \tilde{I})$ the firm sets investment to $\tilde{I}$ and borrows less than the maximum possible. For $w \geq \tilde{I}$ the firm saves $w - \tilde{I}$, does not borrow and does not default in any state.

Replacing $u\delta^{-1}b_t$ by $u\delta^{-1}(m^r-1)w_t$=$hm^r w_t$, we have that expected profits are

$$(27) \qquad E\pi^r(w) = \begin{cases} uf(wm^r) - hm^r w & \text{if } w < \tilde{I}/m^r \\ uf(\tilde{I}) - u\delta^{-1}[\tilde{I} - w] & \text{if } w \in [\tilde{I}/m^r, \tilde{I}) \\ uf(\tilde{I}) + \ \delta^{-1}[w - \tilde{I}] & \text{if } w \geq \tilde{I} \end{cases} .$$

The term $u\delta^{-1}$ appears in the second row because for $w < \tilde{I}$ the firm will be solvent in the good state and insolvent in the bad state. Thus, with probability $1-u$ lenders will be repayed by the bailout. To characterize the CME define the expected profit differential

$$\Lambda(w) := E(\pi^r(w)) - \pi^s(w).$$

To compute $\Lambda(w)$ consider the efficient and the panglossian investment levels defined in Proposition 3

$$(28) \qquad \hat{I} = (\chi\lambda\delta)^{\frac{1}{1-\lambda}}, \quad \tilde{I} = (\lambda\delta)^{\frac{1}{1-\lambda}}, \text{ so } \hat{I} = \chi^{\frac{1}{1-\lambda}}\tilde{I}.$$

Notice that $\hat{I}/m^s > \tilde{I}/m^r$ if and only if $h > h^*$ defined in (30). This result implies that for $h > h^*$ if the borrowing constraint binds under the risky plan, it must also bind under the safe plan. Since all propositions are stated for "large enough h", $h > h^*$ is the relevant case to consider when comparing π^s and $E\pi^r$. That is, we just need to consider the case $\hat{I}/m^s > \tilde{I}/m^r$:

$$(29) \quad \Lambda(w) = \begin{cases} [u[m^r(\zeta_{t+1})]^\lambda - \chi[m^s]^\lambda]w^\lambda - h[m^r(\zeta_{t+1}) - m^s]w & \text{if } w < \tilde{I}/m^r(\zeta_{t+1}) \\ u\tilde{I}^\lambda - \zeta_{t+1}\delta^{-1}[\tilde{I} - w] - \chi[m^s w]^\lambda + hm^s w & \text{if } w \in [\tilde{I}/m^r(\zeta_{t+1}), \hat{I}/m^s) \\ u\tilde{I}^\lambda - \zeta_{t+1}\delta^{-1}[\tilde{I} - w] - \chi\hat{I}^\lambda + \delta^{-1}[\hat{I} - w] & \text{if } w \in [\hat{I}/m^s, \tilde{I}) \\ u\tilde{I}^\lambda - \chi\hat{I}^\lambda + \delta^{-1}[\hat{I} - \tilde{I}] & \text{if } w \geq \tilde{I} \end{cases} .$$

Proof of Part 1. In a safe CME no bailout is expected: $\zeta_{t+1} = 1$. Thus, given that all other firms choose a safe plan, a manager has no incentive to choose a risky plan. To see this set $\zeta_{t+1} = 1$ and $m^r(\zeta_{t+1} = 1) = m^s$ in (29) and notice that $\Lambda(w)$ is negative for all w, i.e., $E\pi^r < \pi^s$. Next, note that only plans that do not lead to diversion are financeable because diversion implies zero debt repayment in both states. Hence, if $\zeta_{t+1} = 1$, the best safe plan is optimal for all levels of w.

Proof of Part 2. Lemma 1 below characterizes $\Lambda(w)$ for $\zeta_{t+1} = u$ and $h > h^*$. It shows that for high h : $\Lambda(w) > 0$ if $w \leq \tilde{I}/m^r$; $\Lambda(w) < 0$ if $w \geq \tilde{I}$ and that $\Lambda(w)$ is continuous and decreasing. Thus, there is a unique w^*, such that $\Lambda(w) < (>) 0 \iff w > (<) w^*$. Since a bailout is granted only if there is no diversion, only non-diversion plans that don't default in the good state are financeable. Thus, the best risky plan characterized above is optimal for $w < w^*$ when $\zeta_{t+1} = u$. This completes the proof of part 2.

Lemma 1 (Characterization of $\Lambda(w)$) There exists a lower bound $\underline{h}^{\dagger} < \bar{h}$, defined in (30), such that if $h > \underline{h}^{\dagger}$, there exists a unique threshold $w^* \in (\tilde{I}/m^r, \tilde{I})$, such that $\Lambda(w) \geq (<) 0$ if and only if $w \leq (>) w^*$:

$$\text{(30)}\quad \underline{h}^{\dagger} = \max\{h^*, h^{***}\},$$
$$h^* \equiv \frac{1-\chi^{\frac{1}{1-\lambda}}}{1-u\chi^{\frac{1}{1-\lambda}}}\bar{h}, \quad h^{***} \equiv \inf\left\{ h < \bar{h} \;\middle|\; \left(u - \chi\left(\frac{m^s}{m^r}\right)^{\lambda}\right)\frac{1}{\lambda\delta} - h\left(1 - \frac{m^s}{m^r}\right) > 0 \right\}.$$

Proof. The proof is in three parts.
(i) $\Lambda(w)$ is negative for all $w \geq \tilde{I}$. Since $h > h^*$, we have that $\tilde{I} > \hat{I} > \hat{I}/m^s$. Thus,

$$\Lambda(w \geq \tilde{I}) = uf(\tilde{I}) - \chi f(\hat{I}) - \delta^{-1}[\tilde{I} - \hat{I}] < f(\tilde{I}) - f(\hat{I}) - (\delta u)^{-1}[\tilde{I} - \hat{I}] < 0.$$

The first inequality follows from dividing by u and substracting $(1 - \chi u^{-1})f(\hat{I}) < 0$. The negative sign follows from the mean value theorem. There is a constant $c \in (\hat{I}, \tilde{I})$ such that $f'(c) = \frac{f(\tilde{I}) - f(\hat{I})}{\tilde{I} - \hat{I}}$. Since $f(I)$ is concave, $f'(c) < f'(\hat{I}) := (\delta\chi)^{-1}$ by (16). Since $u < \chi$, it follows that $f(\tilde{I}) - f(\hat{I}) < (\delta\chi)^{-1}[\tilde{I} - \hat{I}] < (\delta u)^{-1}[\tilde{I} - \hat{I}]$. Hence, $\Lambda(w \geq \tilde{I}) < 0$.

(ii) $\Lambda(w)$ is positive for all $w \leq \tilde{I}/m^r$. First, we find the sign of $\Lambda(\tilde{I}/m^r)$. Since $\hat{I}/m^s > \tilde{I}/m^r$, we have that if $w = \tilde{I}/m^r$, investment in a safe plan is $m^s[\tilde{I}/m^r]$. Since $\tilde{I} = (\lambda\delta)^{\frac{1}{1-\lambda}}$,

$$\vartheta \equiv \lim_{w \to \tilde{I}/m^r -} \Lambda(w) = u\,(\lambda\delta)^{\frac{\lambda}{1-\lambda}} - \chi\left(m^s \frac{(\lambda\delta)^{\frac{1}{1-\lambda}}}{m^r}\right)^{\lambda} - h[m^r - m^s]\frac{(\lambda\delta)^{\frac{1}{1-\lambda}}}{m^r}$$
$$\text{(31)}\quad = (\lambda\delta)^{\frac{1}{1-\lambda}}\left\{\left(u - \chi\left(\frac{m^s}{m^r}\right)^{\lambda}\right)\frac{1}{\lambda\delta} - h\left(1 - \frac{m^s}{m^r}\right)\right\}.$$

To see that h^{***}, defined in (30), exists note that

$$\lim_{h \to \bar{h}} \vartheta = (\lambda\delta)^{\frac{1}{1-\lambda}}\left\{u(\lambda\delta)^{-1} - \bar{h}\right\} = (\lambda\delta)^{\frac{1}{1-\lambda}}\,\frac{u}{\delta}\left\{\frac{1}{\lambda} - 1\right\} > 0.$$

The positive sign follows from $\lambda < 1$. Continuity of ϑ in h implies that there is a threshold h^{***} such that $\Lambda(\tilde{I}/m^r) > 0$ for all $h \in (h^{***}, \bar{h})$. Next, the first and second order derivatives of $\Lambda(w)$ are

$$\Lambda'(w)|_{w<\tilde{I}/m^r} = [u[m^r]^{\lambda} - \chi[m^s]^{\lambda}]\lambda w^{\lambda-1} - h[m^r - m^s],$$
$$\Lambda''(w)|_{w<\tilde{I}/m^r} = \lambda[\lambda - 1][u[m^r]^{\lambda} - \chi[m^s]^{\lambda}]w^{\lambda-2}.$$

Note that $\Lambda' > 0$ and $\Lambda'' < 0$ for all $w < \tilde{I}/m^r$ if and only if $h > h^{**}$, where h^{**} is defined by $\xi(h^{**}) = \left(\frac{m^r}{m^s}\right)|_{h=h^{**}} - \left(\frac{\chi}{u}\right)^{\frac{1}{\lambda}} = 0$. Notice that h^{**} is lower than h^{***} because $\xi(h)$ equals the first term in (31). Thus, if $h = h^{**}$, (31) equals $(\lambda\delta)^{\frac{1}{1-\lambda}}\left\{0 - h\left(1 - \frac{m^s}{m^r}\right)\right\}$, which is negative. Finally, we have shown that for any $h \in (\underline{h}, \bar{h})$: $lim_{w \to \tilde{I}/m^r}\Lambda(w) > 0$, $\Lambda'(w) > 0$ and $\Lambda''(w) < 0$. Since $\lim_{w\to 0}\Lambda(w) = 0$, $\Lambda(w)$ is a concave parabola that is zero at $w = 0$ and has a positive value at $\tilde{I}/m^r$. Thus, it must be positive in the entire range $(0, \tilde{I}/m^r)$.

(iii) We have established that $\Lambda(\tilde{I}) < 0$ and $\Lambda(w \leq \tilde{I}/m^r) > 0$. We will show that $\Lambda(w)$ is continuous and decreasing on $[\tilde{I}/m^r, \tilde{I})$, so a unique threshold w^* exists. To show continuity of $\Lambda(w)$ at $w = \hat{I}/m^s$ note that $\lim_{w\to(\hat{I}/m^s)^-}\Lambda(w) - \Lambda(\hat{I}/m^s) = h\hat{I} - \delta^{-1}[\hat{I} - \hat{I}/m^s] = 0$. This is because $\hat{I}\delta^{-1}[1 - 1/m^s] = \hat{I}\delta^{-1}[\delta h] = h\hat{I}$. The first order derivative is

$$\Lambda'(w) = \begin{cases} \frac{u}{\delta} - m^s\left[\chi\lambda(m^s w)^{\lambda-1}\right] + hm^s < 0 & \text{if } w \in (\tilde{I}/m^r, \hat{I}/m^s) \\ \frac{u}{\delta} - \frac{1}{\delta} < 0 & \text{if } w \in (\hat{I}/m^s, \tilde{I}) \end{cases} .$$

The second line is negative because $u < 1$. For the first line note that by the definition of $\hat{I}$, $\chi\lambda\hat{I}^{\lambda-1} = \delta^{-1}$. Thus, $\chi\lambda(m^s w)^{\lambda-1} > \delta^{-1}$ for $w < \hat{I}/m^s$. Also, $hm^s = \delta^{-1}[m^s - 1]$. Hence, the first line equals $\frac{u}{\delta} - m^s\left[\chi\lambda(m^s w)^{\lambda-1}\right] + \delta^{-1}[m^s - 1] < \frac{u}{\delta} - 1 < 0$.$\square$

Proof of Proposition 4. The proof is the same as that of Proposition 2, and follows directly from the sign of $\Lambda(w)$. The expected growth rate in the risky economy is greater than in the safe one ($E_t(w^r_{t+1}/w_t) > E_t(w^s_{t+1}/w_t)$) if and only if

$$\begin{aligned} E_t(w^r_{t+1}) - w^s_{t+1} &= [1-d]\left[E_t(\pi^r_{t+1}) - \pi^s_{t+1} + [1-u]\alpha\pi^r_{t+1}(\Omega = 1)\right] \\ &= [1-d]\left[\Lambda(w_t) + [1-u]\alpha\pi^r_{t+1}(\Omega = 1)\right]. \end{aligned}$$

It follows that $E_t(w^r_{t+1}) > w^s_{t+1}$ for any $\alpha \in (0,1)$ if and only if $\Lambda(w_t) := E_t(\pi^r_{t+1}) - \pi^s_{t+1} > 0$. Lemma 1 shows that if $\zeta_{t+1} = u$ and $h > \underline{h}^\dagger$, then $\Lambda(w) > 0$ for $w \leq \tilde{I}/m^r$; $\Lambda(w) < 0$ for $w \geq \tilde{I}$ and $\Lambda(w)$ is continuous and decreasing. Thus, there is unique threshold w^*, such that $\Lambda(w) < (>) 0$ if and only if $w > (<) w^*$. This proves parts 1 and 2. For part 3 note that if $d \leq 1-\delta$, then $w_{t+1} > w_t$ along both the safe path and the lucky path along which crises do not occur (i.e., where $\Omega_{j+1} = 1$ for all $j \leq t$). To see this, suppose there is a switch at t (i.e., $w_t \geq w^*$). If $w^* < \hat{I}/m^s$,

$$\begin{aligned} w_{t+1} - w_t &= [1-d][g(w_t m^s) - \delta^{-1}[m^s - 1]w_t] - w_t \\ (w_{t+1} - w_t)|_{d=1-\delta} &= \delta g(w_t m^s) - m^s w_t > 0. \end{aligned}$$

Note that $\delta g(wm^s) - m^s w > 0$ for $w < \hat{I}/m^s$ because $g'(\hat{I}) = \delta^{-1}$ and $g'' < 0$. Next, if $w^* \geq \hat{I}/m^s$,

$$\begin{aligned} w_{t+1} - w_t &= [1-d][g(\hat{I}) - \delta^{-1}(\hat{I} - w_t)] - w_t \\ (w_{t+1} - w_t)|_{d=1-\delta} &= \delta g(\hat{I}) - \hat{I} > 0. \end{aligned}$$

If along the safe path $w_{t+1} > w_t$ for $d = 1 - \delta$, the same must hold for $d < 1 - \delta$. Since along the lucky path realized profits are greater than along a safe path for any $w_t < w^*$, it must be true that along the lucky path $w_{t+1} > w_t$.□

C. Description of the Data

Table EA14 lists the sample of 83 countries. Table EA15 lists the sources for the data used in the regression analysis. Subsection C.A details the selection of the restricted sample of 58 countries without severe wars or large terms of trade deterioration. Subsections C.B and C.C describe the crisis indexes and the financial liberalization indexes used in the paper.

C.A. Wars and Large Term of Trade Deteriorations

Out of our sample of eighty-three countries, we construct a restricted sample of 58 countries that have not experienced an episode of large deterioration in their terms of trade or a severe war episode over the period 1980-2000. The source for war episodes is the Heidelberg Institute of International Conflict Research (HIICK). We use the variable "Average Number of Violent Death" in the HIICK database. A country is classified as having experienced a severe war episode if the ratio of average violent deaths to average population is above five per one hundred thousand for two consecutive years. We identify twelve war cases: Algeria, Congo Rep., Congo, Dem. Rep, El Salvador, Guatemala, Iran, Nicaragua, Peru, Philippines, Sierra Leone, South Africa and Uganda. A country is classified as having experienced a large terms of trade deterioration if its terms of trade index has suffered a drop of more than 30 percent in a single year, or an average annual drop larger than 25 percent (20 percent) in 2 (3) consecutive years.[58] Large terms of trade deterioration cases are: Algeria, Congo, Rep., Congo, Dem. Rep., Cote d'Ivoire, Ecuador, Egypt, Ghana, Haiti, Iran, Pakistan, Sri Lanka, Nicaragua, Nigeria, Sierra Leone, Syria, Togo, Trinidad and Tobago, Uganda, Venezuela and Zambia.

[58] The Terms of Trade index shows the national accounts exports price index divided by the imports price index with a 1995 base year. The source is World Development Indicators [2003].

C.B. Description of Crisis Indexes

Banking Crisis Indexes. De Jure indexes of banking crisis are based on surveys of financial press articles as well as previous academic papers. They are not original country-case studies and therefore are subjective not only based on the judgment of the index authors but also based on that of the underlying sources. The most comprehensive survey is provided by Caprio and Klingebiel [2003] [CK]. They define a systemic crisis as much or all of bank capital being exhausted. CK reports episodes of systemic banking crisis in 93 countries between the late 1970s and 2000.[59] Detriagache and Demirguc-Kunt [2005] [DD] is a meta-survey that uses crisis information from CK and four other indexes. Unlike CK, DD reports the unconditional country dataset in which they search for banking crises over the period 1980-2000.[60] In order to distinguish between severe and not severe (borderline) crises, DD impose one of four restrictions that a country-year must satisfy to be a crisis: (i) a share of non-performing loans greater than 10 percent of the banking sector total assets; (ii) a cost of rescue operations greater than 2 percent of GDP; (iii) large scale nationalization of banks; (iv) bank runs or deposit freezes. The third banking crisis index we use is Kaminsky and Reinhart [1999] [KR] that covers 20 countries over the period 1970-1995.

Currency Crisis Indexes. They are de facto indexes based on measures of currency pressure, which is a weighted average of changes over a period of time in exchange rates, reserves and interest rates. We consider four currency crisis indexes. Glick and Hutchison [2001] [GH] cover 83 countries from 1970 to 1999. They use a monthly weighted average of the change in the real exchange rate and reserves losses (where the weight is the inverse of the variance of each series). Garcia and Soto [2004] [SG] cover 65 countries from 1975 to 2002. They use the same average as Glick and Hutchison, but with a different threshold: there is a crisis if the index is larger than the mean plus two standard deviations. Frankel and Wei [2004][FW] cover 58 countries over the period 1974-2000. Their index is a monthly unweighted average of real exchange rate changes and reserves losses. A crisis is identified if the level of the index is above 15 percent, 25 percent, or 35 percent and when there is a change in the index of 10 percent. Furthermore, they have a restriction that there cannot be more than one crisis in a three-year window. Finally, Becker and Mauro [2006][BM1] cover 81 countries from 1960 to 2000. According to their definition, a crisis takes place if : (i) there was a cumulative nominal depreciation of at least 25 percent over 12 months, (ii) the nominal depreciation rate is at least 10 percentage points greater than in the preceding 12 months and (iii)at least 3 years have passed since the last crisis.[61]

[59] The majority of the crisis episodes are precisely dated, but several are referred by vague indications such as "Nigeria, early 1990s."

[60] DD consider a sample of 94 countries with data on real interest rate and inflation, excluding communist or transition economies. The sample of DD covers 52 countries in our sample of 58 countries without wars or large terms of trade deteriorations.

[61] The coverage of the currency crisis indexes for our sample of 58 countries without war or large terms of trade

Sudden Stops. We consider three sudden stops indexes. Mauro and Becker [2006] [BM2] look at 77 countries from 1977 to 2000 and define a sudden stop as a situation where the financial account balance worsens by more than 5 percentage points of GDP compared with the previous year. Calvo, Izquierdo and Mejia [2004][CIM] examine 26 countries from 1992 to 2000, and identify a crisis when there is a decline of more than two standard deviations of the individual country distribution. Frankel and Cavallo [2006] [FC] look at 81 countries and identify a crisis by combining the definition of CIM with the requirement of a fall in GDP the year of the sudden stop or the following year in order to ensure that the episode is *disruptive.*[62]

As mentioned in the text, we construct an index of consensus crises that identifies crises that have been confirmed by at least two banking crises indexes or two currency crisis indexes or two sudden stop indexes. Table EA5 reports all the consensus crises in our 58 country sample. Table EA4 reports both consensus crises (labeled CC) and simple coded crises (labeled C) that are associated with any of the three extreme credit growth observations for each country.

C.C. Description of Financial Liberalization Indexes

De Facto Financial Liberalization Index. This index 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).[63] A country is financially liberalized (FL) in 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 percent at or before t, or (ii) its KI-to-GDP ratio is greater than 10 percent at or before t, or (iii) the country is associated with the EU or the G10.[64] The 5 percent and 10 percent thresholds reduce the possibility of false liberalization and false non-liberalization signals, respectively. 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 percent significance level. The FL index does

deterioration is: 58(GH), 48(GS), 34 (FW) and 58(BM1).

[62] The coverage of the sudden stops indexes for our sample of 58 countries without war or large terms of trade deterioration is: 53(BM2), 26(CIM) and 57 (FC).

[63] 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 or the inflows of FDI.

[64] The G10 is the group of countries that have agreed to participate in the General Arrangements to Borrow (GAB). It includes Belgium, Canada, France, Italy, Japan, the Netherlands, the United Kingdom, the United States, Germany, Sweden and Switzerland.

not allow for policy reversals: once a country liberalizes, it does not close thereafter. We consider that this approach is appropriate to analyze the decadal effects of liberalization on growth over the period 1980-2000.[65]

De Jure Financial Liberalization Indexes. We use two indexes of de jure financial liberalization. The first index is due to Abiad and Mody [2005] and has been extended by Abiad, Detragiache and Tressel [2006]. This index codes the restrictions on international financial restrictions on the following scale: 0 (fully repressed), 1 (partially repressed), 2 (largely liberalized), 3 (fully liberalized). The original sources are listed in Abiad and Mody [2005] and include previous surveys, central bank bulletins and International Monetary Fund country reports. We have rescaled the index on a zero to one range by dividing the value of each observation by four. The Abiad and Mody index covers 32 countries in our sample of 58 countries since the 1970s. The second index is due to Quinn [1997] and has been updated by Quinn and Toyoda [2003]. This index codes the intensity of restriction on capital account restriction on a zero to 100 scale. The original sources are various issues of the International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions. We have rescaled the index on a zero to one range by dividing each observation by 100. The Quinn index covers 49 countries in our sample of 58 countries since the 1960s.

D. Bailouts

Here, we present stylized facts of ex-post bailouts that support the assumptions of our model. First, most of the crises in our sample are associated with International Monetary Fund rescue packages that are large relative to GDP. Second, bailout packages are in large part designed to insure the repayment of external liabilities resulting in the bailout of lenders. Third, in most cases governments repay these loans in full rather quickly. Our model assumes that during a systemic crisis the government can borrow internationally in order to bail out lenders and that it repays these loans during good times.

In our sample of 58 countries over the period 1984-2000, we find that 18 of the 28 banking crises (64 percent) were associated with an International Monetary Fund crisis support package in the year of or the year following the start of the crisis. If we look at the subset of banking crises that coincided with a currency crises (i.e., twin crises), this share increases to 84 percent. This share is quite high considering that some crisis countries opted not to make use of International Monetary Fund credit (e.g., Finland, Malaysia and Sweden).

[65] Incomplete data coverage on financial inflows prevents us from computing the de facto index before the 1980s. Only 11 out of our 58 countries sample have a complete coverage over the 1970s.

Crises and IMF-Supported Crisis Facilities (Stand-By Arrangement and Exceptional Fund Facility

	"Twin"crises	Systemic banking crises	Currency crises
Number of crises	19	28	54
Number of crises associated with an IMF-supported crisis package	16	18	39
Percentage of crises matched with IMF-supported crisis facilities	84%	64%	72%

Note: Crises are identified by the consensus indexes described in Section 3.1. The 58 countries sample is used. The period covered is 1984-2000. To be matched with a crisis, the IMF facility should occur the year of the crisis or the year after.

These International Monetary Fund packages are large relative to GDP: Turkey 1999 (11.19 percent), Uruguay 1983 (7.96 percent) Mexico 1995 (6.39 percent), Chile 1983 (5.08 percent), Indonesia 1998 (5.2 percent) or Korea 1998 (4.14 percent). Moreover, international financial assistance comes not only from the International Monetary Fund, but also from other agencies (e.g. the Asian Development Bank) or from bilateral sources (e.g. the U.S. Treasury). Jeanne and Zettelmeyer [2001] report the following total sizes of international bailouts as a percentage of GDP: Mexico 1995 (18.3 percent), Thailand 1998 (11.5 percent), Indonesia 1998 (19.6 percent) and Korea (12.3 percent). In addition, domestic resources used in bailouts can be also quite large: Malaysia 1998 (13 percent of GDP) or Finland 1991-1992 (5 percent of GDP).[66]

Several important features of crisis rescue packages – central bank liquidity support and government guarantees – are explicitly designed to insure that external obligations are repaid.[67] *Liquidity support* provided by central banks allow banks to service their short-term liabilities and usually includes dollar loans that are used to repay short-term foreign currency denominated debts. Hoelscher et.al. [2003] report liquidity support in quantities ranging from 2.5 percent of GDP (Korea 1998-2000) to 22 percent of GDP (Thailand 1998-2000). In addition to liquidity support, the government often provides its *guarantee to the external liabilities* of the banking sector during a systemic crisis. Hoelscher et. al. [2003] report the presence of such guarantees in many crisis countries including Finland, Indonesia, Jamaica, Korea, Malaysia, Mexico, Sweden, Thailand and Turkey. As these government guarantees are implemented only during systemic crises –in contrast to "normal times" where protection is limited to deposit insurance– and tend to apply to all the foreign currency

[66] These two figures correspond to the ratio of emergency central bank loans to GDP.

[67] According to the governor of the central bank of Mexico, Guillermo Ortiz "The emergency financial package with the U.S. government, the International Monetary Fund, the World Bank, and the Inter-American Development Bank was designed to avoid suspending payments on the country's external obligations.[..] and included the following measures: provision of liquidity in foreign exchange by the central bank to commercial banks to prevent them from becoming delinquent on their foreign obligations" [Ortiz, 1998].

liabilities of banks, they are indeed a close equivalent to the systemic bailout guarantees described in our model.

The third stylized fact is documented by Jeanne and Zettelmeyer [2001]. They show that, with the exception of highly indebted poor countries, complete debt cycles by far outweigh incomplete debt cycles (where the International Monetary Fund rolls over the debt in the end). The transfer element in crisis lending for "non-poor" countries is less than 1 percent of GDP, much less than the actual fiscal cost of crises. Consider the case of Mexico. The full value of the International Monetary Fund and Bank for International Settlements loans was disbursed by the end of 1995. By the middle of 1997, Mexico had repaid two thirds of its loans, and had repaid them fully by early 2000.

E. Generalized Method of Moments System Estimation

Here, we use a GMM system estimator developed by Arellano and Bover [1995] and Blundell and Bond [1998] that controls for unobserved time- and country-specific effects, and accounts for some endogeneity in the explanatory variables. The regression equation to be estimated is $y_{i,t} - y_{i,t-1} = (\alpha - 1)\, y_{i,t-1} + \beta' Z_{i,t} + \eta_i + \varepsilon_{i,t}$, where $y_{i,t}$ is the logarithm of real per-capita GDP, Z_{it} is the set of explanatory variables excluding initial income and a time dummy, η_i is the country-specific effect, and $\varepsilon_{i,t}$ is the error term. In order to eliminate the country-specific effect, we take first-differences and get

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(Z_{i,t} - Z_{i,t-1}) + \varepsilon_{i,t} - \varepsilon_{i,t-1}. \tag{32}$$

We relax the assumption of exogeneity of the explanatory variables by allowing them to be correlated with current and previous realizations of the error term. However, we assume that future realizations of the error term do not affect current values of the explanatory variables.[68] The use of instruments deals with: (i) the likely endogeneity of the explanatory variables, and (ii) the problem that, by construction, the new error term, $\varepsilon_{i,t} - \varepsilon_{i,t-1}$, is correlated with the lagged dependent variable, $y_{i,t-1} - y_{i,t-2}$. Following Blundell and Bond [1998], we use the *GMM system estimator.*[69] This estimator combines the regression in differences (32) and the corresponding regression in levels together into a single system. The system estimator uses a set of moment conditions where lagged

[68] As Levine et al.[2000] point out, this assumption of *weak exogeneity* does not imply that expectations of future growth do not have an effect on current moments of credit expansion, but only that unanticipated future shocks to economic growth do not influence the current realizations of the explanatory variables.

[69] The GMM system estimator has two advantages: (i) it reduces the potential biases and imprecision associated with the usual GMM difference estimator; and (ii) it allows us to exploit simultanously the between and within country variations to estimate the effects of the moments of credit growth on GDP growth.

levels are used as instruments in the difference equations and lag differences in the level equation.[70] The consistency of the GMM estimates depends on whether lagged values of the explanatory variables are valid instruments in the growth regression. We address this issue by considering two specification tests. The first is a Sargan-Hansen test of over-identifying restrictions, which tests the overall validity of the instruments.[71] The second test examines whether the differenced error term is second-order serially correlated.

The use of lagged variables as instruments and the requirement of three consecutive time units to perform the two specification tests restrict the available periods of estimation to 1970-2000. Table EA6 shows the estimation results. In the first column all regressors are treated as endogenous and moment conditions are computed using appropriate lagged values of the levels and differences of the explanatory and dependent variables. In the second column, all the regressors are treated as endogenous with the exception of skewness. We can see that skewness enters with very similar coefficients in both regressions (-0.60 and -0.59) and that both are significant at the 5 percent level. Thus, relaxing the exogeneity assumption for skewness seems to have little effect on the estimates. Notice that the coefficients on the skewness and mean of credit growth are noticeably higher with the GMM estimation than with the GLS estimation. In contrast, the standard deviation is not significant in the GMM specification. The Sargan-Hansen test shows that, in both regressions, the validity of the instruments cannot be rejected.[72]

Table EA7 is the counterpart of Table III in the paper. It shows that the interaction effects presented in subsection III.B are also significant in the GMM specification. In sum, these results confirm that when we correct for biases resulting from unobserved country fixed effects and control for some of the endogeneity in the explanatory variables, the link between skewness and growth established in subsection III.B remains robust and in fact appears even stronger.

F. Crisis Volatility and Business Cycle Volatility: Skewness vs. Variance

In the data, there are sources of growth fluctuations other than financial crises, chiefly business cycle fluctuations. Consider Barro's rare disaster setup [Barro, 2006], where there are two sources of volatility: symmetric business cycle fluctuations and rare crises. The growth process in this

[70] We compute robust two-step standard errors by following the methodology proposed by Windmeijer [2005] that corrects the small sample downward bias in the two-step standard errors and therefore allows us to rely on the asymptotically efficient two-step estimates of the coefficients.

[71] Since the validity of the moment conditions using internal instruments depends on the weak exogeneity of the explanatory variables, the Sargan-Hansen test is also, by construction, a test of this assumption.

[72] The second order serial correlation tests indicate that second order correlation can be safely rejected.

economy is given by:

$$gr_t = \gamma + v_t + c_t, . \tag{33}$$

where v_t is a normal i.i.d. business cycle disturbance with mean zero and variance σ_v^2, c_t is a crisis variable equal to zero with probability u (tranquil times) and $\log(\alpha) < 1$ with probability $1 - u$ (crisis times), and γ is the mean growth rate in tranquil times.[73,74] When business cycle fluctuations are introduced ($\sigma_v > 0$), the variance, skewness and excess kurtosis of growth are given by:

$$\underbrace{var}_{\text{total variance}} = \underbrace{\sigma_v^2}_{\text{variance due to business fluctuations}} + \underbrace{\sigma_c^2}_{\text{variance due to crises}}, \qquad \sigma_c^2 = [\log(\alpha)]^2 \, u(1-u),$$

$$\underbrace{sk}_{\text{total skewness}} = \underbrace{\left[\frac{\sigma_c^2}{\sigma_c^2 + \sigma_v^2}\right]^{3/2}}_{\text{share of total variance due to crises}} \cdot \underbrace{\left[\left(\frac{1-u}{u}\right)^{1/2} - \left(\frac{u}{1-u}\right)^{1/2}\right]}_{\text{skewness of } c_t}, \tag{34}$$

$$\underbrace{ek}_{\text{total excess kurtosis}} = \underbrace{\left[\frac{\sigma_c^2}{\sigma_c^2 + \sigma_v^2}\right]^{2}}_{\text{share of total variance due to crises}} \cdot \underbrace{\left[\frac{1}{(1-u)u} - 6\right]}_{\text{excess kurtosis of } c_t}. \tag{35}$$

Skewness and excess kurtosis

The total skewness of credit growth reflects the skewness of the crisis component weighted by the share of variance due to crises in total variance. The skewness of the crisis component is negative and large when crises are rare events. For a given probability of crisis, the share of variance due to crises is increasing in the severity of crisis and decreasing with business cycle variance. Notice that since business fluctuations are normally distributed, they exhibit neither skewness nor excess kurtosis.

The total excess kurtosis reflects the excess kurtosis due to crises weighted by the share of variance due to crises. In our benchmark calibration ($1 - u = 4.13$ *percent*, $\alpha = 0.7$ and $\sigma_v = 6$ *percent*), the skewness of credit growth is -2.05 and the excess kurtosis is 6.5.[75]

Variance vs. skewness

The aspects of volatility captured by variance and skewness are different in two important dimensions. First, variance is equally affected by the variance of the crisis component and the variance of the business cycle component. In contrast, skewness is increasing in the variance of the crisis component but *decreasing* in the variance of the business cycle component. Hence, unlike variance, skewness disentangles the occurrence of severe crises from the effect of regular business

[73] In our model $1 - \alpha$ captures the financial distress cost of crises (i.e., the fall in internal funds and credit).
[74] As in Barro [2006], we assume that the business cycle component (v) and the crisis component (c) are independent.
[75] σ_v is set equal to the standard deviation of credit growth in Thailand over the period 1981-2001 excluding the banking crises years identified by our consensus index.

cycle fluctuations. Second, variance is at its maximum when crises are just as frequent as tranquil episodes ($u = 1/2$), whereas negative skewness reaches its maximum when the probability of crisis is small.

Derivation of (34) and (35). We use the following results for the skewness and kurtosis of the sum of two independent random variables x and y :

$$sk(x+y) = \frac{sk_x \sigma_x^3 + sk_y \sigma_y^3}{\left(\sigma_x^2 + \sigma_y^2\right)^{3/2}}, \tag{36}$$

$$kur(x+y) = \frac{kur(x)\sigma_x^4 + kur(y)\sigma_y^4 + 6\sigma_y^2\sigma_x^2}{\left(\sigma_x^2 + \sigma_y^2\right)^2}, \tag{37}$$

where sk_x is the skewness of x, sk_y is the skewness of y, kur_x is the kurtosis of x and kur_y is the kurtosis of y. To derive the expressions above note that $sk(x+y) = \frac{E(x+y-\overline{x}-\overline{y})^3}{(\sigma_{x+y})^3}$ and $kur(x+y) = \frac{E(x+y-\overline{x}-\overline{y})^4}{(\sigma_{x+y})4}$. Using the normalization variables $z = x - \overline{x}$ and $w = y - \overline{y}$, we have that:

$$E(x+y-\overline{x}-\overline{y})^3 = E(z+w)^3 = E(z^3) + \underbrace{3E(w^2z) + 3E(wz^2)}_{=0} + E(w^3) = sk_x\sigma_x^3 + sk_y\sigma_y^3$$

$$E(x+y-\overline{x}-\overline{y})^4 = E(z+w)^4 = E(z^4) + E(w^4) + 6E(z^2)E(w^2) = kur_x\sigma_x^4 + kur_y\sigma_y^4 + 6\sigma_x^2\sigma_y^2.$$

Equation (34) follows directly from (36) To derive (35) we replace (37) in $ek = kur - 3$.

$$\begin{aligned}
ek &= kur(c)\left(\frac{\sigma_c^2}{\sigma_c^2+\sigma_v^2}\right)^2 + 3\left(\frac{\sigma_v^2}{\sigma_c^2+\sigma_v^2}\right)^2 + 6\left(\frac{\sigma_c\sigma_v}{\sigma_c^2+\sigma_v^2}\right)^2 - 3 \\
&= (kur(c)-3)\left(\frac{\sigma_c^2}{\sigma_c^2+\sigma_v^2}\right)^2 + 3\left[\left(\frac{\sigma_v^2}{\sigma_c^2+\sigma_v^2}\right)^2 + \left(\frac{\sigma_c^2}{\sigma_c^2+\sigma_v^2}\right)^2\right] + 6\left(\frac{\sigma_c\sigma_v}{\sigma_c^2+\sigma_v^2}\right)^2 - 3 \\
&= ek(c)\left(\frac{\sigma_c^2}{\sigma_c^2+\sigma_v^2}\right)^2 + 3\left[\underbrace{\left(\frac{\sigma_v^2}{\sigma_c^2+\sigma_v^2}\right) + \left(\frac{\sigma_c^2}{\sigma_c^2+\sigma_v^2}\right)}_{=1}\right]^2 \underbrace{-3\left[2\left(\frac{\sigma_c\sigma_v}{\sigma_c^2+\sigma_v^2}\right)^2\right] + 6\left(\frac{\sigma_c\sigma_v}{\sigma_c^2+\sigma_v^2}\right)^2}_{=0} - 3 \\
&= ek(c)\left(\frac{\sigma_c^2}{\sigma_c^2+\sigma_v^2}\right)^2 = \left(\frac{\sigma_c^2}{\sigma_c^2+\sigma_v^2}\right)^2\left(\frac{1}{u(1-u)} - 6\right).
\end{aligned}$$

G. Correspondence Between Skewness, Kurtosis and Coded Crises

In this appendix, we assess the link between kurtosis and systemic financial risk in the subsample of 35 countries with at least one consensus crisis between 1981 and 2000.[76] We also compare this

[76] See Section 3.1 of the paper for the definition of the consensus crisis indexes.

link with the link between skewness and systemic financial risk in the same sample.

G.A. Skewness and Kurtosis in the Sample of Countries with at least One Consensus Crisis

As we can see in Table EA16, the exclusion of consensus crises eliminates, on average, excess kurtosis; kurtosis is reduced from 3.9 to 3. However, kurtosis is reduced in only 24 out of 35 countries. By comparison, as Table EA17 shows, skewness increases in 32 out of the 35 crisis countries and, on average, increases from -0.41 to 0.32.

Table EA18 follows a different approach and identifies for each country the 2 (3) observations whose joint omission results in the largest reduction in kurtosis. Table EA18 shows that (i) the elimination of three observations in each country removes virtually all excess kurtosis; and (ii) 60 percent (62 percent) of the eliminated observations correspond to coded crises. Table EA19 shows that when the same procedure is applied to skewness, the elimination of three observations also removes nearly all negative skewness, but the share of eliminated observations corresponding to coded crises is sensibly higher at 76 percent (74 percent).

In order to complement the information presented in Tables EA18 and EA19, we look at whether the observations with highest impact on kurtosis and skewness belong to the extreme left tail, the center, or the extreme right tail of the distribution of credit growth rates. This is especially relevant for kurtosis, since there is, in theory, the possibility that a cluster of observations near the center of the distribution generates excess kurtosis. For each country, we select the observation whose elimination results in the largest increase in skewness and in the largest reduction in kurtosis. Each observation is then characterized by its *rank* in the country's distribution of credit growth rates, with rank 1 being the lowest and rank 20 the highest. Figure EA1 plots the frequency of eliminated observations of each rank for skewness (upper panel) and for kurtosis (lower panel). In the case of skewness, the observation eliminated has a rank 1 in 30 out of the 35 countries. In the case of kurtosis, the observation eliminated has a rank 1 in 16 countries and a rank 19 or 20 in 8 countries. Interestingly, in 7 cases, the observation with the highest impact on kurtosis has a rank 10 or a rank 11, and is thus located right in the middle of the credit growth distribution.

G.B. Country Case Studies

Here, we present six country case studies. In the first four countries, skewness and kurtosis capture rare and severe crises equally well. In the last two countries, skewness reflects rare and severe crises, but kurtosis is mostly affected by observations near the center of the distribution and thus reflects the peakedness of the distribution.

Indonesia. The two years that have the largest impact on skewness and kurtosis are 1998 and 1999, in which real credit growth is -29 percent and -83 percent, respectively. These years correspond to the Asian financial crisis. Figure EA2, panel 1, makes clear that these two years are outliers. The complete credit growth distribution exhibits large negative skewness (−2.6) and large kurtosis (9.9). When the observations for 1998 and 1999 are eliminated, kurtosis exhibits a reduction of −6.2 and skewness exhibits an increase of 3.7.

Senegal. Large negative skewness (−2.0) and large kurtosis (8.9) capture the 1994 crisis associated with a credit growth of −51 percent, following the large devaluation of the CFA Franc. When the observation for 1994 is eliminated, kurtosis falls to 3.2 and skewness increases to 0.8.

Sweden. The year that has the largest impact on kurtosis and skewness is 1993. This year experiences a contraction of real credit growth of 25 percent and it is coded as a consensus crisis. When the observation for 1993 is eliminated, kurtosis falls from 4.6 to 2.16 and skewness increases from −1.01 to 0.08.

Thailand. Skewness and kurtosis are mostly impacted by the years 1998, 1999, and 2000, which correspond to the Asian financial crisis. Over these three years, real credit growth is −12 percent, −6 percent and -20 percent. When these observations are eliminated, kurtosis falls from 3.28 to 2.3 and skewness increases from −1.09 to −0.2.

Dominican Republic. The three observations with the largest impact on skewness are 1984, 1988 and 1990. These years correspond to the three largest negative credit growth rates (−23 percent, −19 percent, −32 percent), and are coded as consensus crisis years. Removing them increases skewness by 0.78. The three observations with the largest impact on kurtosis are 1995, 1998 and 2000. These observations belong to the center of the credit growth distribution (11 percent, 9 percent, 13 percent), and none of them are consensus crisis years. Removing these observations reduces kurtosis by 0.41 by making the credit growth distribution less peaked, as shown in Figure EA3, panel 1.

Finland. The three observations with the largest impact on skewness are 1992, 1993 and 1994, the years of the Finnish banking crisis. These years correspond to the three largest negative credit growth rates (−9 percent, −11 percent, −12 percent). Removing them increases skewness from −0.36 to −0.01. The three observations with the largest impact on kurtosis are 1981, 1988 and 1998. One of these observations is the peak of a lending boom and the two others belong to the center of the distribution. Removing these observations lowers kurtosis by 0.48 by reducing the peakedness of the credit growth distribution, as shown in Figure EA3, panel 2.

G.C. Skewness and Kurtosis in Long Time Series

Here, we analyze the link between skewness and kurtosis of real GDP per capita growth and the incidence of disasters in the G7 countries over 1890-2004, the sample considered by Barro [2006,

Table III].[77] We identify the five observations whose joint omission results in the largest increase (reduction) in skewness (kurtosis) over 1890-2004.[78] Table EA20 presents the results for skewness and shows that (i) in all countries, the five observations with the highest impact on skewness correspond to the five lowest GDP growth rates; and (ii) the elimination of these five observations eliminates negative skewness in the 6 countries that where initially negatively skewed. If we exclude Japan, 25 out of the 30 eliminated observations correspond to disasters identified by Barro [2006]. Among the five observations not matched with disasters, we find well-known events such as the year of the hyperinflation in Germany (1923) and the year following the 1907 U.S. banking crisis.[79,80]

Table EA21 presents analogous results for kurtosis. In all countries, the elimination of the five observations generates a large reduction in kurtosis. Excluding Japan, 20 out the 30 observations eliminated correspond either to disasters identified by Barro [2006] or to the German hyperinflation. Nine observations correspond to booms that occur either during WWII (United States, United Kingdom, Canada) or in the aftermath of WWII (Italy, France). Only two observations for Canada belong to the center of the distribution, which suggests that the issue of peakedness is at best marginal in this sample. In sum, we find that kurtosis captures mostly disasters and also some booms. In contrast to our sample, kurtosis appears not to be affected by observations located in the center of the distribution.

G.D. Excess Kurtosis, Peakedness and Fat Tails: a Theoretical Example

In the empirical analysis presented above, we find that for the vast majority of countries, both skewness and excess kurtosis are driven by extreme observations associated with crises. However, in about a fifth of our sample, excess kurtosis is predominantly affected by observations located in the center of the distribution. This feature is consistent with the statistical literature according to which excess kurtosis can be generated by fat tails as well as by a cluster of observations around the mean, affecting the peakedness of the distribution.[81]If middle observations matter empirically for kurtosis, then excess kurtosis is likely to be a noisy indicator of the occurrence of rare and severe crises. Here, we construct a simple theoretical example to illustrate this possibility.

Suppose that with probability p credit growth equals v, which is the realization of a random variable with a probability distribution $N(m, \sigma^2)$, and with probability $1-p$ credit growth equals $m - \beta\sigma$, where $\beta \geq 0$ and $p > 1/2$. We capture peakedness by setting $\beta = 0$, which corresponds to

[77] Our dataset uses the 2007 revision of Maddison's Dataset [Maddison, 2007] for 1891-2003 and the Penn World Tables 6.2 for 2004. Two remarks on the dataset: (i) Maddison [2007] now offers a complete time coverage for each of the G7 countries. Barro [2006], using Maddison (2003), reports missing data for Germany in 1918-1919 (ii) for convenience, we use Maddison data for the U.S. while Barro [2006] uses alternative sources.

[78] This procedure requires ranking $2.44 \cdot 10^{11}$combinations and is achieved by using the algorithm of Mifsud [2003].

[79] The three other unmatched observations are the starting year of World War I (1914) for the United States and Canada and 1908 for the United Kingdom.

[80] In Japan, skewness is fully removed by eliminating a single year: 1945.

[81] See Kotz and Johnson [1983] and Darlington [1970]

the addition of a mass point at the center of the distribution. In contrast, a large β corresponds to the addition of severe crises, which fattens the left tail of the distribution. When $\beta = 0$, excess kurtosis and skewness are given by:

$$ek_o = \frac{3p\sigma^4}{p^2\sigma^4} - 3 = \frac{3}{p} - 3 > 0, \qquad sk_o = 0. \tag{38}$$

When crises are very severe (i.e., $\beta \to \infty$), excess kurtosis and skewness are given by:

$$ek_\infty = \frac{1}{p(1-p)} - 6, \qquad sk_\infty = \left(\frac{1-p}{p}\right)^{1/2} - \left(\frac{p}{1-p}\right)^{1/2}. \tag{39}$$

We show below that when $\beta \to \infty$ there is excess kurtosis only if crises are rare enough: $p > \frac{1}{2}+\frac{1}{6}\sqrt{3}$. Skewness is negative since $p > 1/2 > 1-p$. Furthermore, when $\beta \to \infty$, both negative skewness and excess kurtosis are large when crises are rare.

The expressions above show that starting from a normal distribution, excess kurtosis can be obtained by adding a mass point either at the mean or at the left tail of the distribution. In the first case, excess kurtosis reflects the peakedness of the distribution. In the second case, it reflects the presence of rare crises. Notice that it is even possible that the addition of a mass point in the middle of the distribution results in higher excess kurtosis than the addition of the same mass point in the tail of the distribution.[82] Figure EA4 depicts the effect of adding a mass point to a normal distribution in different locations for different values of the probability p.[83] This plot confirms the finding that excess kurtosis can be generated by observations in the center as well as observations in the extreme of the distribution.

Derivation of (38) and (39). First, we derive the four moments of the growth distribution. Then we take the limits $\beta \to 0$ and $\beta \to \infty$. The mean and variance are given by:

$$\mu = m - (1-p)\beta\sigma, \tag{40}$$

$$var = pE(v-\mu)^2 + (1-p)(m-\beta\sigma-\mu)^2 = p\sigma^2 + (1-p)p\sigma^2\beta^2. \tag{41}$$

To derive the skewness, we use the fact that $E(v-m)^2 = \sigma^2$ and $E(v-m)^3 = 0$:

$$\begin{aligned} sk &= \frac{pE(v-\mu)^3 - (1-p)(m-\beta\sigma-\mu)^3}{var^{3/2}} = \frac{p\left[3(1-p)\beta\sigma^3 + (1-p)^3\beta^3\sigma^3\right] - (1-p)\left(p\beta\sigma\right)^3}{var^{3/2}} \\ &= \frac{p\sigma^3(1-p)\beta(3+\beta^2(1-2p))}{(p\sigma^2+(1-p)p\beta^2\sigma^2)^{3/2}} = \frac{(1-p)\,\beta(3+\beta^2(1-2p))}{p^{1/2}(1+(1-p)\beta^2)^{3/2}}. \end{aligned} \tag{42}$$

[82] Below we show that adding a mass point in the middle of the distribution increases excess kurtosis more than adding a mass point in the tail if $p \in (\frac{1}{6}\sqrt{3}+\frac{1}{2}, \sqrt{\frac{2}{3}})$.

[83] The frequency distribution in the upper panel of Figure EA4 has been generated by 10^6 random draws from a Normal distribution $N(10,1)$

To derive excess kurtosis we use $E(v-m)^4 = 3\sigma^4$:

$$\begin{aligned} ek &= \frac{pE(v-\mu)^4 - (1-p)(m-\beta\sigma-\mu)^4}{var^2} - 3 \\ &= \frac{p\left[3\sigma^4 + (1-p)^4\beta^4\sigma^4 + 6\sigma^4(1-p)^2\beta^2\right] - (1-p)(p\beta\sigma)^4}{var^2} - 3 \\ &= \frac{3 + \beta^4(1-p)((1-p)^3 + p^3) + 6(1-p)^2\beta^2}{p\left[1 + (1-p)\beta^2\right]^2} - 3. \end{aligned} \tag{43}$$

Using (42) and (43), we obtain (38) directly by setting $\beta = 0$

$$sk_{\beta=0} = 0, \qquad ek_0 = \frac{3}{p} - 3 > 0.$$

We obtain (38) by taking the limit as β goes to infinity, and using the restriction $p > 1/2$:

$$\begin{aligned} \lim_{\beta\to\infty} sk &: = sk_\infty = \left(\frac{1-p}{p}\right)^{1/2} - \left(\frac{p}{1-p}\right)^{1/2} < 0 \\ \lim_{\beta\to\infty} ek &: = ek_\infty = \frac{1}{p(1-p)} - 6 \\ ek_\infty &> 0 \Leftrightarrow 6p^2 - 6p + 1 > 0 \Leftrightarrow p > \frac{1}{6}\sqrt{3} + \frac{1}{2}. \end{aligned}$$

It also follows from (42) and (43) that negative skewness and excess kurtosis are large when crises are rare: $\lim_{p\to 1^-} sk_\infty = -\infty$ and $\lim_{p\to 1^-} ek_\infty = +\infty$. Finally, we derive the conditions under which the addition of a mass point in the middle of the distribution has a larger impact on kurtosis than the addition of the same mass at the tail:

$$ek_0 > ek_\infty \Leftrightarrow \frac{1 - 3p(1-p)}{p(1-p)}\frac{p}{3} > 1 \Leftrightarrow p < \sqrt{\frac{2}{3}}.$$

The restriction $p < \sqrt{\frac{2}{3}}$ is consistent with $ek_\infty > 0$ because $\sqrt{\frac{2}{3}} > \frac{1}{6}\sqrt{3} + \frac{1}{2}$.

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Table EA1
Crisis Indexes and Growth
Robustness: Extended Set of Control Variables
Dependent variable: Real per capita GDP growth
Estimation: Panel feasible GLS
(Standard errors are presented below the corresponding coefficient.)

Estimation period	1981-2000				
Unit of observations	Non-overlapping 10 year windows				
	[1]	[2]	[3]	[4]	[5]
Moment of credit growth:					
Real credit growth - mean	0.138 ***	0.13 ***	0.129 ***	0.136 ***	0.138 ***
	0.008	*0.009*	*0.009*	*0.008*	*0.008*
Real credit growth - standard deviation	-0.06 ***	-0.06 ***	-0.062 ***	-0.061 ***	-0.057 ***
	0.009	*0.009*	*0.009*	*0.009*	*0.008*
Crisis indexes:					
Banking crisis: Caprio Klingebiel index	0.361 ***				
	0.138				
Banking crisis: Detragriache et al. index		0.248 **			
		0.112			
Banking crisis: Consensus index			0.254 **		
			0.122		
Sudden stop: Consensus index				0.464 **	
				0.191	
Currency crisis: Consensus index					0.11
					0.176
Control set of variables	Extended set	Extended set	Extended set	Extended set	Extended set
No. countries / No. observations	58/114	58/114	58/114	58/114	58/114

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The coefficients for control variables (initial income per capita, secondary schooling, inflation rate, trade openness, government expenditures, life expectancy, black market premium) and period dummies are not reported.

Table EA2
Investment Regression
Robustness: Extended Set of Control Variables
Dependent variables: Domestic price-investment rate, PPP-investment rate
Estimation: Panel feasible GLS
(Standard errors are presented below the corresponding coefficient.)

Dependent variable	PPP-investment rate		Domestic price-investment rate	
Estimation period	1981-2000	1971-2000	1981-2000	1971-2000
Unit of observations	Non-overlapping 10 year windows			
Moment of credit growth:				
Real credit growth - mean	0.223 ***	0.218 ***	0.26 ***	0.263 ***
	0.023	*0.027*	*0.038*	*0.036*
Real credit growth - standard deviation	-0.065 ***	-0.049 **	-0.083 ***	-0.061 **
	0.019	*0.024*	*0.026*	*0.026*
Real credit growth - skewness	-0.777 ***	-0.676 ***	-0.448 **	-0.546 ***
	0.145	*0.178*	*0.197*	*0.202*
Lagged investment rate:				
Lagged investment rate (PPP)	0.631 ***	0.706 ***		
	0.025	*0.031*		
Lagged investment rate (domestic price)			0.697 ***	0.718 ***
			0.039	*0.036*
Control set of variables	Extended set	Extended set	Extended set	Extended set
No. countries / No. observations	57/112	57/163	57/112	57/163

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The coefficients for control variables (initial income per capita, secondary schooling, inflation rate, trade openness, government expenditures, life expectancy, black market premium) and period dummies are not reported.

Table EA3
Three Stage Least Square Estimation

Dependent variable: Real per capita GDP growth
Estimation: Three stage least square estimation
(Standard errors are presented below the corresponding coefficient.)

Estimation period	1971-2000	
Unit of observations	Non-overlapping 10 year windows	
	[1]	[2]
Moment of credit growth:		
Real credit growth - mean	0.330 ***	0.325 ***
	0.027	*0.031*
Real credit growth - standard deviation	-0.061 ***	-0.154 ***
	0.014	*0.026*
Real credit growth - skewness	-0.669 ***	-0.498 ***
	0.151	*0.164*
Control set of variables	Simple set	Simple set
No. countries / No. observations	58/114	58/114

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The regression specification is identical to regression 5, Table II. In regression 1, mean credit growth is treated as endogenous and instrumented by lagged mean credit growth. In regression 2, mean credit growth and standard deviation of credit growth are treated as endogenous and are instrumented by the lagged mean credit growth and lagged standard deviation of credit growth. The coefficients for the control variables (initial income per capita and secondary schooling) and period dummies are not reported.

Table EA4
Extreme Observations, Coded Crises and Skewness
Sample: 29 countries with negative skewness (1981-2000)

Country	Extreme observation 1			Extreme observation 2			Extreme observation 3			Skewness		
	Year	Credit Growth	Crisis info*	Year	Credit growth	Crisis info*	Year	Credit growth	Crisis info*	All years	2 Extreme observations excluded	3 Extreme observations excluded
Indonesia	1999	-0.83	CC	1998	-0.29	CC	1991	0.07		-2.56	1.11	1.14
Senegal	1994	-0.51	CC	1984	-0.08	CC	1983	-0.08	CC	-2.01	0.77	0.78
Argentina	1990	-0.55	CC	1983	-0.23	CC	1984	-0.19	CC	-1.59	-0.27	0.25
Jordan	1989	-0.20	CC	1988	-0.05	CC	1997	-0.01		-1.11	0.73	0.87
Thailand	2000	-0.19	CC	1998	-0.12	CC	1999	-0.06	CC	-1.09	-0.71	-0.20
Sweden	1993	-0.26	CC	1991	-0.08	CC	1994	-0.07		-1.01	0.15	0.25
Panama	1988	-0.23	CC	1982	-0.03	C	1983	-0.03	C	-0.94	-0.10	-0.14
Bolivia	1984	-0.75	CC	1983	-0.74	CC	2000	-0.07		-0.93	1.51	1.60
Israel	1983	-0.08	CC	1985	-0.04	CC	1989	0.01		-0.92	-0.18	-0.04
Niger	1995	-0.58	C	1994	-0.27	CC	1997	-0.24		-0.88	0.57	0.85
Zimbabwe	1984	-0.46	CC	1999	-0.33	CC	1983	-0.20	CC	-0.84	-0.05	0.26
Kenya	1993	-0.38	CC	1990	-0.09	C	1981	-0.07	CC	-0.62	1.46	1.54
Singapore	1999	-0.04		1986	-0.02	C	1985	0.00		-0.62	-0.36	0.02
Jamaica	1991	-0.26	CC	1985	-0.16	C	1992	-0.15	C	-0.55	-0.48	-0.43
Gambia	1986	-0.52	CC	1992	-0.34	C	1987	-0.19	C	-0.53	0.87	1.10
Costa Rica	1981	-0.41	CC	1982	-0.24		1995	-0.20		-0.53	-0.06	0.14
Dominican Republic	1990	-0.32	CC	1984	-0.23	CC	1988	-0.19	CC	-0.53	-0.12	0.25
United States	1991	-0.06	C	1990	-0.05	C	1992	-0.03	C	-0.48	-0.12	0.13
Botswana	1985	-0.22	CC	1982	-0.13		1995	-0.13	C	-0.43	-0.29	-0.09
Finland	1994	-0.12	CC	1993	-0.12	CC	1992	-0.11	CC	-0.36	-0.25	-0.01
Malawi	1995	-0.51	CC	1987	-0.45	CC	1993	-0.29		-0.33	0.42	0.65
Chile	1983	-0.12	CC	1985	-0.09	CC	1990	-0.08	C	-0.28	0.08	0.76
Korea, Rep.	1998	0.04	CC	1988	0.05		1993	0.07		-0.28	-0.11	-0.04
Madagascar	1994	-0.25	CC	1981	-0.17	CC	1995	-0.17	CC	-0.22	0.09	0.32
France	1993	-0.05	C	1994	-0.03	C	1996	-0.03		-0.20	-0.17	-0.15
Malaysia	1998	-0.02	CC	1999	-0.01	CC	1987	-0.01	CC	-0.15	-0.08	0.11
Mexico	1995	-0.49	CC	1982	-0.48	CC	1996	-0.41	CC	-0.14	-0.03	0.15
Turkey	1994	-0.26	CC	1988	-0.15	CC	1999	-0.15	CC	-0.06	0.13	0.23
Papua New Guinea	1999	-0.16		1995	-0.13		1993	-0.12	C	-0.04	-0.01	0.04

*C refers to a crisis coded by any of the ten crisis indexes we list in the extended appendix; CC refers to a crisis coded by any of the consensus indexes described in Section III.A.

Note: 17 observations are not associated with a coded crisis and can be explained as follows. First, if we allow a one-year lag, we can explain 4 extreme observations where a credit crunch occurs the year following a coded crisis: Costa Rica (1982 and 1995), Malawi (1993), and Sweden (1994). Second, 5 additional extreme observations correspond to an actual crisis, but have not been coded by any of the ten indexes we have considered. These include Papua New Guinea (1995, 1999), where Milesi-Ferreti and Razin (1998) report a currency crisis in 1995 and 1998 and the IMF granted rescue packages of 1.2% and 3.2% of GDP in 1995 and 2000, respectively; Jordan (1997), where a bailout of 4.2% of GDP was granted; Niger (1997), with credit growth of -24%, is the continuation of the 1994-95 crisis discussed above; Bostwana (1982), where Milesi-Ferreti and Razin (1988) and the IMF staff report (IMF, 1982) record a currency and current account crisis as well as a credit crunch. Third, the remaining 8 country-years had indeed no crisis. Six of these observations correspond to the third extreme observation and, in 4 cases, skewness is either positive or substantially reduced after the elimination of two observations: Indonesia (1993), Bolivia (2000), Israel (1989) and Korea (1988).
All credit growth series are required to have 20 observations over the 1981-2000 period. This restriction excludes Columbia, which does not have data for 1986-1987 and 1989-1990, and China, whose credit growth series starts in 1986.

Table EA5
Consensus Crisis Years and Skewness in 58 Countries Sample (1981-2000)

Country	Banking crises	Currency crises	Sudden stops	Skewness all years	Skewness without crisis years	Difference in skewness
Indonesia	1992;1998;1999;2000	1998;1999		-2.56	1.09	3.65
Senegal	1988	1981;1994	1982	-2.01	0.96	2.97
Argentina	1982;1990;1995	1983;1984;1990;1995		-1.59	0.02	1.61
Jordan	1989	1984;1988;1989	1984;1989;1992	-1.11	0.63	1.73
Thailand	1985;1986;1987;1998;1999;2000	1998	1998	-1.09	-0.10	0.99
Sweden	1991;1992;1993	1993		-1.01	0.05	1.06
Panama	1988;1989		2000	-0.94	-0.25	0.69
Bolivia		1982;1983;1984;1985		-0.93	0.00	0.93
Israel	1983	1983	1983;1985	-0.92	-0.18	0.74
Niger	1983	1981;1994		-0.88	-1.03	-0.15
Zimbabwe	1995;1996;1997;1998	1983;1984;1998;1999		-0.84	0.15	0.99
Kenya	1993;1994;1995	1981		-0.62	0.46	1.08
Jamaica	1994;1995;1996;1997;1998;1999;2000	1991;1994		-0.55	-0.32	0.23
Gambia		1982;1984;1986	1982;1984;1986	-0.53	0.01	0.54
Costa Rica		1981		-0.53	-0.15	0.38
Dominican Republic		1984;1985;1988;1990;1991		-0.53	0.28	0.81
Botswana		1985		-0.43	-0.30	0.13
Finland	1991;1992;1993;1994	1993		-0.36	-0.14	0.23
Malawi		1982;1987;1997	1981;1995	-0.33	0.35	0.68
Chile	1982;1983	1982;1983;1985	1998	-0.28	0.11	0.38
Korea, Rep.	1998;1999;2000			-0.28	-0.08	0.19
Madagascar	1988	1981;1987;1994;1995	1981	-0.22	0.17	0.39
Malaysia	1986;1987;1988;1998;1999;2000			-0.15	0.00	0.15
Mexico	1982;1983;1984;1995;1996;1997	1982;1985;1995	1995	-0.14	0.11	0.25
Turkey	1982;1991;1994	1984;1988;1994;1998;1999	1988;1994	-0.06	0.44	0.50
India		1991		0.07	0.10	0.02
Spain		1992		0.11	0.01	-0.10
Uruguay	1981;1982;1983;1984	1982;1985;1991	1983	0.15	1.21	1.06
Norway	1988;1989;1990;1991;1992;1993			0.23	0.27	0.03
Burkina Faso	1988;1989;1990;1991;1992;1993;1994	1994		0.28	2.21	1.93
Honduras		1990;1994		0.30	0.76	0.46
Paraguay	1995;1996;1997;1998;1999	1984;1985;1988;1989	1988	0.55	0.88	0.34
Denmark			1989	0.63	0.65	0.02
Brazil	1990;1995;1996;1997;1998;1999	1982;1985;1987;1990;1991;1995;1996	1983	0.92	0.26	-0.66
Morocco		1984;1985;1986		1.38	2.40	1.03

Note: Consensus crises are meant to capture truly severe crises. They are defined in subsection III.A.

Table EA6
Skewness and Growth: GMM System Estimations
Dependent variable: Real per capita GDP growth
(Standard errors are presented below the corresponding coefficient.)

Estimation period	1971-2000	
Unit of observations	Non-overlapping 10 year windows	
	[1]	[2]
Moment of credit growth:		
Real credit growth - mean	0.26 ***	0.24 ***
	0.039	*0.044*
Real credit growth - standard deviation	-0.109	-0.15
	0.089	*0.104*
Real credit growth - skewness	-0.601 ***	-0.589 **
	0.163	*0.222*
Set of control variables	Simple set	Simple set
No. countries / No. observations	58/166	58/166
SPECIFICATION TESTS (*p* -values)		
(a) Sargan-Hansen Test:	0.13	0.18
(b) Second-order serial correlation:	0.29	0.3

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: 2-step system GMM estimates are reported. Robust standard errors are computed using Windmeijer's (2005) small sample correction. In regression 1, all regressors are treated as endogenous. In regression 2, all regressors are treated as endogenous with the exception of skewness. Appropriate lagged levels (differences) are used as instruments to estimate the difference (level) equation. All GMM system regressions include time effects and country fixed effects. The coefficients for the control variables (initial income per capita and secondary schooling) and period dummies are not reported.

Table EA7
Skewness and Growth: Country Groupings GMM System Estimations
Dependent variable: Real per capita GDP growth
(Standard errors are presented below the corresponding coefficient.)

Financial liberalization indicator	De jure (Quinn)	De jure (Mody)
Estimation period	1971-2000	
Unit of observations	Non-overlapping 10 year windows	
	[1]	[2]
Moment of credit growth:		
Real credit growth - mean	0.042	0.129
	0.063	*0.082*
Real credit growth - standard deviation	-0.135 ***	-0.126 **
	0.026	*0.05*
Real credit growth - skewness	0.04	-0.037
	0.134	*0.218*
Moment of credit growth interacted:		
Mean credit growth* MEC_FL	0.278 **	0.132
	0.113	*0.142*
Standard deviation of credit growth* MEC_FL	0.095	0.075
	0.06	*0.093*
Skewness of credit growth* MEC_FL	-1.007 ***	-1.222 ***
	0.344	*0.437*
MEC_FL	-1.899 *	-0.697
(Medium contract enforceability*financial liberalization)	*1.028*	*2.063*
Set of control variables	Simple set	Simple set
No. countries / No. observations	49/144	32/93
SPECIFICATION TESTS (*p* -values)		
(a) Sargan-Hansen Test:	0.32	0.35
(b) Second-order serial correlation:	0.28	0.23

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: 2-step system GMM estimates are reported. Robust standard errors are computed using Windmeijer's (2005) small sample correction. The coefficients for the control variables (initial income per capita and secondary schooling) and period dummies are not reported.

Table EA8
Skewness and Growth
Robustness: Extended Set of Controls

Dependent variable: Real per capita GDP growth
Estimation: Panel feasible GLS
(Standard errors are presented below the corresponding coefficient.)

Estimation period	1961-2000	1971-2000	1981-2000
Unit of observations		Non-overlapping 10 year windows	
	[1]	[2]	[3]
Moments of real credit growth:			
Real credit growth - mean	0.133 ***	0.126 ***	0.138 ***
	0.011	*0.013*	*0.01*
Real credit growth - standard deviation	-0.036 ***	-0.037 ***	-0.046 ***
	0.01	*0.01*	*0.009*
Real credit growth - skewness	-0.261 ***	-0.234 ***	-0.226 ***
	0.072	*0.073*	*0.071*
Control variables:			
Initial secondary schooling	0.001	0.008	0.01
	0.005	*0.006*	*0.007*
Initial income per capita	-0.27 *	-0.405 **	-0.217
(in logs)	*0.15*	*0.162*	*0.179*
Openness to trade	-0.045	0.346 **	0.769 ***
	0.147	*0.159*	*0.159*
Government consumption as a share of GDP	-0.042 ***	-0.059 ***	-0.063 ***
	0.014	*0.014*	*0.014*
Inflation rate	-0.016 ***	-0.015 ***	-0.007 *
	0.004	*0.004*	*0.004*
Life expectancy at birth	0.083 ***	0.073 ***	0.039 ***
	0.015	*0.015*	*0.014*
Black market premium	-0.131	-0.178 *	-0.164 ***
	0.081	*0.099*	*0.015*
No. countries / No. observations	58/209	58/166	58/114

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The specification of the regressions is identical to regressions 4 to 6, Table II and includes five additional control variables: Openness to trade, government consumption as a share of GDP, life expectancy at birth, and black market premium.

Table EA9
Skewness and Growth: Country Groupings Estimations
Robustness: Alternative Definitions of the MEC Set
Dependent variable: Real per capita GDP growth
Estimation: Panel feasible GLS
(Standard errors are presented below the corresponding coefficient.)

Estimation period	1981-2000		
Unit of observations	Non-overlapping 10 year windows		
	[1]	[2]	[3]
Moment of credit growth:			
Real credit growth - mean	0.084 ***	0.127 ***	0.106 ***
	0.019	*0.013*	*0.013*
Real credit growth - standard deviation	-0.057 ***	-0.066 ***	-0.047 ***
	0.011	*0.008*	*0.009*
Real credit growth -skewness	-0.01	-0.182 **	-0.172 **
	0.098	*0.072*	*0.069*
Moment of credit growth interacted:			
Mean credit growth * MEC_FL	0.195 ***	0.184 ***	0.312 ***
	0.037	*0.06*	*0.06*
Standard deviation of credit growth * MEC_FL	0.018	0.095 ***	-0.036
	0.023	*0.026*	*0.031*
Skewness of credit growth * MEC_FL	-0.814 ***	-0.551 ***	-0.625 ***
	0.189	*0.198*	*0.195*
MEC_FL	-0.238	-1.453 ***	-0.249
(Medium contract enforceability*financial liberalization)	*0.261*	*0.561*	*0.593*
Skewness (fully liberalized MEC countries):			
Coefficient	-0.82	-0.73	-0.8
Standard error	*0.16*	*0.18*	*0.19*
F-test Ho: Coefficient=0 (P-value)	0	0	0
Set of control variables	simple set	simple set	simple set
No. countries / No. observations	58/114	58/114	58/114

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The specification of the regressions is identical to regression 1, Table III with alternative definitions of the MEC set. Countries classified as MEC have a PRS law and order index equal to (i) 3, 4 or 5 (regression 1), (ii) 2, 3 or 4 (regression 2), (iii) 3 or 4 (regression 3). The coefficients for the other control variables (initial income per capita and secondary schooling) are not reported.

Table EA10

Negative Skewness and Growth

Dependent variable: Real per capita GDP growth

(Standard errors are presented below the corresponding coefficient.)

Estimation period	1961-2000	1971-2000	1981-2000
Estimation technique		FGLS	
Unit of observations		Non-overlapping 10 year windows	
	[1]	[2]	[3]
Moments of real credit growth:			
Real credit growth - mean	0.13 ***	0.154 ***	0.161 ***
	0.01	*0.01*	*0.013*
Real credit growth - standard deviation	-0.055 ***	-0.058 ***	-0.05 ***
	0.01	*0.009*	*0.01*
Magnitude of Skewness			
Real credit growth - magnitude of negative skewness	0.479 ***	0.476 ***	0.551 ***
	0.153	*0.175*	*0.175*
Real credit growth - magnitude of positive skewness	-0.122	-0.17	-0.15
	0.112	*0.108*	*0.119*
No. countries / No. observations	58/209	58/166	58/114

* significant at 10%; ** significant at 5%; *** significant at 1%

Note : The variable "magnitude of negative skewness" is equal to the absolute value of skewness if skewness is negative and equal to zero otherwise. The variable "magnitude of positive skewness" is equal to skewness if skewness is positive and equal to zero otherwise. The coefficients for the control variables (initial income per capita and secondary schooling) and period dummies are not reported.

Table EA11

Crisis Indexes, Skewness and Growth

Dependent variable: Real per capita GDP growth

Estimation: Panel feasible GLS

(Standard errors are presented below the corresponding coefficient.)

Estimation period	1981-2000									
Unit of observations	Non-overlapping 10 year windows									
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Moment of credit growth:										
Real credit growth - mean	0.178 ***	0.16 ***	0.165 ***	0.161 ***	0.165 ***	0.162 ***	0.159 ***	0.162 ***	0.164 ***	0.158 ***
	0.005	*0.012*	*0.007*	*0.012*	*0.007*	*0.011*	*0.01*	*0.011*	*0.008*	*0.013*
Real credit growth - standard deviation	-0.064 ***	-0.051 ***	-0.06 ***	-0.05 ***	-0.061 ***	-0.05 ***	-0.06 ***	-0.051 ***	-0.057 ***	-0.048 ***
	0.007	*0.009*	*0.007*	*0.009*	*0.007*	*0.009*	*0.007*	*0.009*	*0.006*	*0.009*
Real credit growth - skewness		-0.246 ***		-0.246 ***		-0.253 ***		-0.266 ***		-0.267 ***
		0.075		*0.077*		*0.079*		*0.073*		*0.071*
Crisis indexes:										
Banking crisis: Caprio Klingebiel index	0.258 **	0.123								
	0.127	*0.139*								
Banking crisis: Detragiache et al. index			0.223 **	0.155						
			0.105	*0.118*						
Banking crisis: Consensus index					0.228 **	0.12				
					0.110	*0.132*				
Sudden stop: Consensus index							0.464	0.338		
							0.201 **	*0.214*		
Currency crisis: Consensus index									0.072	-0.039
									0.169	*0.224*
Set of control variables	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set
No. countries / No. Observations	58/114	58/114	58/114	58/114	58/114	58/114	58/114	58/114	58/114	58/114

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: A crisis index is equal to one, if a country-decade experienced a crisis, zero otherwise. See Section III.A. for the construction of the consensus crisis indexes. The coefficients for the control variables (initial income per capita and secondary schooling) and period dummies are not reported.

Table EA12
Skewness and Growth
Robustness: Full Sample of 83 Countries

Dependent variable: Real per capita GDP growth
Estimation: Panel feasible GLS
(Standard errors are presented below the corresponding coefficient.)

Estimation period	1961-2000	1971-2000	1981-2000	1961-2000	1971-2000	1981-2000
Unit of observations	Non-overlapping 10 year windows					
	[1]	[2]	[3]	[4]	[5]	[6]
Moments of real credit growth:						
Real credit growth - mean	0.14 ***	0.137 ***	0.128 ***	0.115 ***	0.107 ***	0.106 ***
	0.009	*0.011*	*0.008*	*0.01*	*0.01*	*0.011*
Real credit growth - standard deviation	-0.031 ***	-0.038 ***	-0.031 ***	-0.023 ***	-0.026 ***	-0.018 **
	0.007	*0.008*	*0.006*	*0.008*	*0.008*	*0.007*
Real credit growth - skewness	-0.289 ***	-0.213 ***	-0.224 ***	-0.225 ***	-0.196 ***	-0.189 ***
	0.065	*0.065*	*0.05*	*0.063*	*0.058*	*0.067*
Control variables:						
Initial secondary schooling	0.005	0.012 **	0.017 **	0.006	0.012 **	0.012 **
	0.006	*0.005*	*0.007*	*0.004*	*0.005*	*0.005*
Initial income per capita	0.082	-0.182	-0.244 **	-0.472 ***	-0.601 ***	-0.485 ***
	0.122	*0.118*	*0.122*	*0.12*	*0.123*	*0.121*
Openness to trade				0.327 **	0.481 ***	0.711 ***
				0.137	*0.151*	*0.158*
Government consumption as a share of GDP				-0.03 ***	-0.034 ***	-0.032 **
				0.012	*0.012*	*0.014*
Inflation rate				-0.01 ***	-0.011 ***	-0.008 **
				0.004	*0.004*	*0.003*
Life expectancy at birth				0.117 ***	0.119 ***	0.096 ***
				0.014	*0.016*	*0.015*
Black market premium				-0.165 ***	-0.145 **	-0.120 ***
				0.064	*0.059*	*0.021*
No. countries / No. observations	83/299	83/237	83/161	83/299	83/237	83/161

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The specifications for regressions 1-3 are identical to regressions 4-6 in Table II. The specifications for regressions 4-6 are identical to regressions 1-3, Table EA8.

Table EA13
Skewness and Growth
Robustness: Outliers
Dependent variable: Real per capita GDP growth
Estimation: Panel feasible GLS
(Standard errors are presented below the corresponding coefficient.)

Estimation period	1961-2000						
Unit of observations	Non-overlapping 10 year windows						
Outlier omitted	None	Bolivia (60s)	Niger (70s)	Senegal (70s)	Jordan (80s)	Papua New Guinea (80s)	Niger (80s)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Moments of credit growth:							
Real credit growth - mean	0.16 ***	0.16 ***	0.16 ***	0.16 ***	0.16 ***	0.16 ***	0.15 ***
	0.01	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
Real credit growth - standard deviation	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***
	0.01	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
Real credit growth - skewness	-0.33 ***	-0.31 ***	-0.32 ***	-0.31 ***	-0.35 ***	-0.34 ***	-0.32 ***
	0.07	*0.07*	*0.07*	*0.07*	*0.07*	*0.08*	*0.07*
Set of control variables	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set
No. countries / No. observations	58/209	58/208	58/208	58/208	58/208	58/208	58/208

* significant at 10%; ** significant at 5%; *** significant at 1%

Estimation period	1961-2000							
Unit of observations	Non-overlapping 10 year windows							
Outlier omitted	Brazil (70s)	Indonesia (70s)	Singapore (70s)	Korea (80s)	Botswana (80s)	Japan (60s)	China (90s)	all outliers
	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]
Moments of credit growth:								
Real credit growth - mean	0.16 ***	0.16 ***	0.16 ***	0.15 ***	0.16 ***	0.16 ***	0.15 ***	0.15 ***
	0.01	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
Real credit growth - standard deviation	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***
	0.01	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
Real credit growth - skewness	-0.34 ***	-0.33 ***	-0.33 ***	-0.31 ***	-0.33 ***	-0.35 ***	-0.30 ***	-0.24 ***
	0.07	*0.07*	*0.07*	*0.07*	*0.07*	*0.07*	*0.07*	*0.07*
Set of control variables	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set	Simple set
No. countries / No. observations	58/208	58/208	58/208	58/208	58/208	58/208	57/208	57/196

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The specification of the regressions is identical to regression 4, Table II. A country-decade is an outlier if the absolute value of its corresponding residual exceeds two standard deviations.

Table EA14
Sample of Countries

Algeria		Haiti		Philippines	
Argentina	*	Honduras	*	Portugal	*
Australia	*	Iceland	*	Senegal	*
Austria	*	India	*	Sierra Leone	
Bangladesh	*	Indonesia	*	Singapore	*
Belgium	*	Iran, Islamic Rep.		South Africa	
Bolivia	*	Ireland	*	Spain	*
Botswana	*	Israel	*	Sri Lanka	
Brazil	*	Italy	*	Sweden	*
Burkina Faso	*	Jamaica	*	Switzerland	*
Canada	*	Japan	*	Syrian Arab Republic	
Chile	*	Jordan	*	Thailand	*
China	*	Kenya	*	Togo	
Colombia	*	Korea, Rep.	*	Trinidad and Tobago	
Congo, Dem. Rep.		Madagascar	*	Tunisia	*
Congo, Rep.		Malawi	*	Turkey	*
Costa Rica	*	Malaysia	*	Uganda	
Cote d'Ivoire		Mexico	*	United Kingdom	*
Denmark	*	Morocco	*	United States	*
Dominican Rep.	*	Netherlands	*	Uruguay	*
Ecuador		New Zealand	*	Venezuela	
Egypt, Arab Rep.		Nicaragua		Zambia	
El Salvador		Niger	*	Zimbabwe	*
Finland	*	Nigeria			
France	*	Norway	*		
Gambia, The	*	Pakistan			
Germany	*	Panama	*		
Ghana		Papua New Guinea	*		
Greece	*	Paraguay	*		
Guatemala		Peru			

* Countries in the 58 countries sample

Table EA15
Definitions and Sources of Variables used in the Regression Analysis

Variable	Definition and construction	Source
GDP per capita	Ratio of total GDP to total population. GDP is in 1995 constant US$.	World Development Indicators (2003).
GDP per capita growth	Log difference of real GDP per capita.	World Development Indicators (2003).
Initial GDP per capita	Initial value of ratio of total GDP to total population (in logs). GDP is in 1995 constant US$.	World Development Indicators (2003).
Secondary schooling	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 the private sector.	Author's calculations using data from IFS - line 22, and central banks' publications. The method of calculations is based on Beck, Demirguc-Kunt and Levine (1999). Domestic bank credit claims are deflated with end of the year CPI index.
Investment rate PPP-prices	Ratio of investment to GDP measured in PPP-adjusted prices.	Penn World Tables 6.1
Investment rate domestic prices	Ratio of investment to GDP measured in domestic prices.	Penn World Tables 6.1
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).
Terms of trade growth	Growth rate of terms of trade Index.	World Development Indicators (2003).
Government consumption	Ratio of government consumption to GDP.	World Development Indicators (2003).
CPI	Consumer price index (1995 = 100) at the end of the year.	Author's calculations with data from IFS.
Inflation rate	Annual % change in CPI.	Author's calculations with data from IFS.
Life expectancy	Life expectancy at birth.	World Development Indicators (2003).
Trade openness	Residual of a regression of the log of the ratio of exports and imports (in 1995 US$) to GDP (in 1995 US$), on the logs of area and population, and dummies for oil exporting and for landlocked countries.	Author's calculations with data from Global Development Network (2002).
Black market premium	Ratio of black market exchange rate and official exchange rate minus one (in percentage points).	Author's calculations with data from Global Development Network (2002).
MEC_FL index	See Section 3 for the construction of the composite index of financial liberalization and medium degree of contract enforceability.	Degree of contract enforceability: Law and order index from Political Risk Service (2004). Financial liberalization indexes: see Extended Appendix.
Financial liberalization indexes	See Section C2	See Section C2
Crisis indexes	See Section C1	See Section C1

Table EA16
Consensus Crisis Years and Kurtosis
Sample: 35 countries with at least one consensus crisis (1981-2000)

Number of countries with reduced kurtosis after elimination of crisis years	Average kurtosis of credit growth	
	Complete distributions	Distributions without crisis years
24	3.91	3.03

Note: For each country we exclude consensus crises and compute the effect on kurtosis.

Table EA17
Consensus Crisis Years and Skewness
Sample: 35 countries with at least one consensus crisis (1981-2000)

Number of countries with increased skewness after elimination of crisis years	Average skewness of credit growth	
	Complete distributions	Distributions without crisis years
32	-0.41	0.32

Note: For each country we exclude consensus crises and compute the effect on skewness.

Table EA18
Observations with Highest Impact on Kurtosis, Coded Crises and Kurtosis
Sample: 35 countries with at least one consensus crisis (1981-2000)

Observations with highest impact on kurtosis		Complete credit growth distributions	Credit growth distributions without observations with highest impact on kurtosis		
Observations eliminated	Percentage of crisis years	Average kurtosis	Average kurtosis	Share of countries with kurtosis <3.2	Share of countries with kurtosis<3 or reduced by 80% in absolute value
2	60%	3.91	2.5	83%	89%
3	62%	3.91	2.13	97%	100%

Note: For each country we eliminate the 2 (3) observations whose joint omission results in the highest reduction in kurtosis.

Table EA19
Observations with Highest Impact on Skewness, Coded Crises and Skewness
Sample: 35 countries with at least one consensus crisis (1981-2000)

Observations with highest impact on skewness		Complete credit growth distributions	Credit growth distributions without observations with highest impact on skewness		
Observations eliminated	Percentage of crisis years	Average skewness	Average skewness	Share of countries with skewness >-0.2	Share of countries with skewness>0 or reduced by 80% in absolute value
2	76%	-0.41	0.93	91%	80%
3	74%	-0.41	1.16	97%	97%

Note: For each country we eliminate the 2 (3) observations whose joint omission results in the highest increase in skewness.

Table EA20

Observations with Highest Impact on Skewness of Real per Capita Growth in the Sample of Barro (2006, Table III)

Sample: G7 countries (1890-2004)

Country	Skewness of complete distribution	Skewness of truncated distribution	Change in skewness	Disasters identified by Barro (2006)	Other events
France	0.51	2.84	2.33	1917;1918;1940;1941;1944	
Germany	-4.98	0.53	5.51	1914;1919;1945;1946	1923
Italy	-1.01	1.51	2.52	1919;1920;1943;1944;1945	
UK	-0.94	-0.03	0.91	1919;1920;1931;1945	1908
Canada	-0.92	-0.03	0.89	1919;1921;1931;1932	1914
US	-0.80	0.61	1.42	1930;1932;1946	1908;1914
Japan	-5.53	0.29	5.82	1945	1896;1899;1920;1930

Note: For each country, we eliminate the five observations whose joint omission results in the highest increase in skewness. In all countries, the 5 years with the highest impact on skewness are the five lowest real GDP per capita growth rates observations. Observations unrelated with a disaster identified by Barro (2006) include: 1923 for Germany, the year of the hyperinflation; 1914 for Canada and US, the starting year of WWI ; 1908, the year of the recession that followed the 1907 US Banking Panic. In Japan, negative skewness is fully removed by eliminating 1945, the observation with the lowest real GDP per capita growth rate.

Table EA21

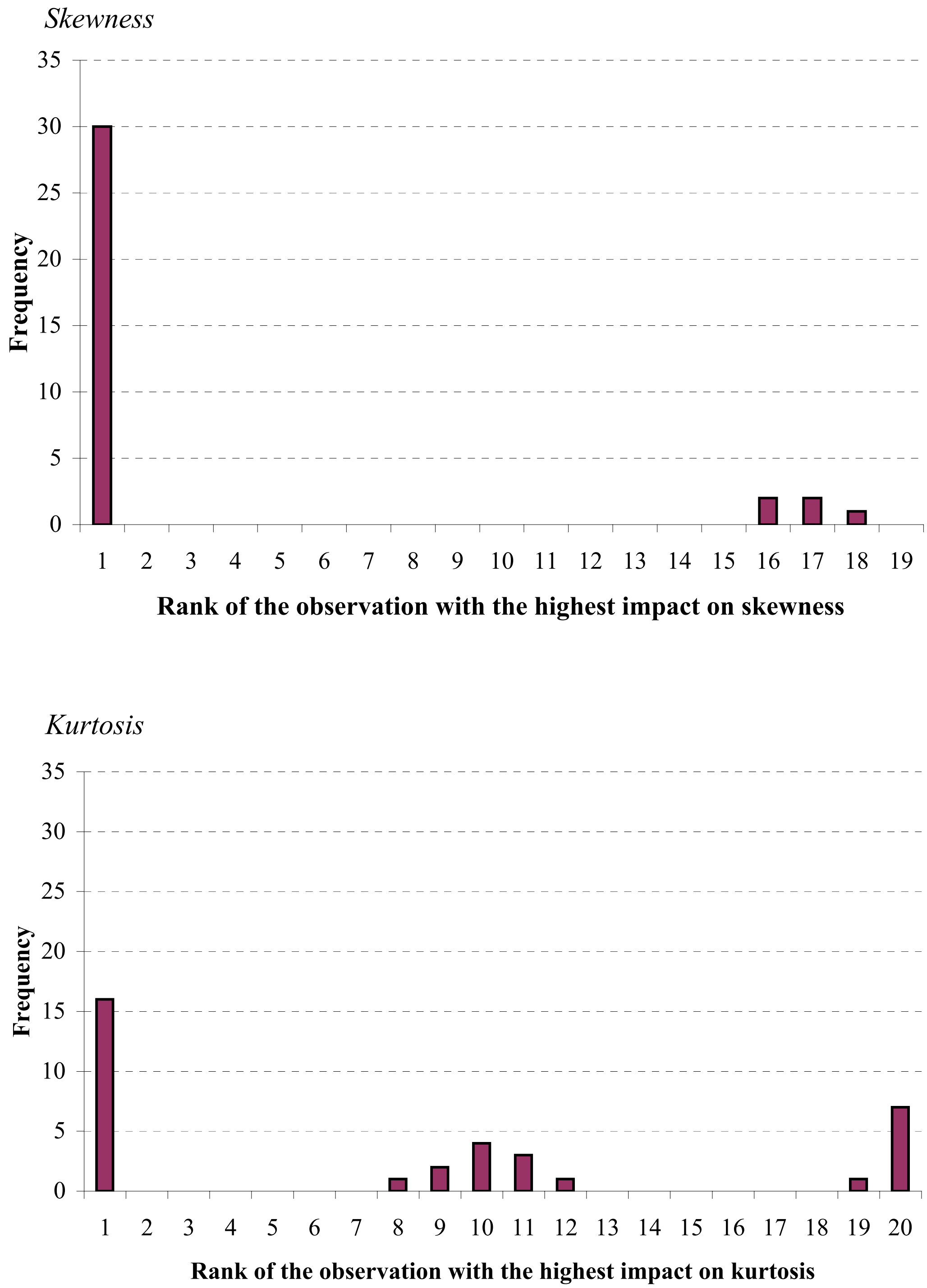
Observations with Highest Impact on Kurtosis of Real Per Capita Growth in the Sample of Barro (2006, Table III)

Sample: G7 countries (1890-2004)

Country	Kurtosis of complete distribution	Kurtosis of truncated distribution	Change in kurtosis	Disasters identified by Barro (2006)	Booms	Other events
France	12.39	5.86	-6.53	1918;1940;1941;1944	1946	
Germany	38.21	5.09	-33.12	1914;1919;1945;1946		1923
Italy	10.38	4.11	-6.27	1919;1944;1945	1946;1947	
UK	5.75	3.58	-2.17	1919;1920;1931	1940;1941	
Canada	5.43	3.67	-1.76	1919;1921;1931	1942	1914
US	6.95	3.73	-3.22	1932;1946	1941;1942;1943	
Japan	48.85	2.75	-46.10	1945	1898	1899;1920;1930

Note: For each country, we eliminate the five observations whose joint omission results in the highest decrease in kurtosis. A boom is defined as an observation that is among the five largest real GDP per capita growth rates in each country. In Japan, excess kurtosis is fully removed by eliminating 1945, the observation with the lowest real GDP per capita growth rate.

Figure EA1. Observations with the Highest Impact on Skewness and Kurtosis

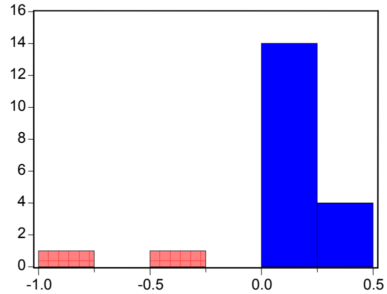


Note: For each country, we select the observation whose elimination results in the largest increase in skewness and in the largest reduction in kurtosis. Each observation is then characterized by its rank in the country's distribution of credit growth rates, with rank 1 being the lowest and rank 20 the highest. The figure plots the frequency of eliminated observations of each rank for skewness (upper panel) and for kurtosis (lower panel).

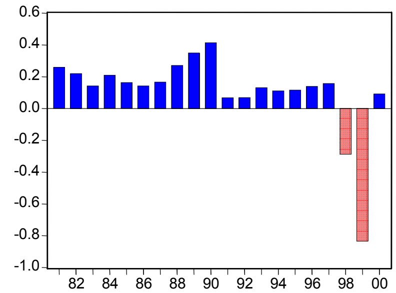
Figure EA2. Examples of Countries where Kurtosis Captures the Occurrence of Crises

1. Indonesia

Histogram:



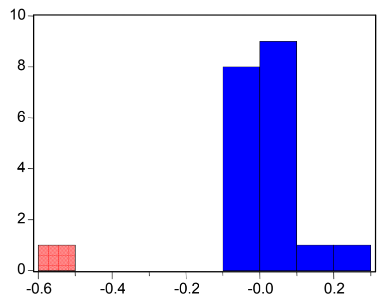
Bar graph:



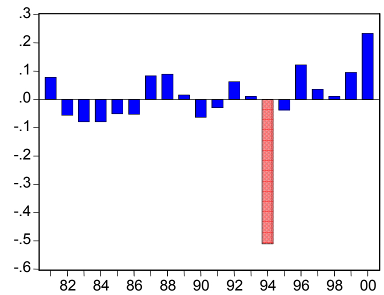
Full Sample: Skewness: -2.56, Kurtosis: 9.90

2. Senegal

Histogram:



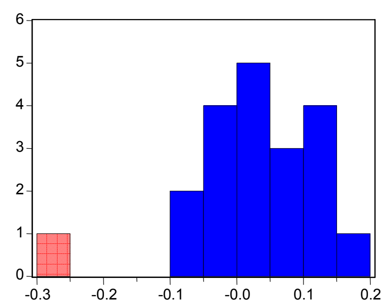
Bar graph:



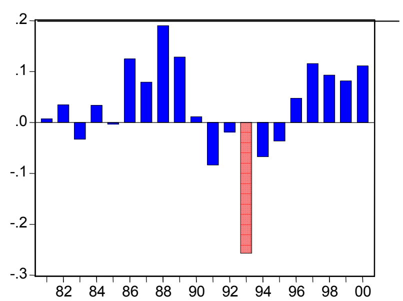
Full Sample: Skewness: -2.01**,** Kurtosis: 8.93

3. Sweden

Histogram:



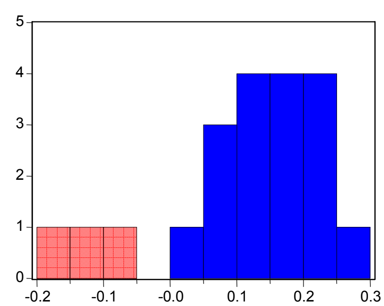
Bar graph:



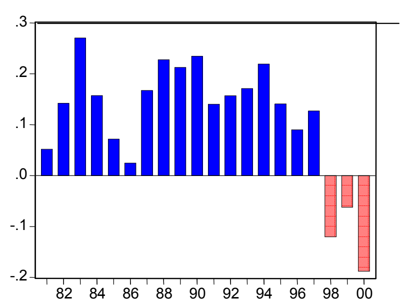
Full Sample: Skewness: -1.01**,** Kurtosis: 4.60

4. Thailand

Histogram:



Bar graph:



Full Sample: Skewness: -1.09, Kurtosis: 3.48

Note: On each plot, the shaded area corresponds to the observations that have the largest impact on both skewness and kurtosis.

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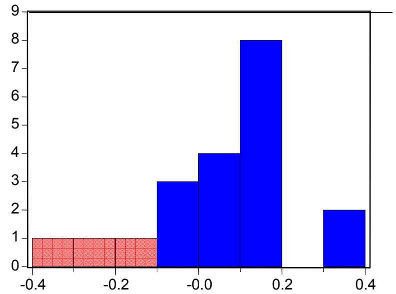
Figure EA3. Examples of Countries Where Kurtosis Captures Peakedness

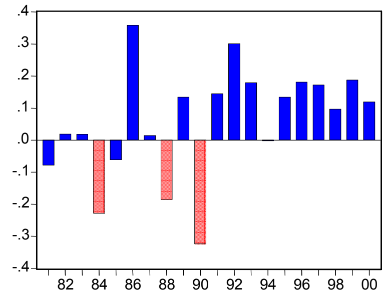
1. Dominican Republic

Skewness

Histogram:

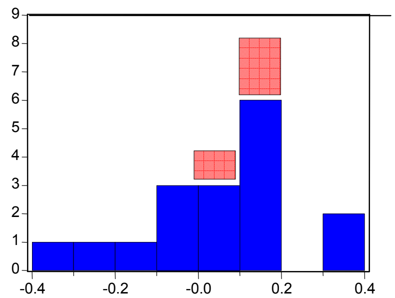


Bar graph:

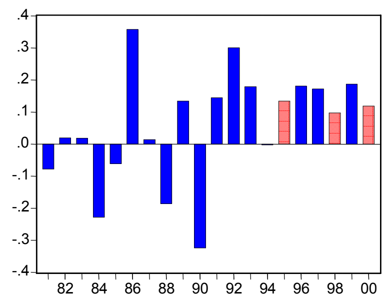


Kurtosis

Histogram:



Bar graph:

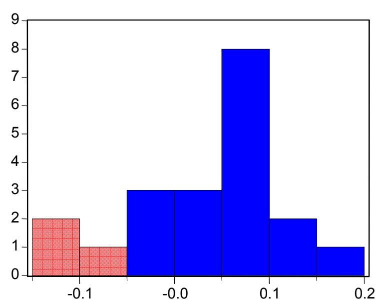


Full Sample: Skewness: -0.53, Kurtosis: 2.85

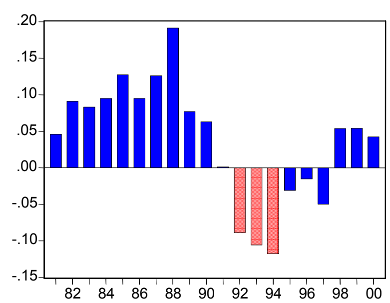
2. Finland

Skewness

Histogram:

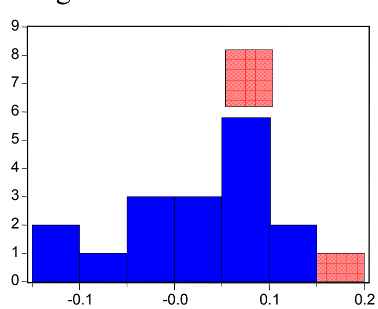


Bar graph:

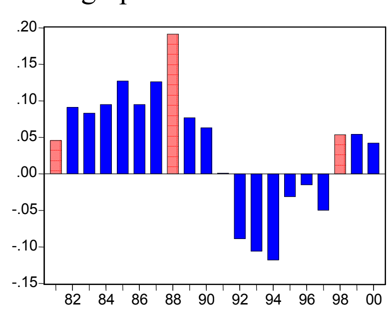


Kurtosis

Histogram:



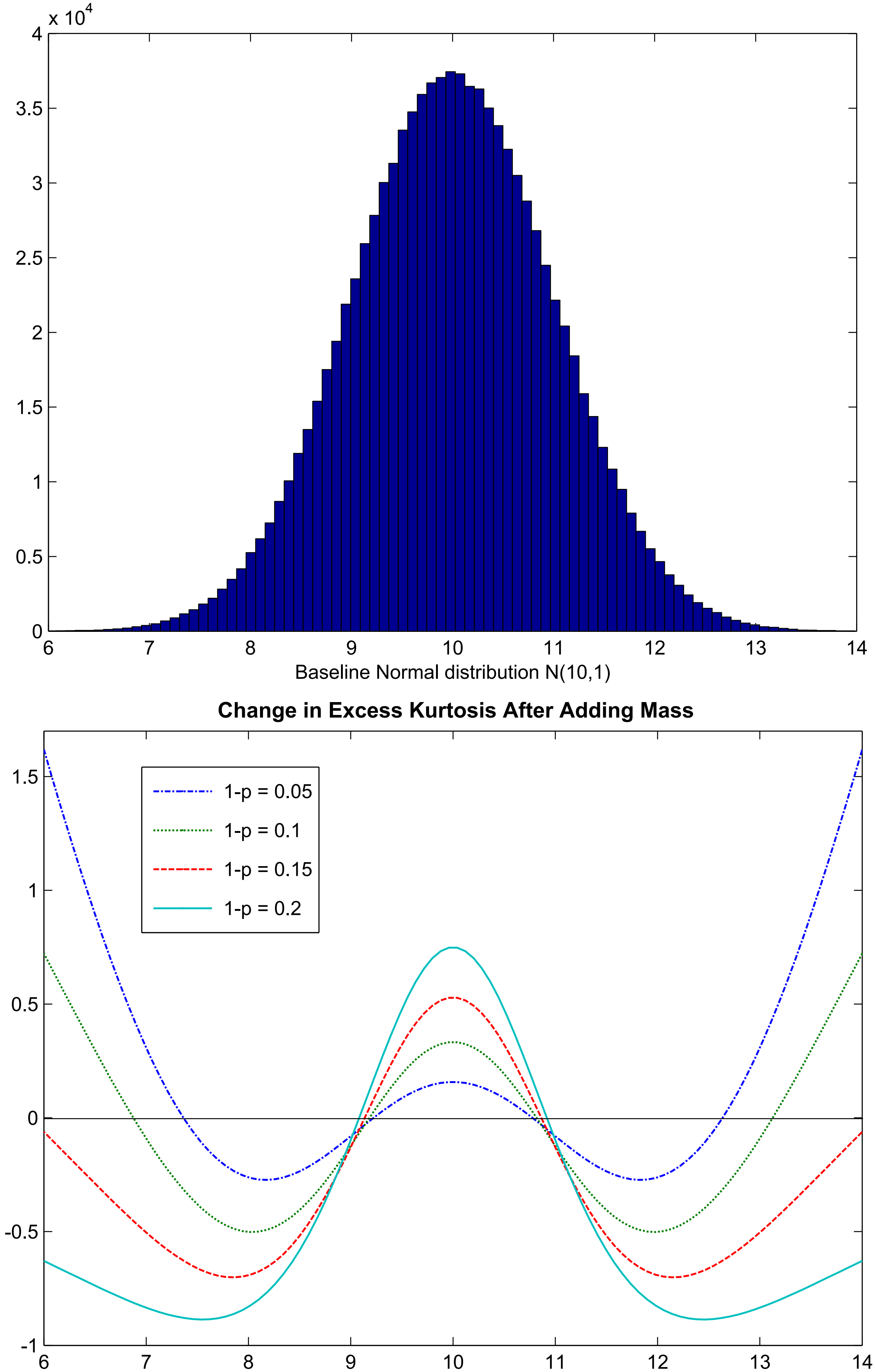
Bar graph:



Full Sample: Skewness: -0.36, Kurtosis: 2.40

Note: On each plot, the shaded area corresponds to the observations that have the largest impact on either skewness or kurtosis.

Figure EA4. Effect on Excess Kurtosis of Adding Mass to a Normal Distribution



Note: This figure depicts the effect on excess kurtosis of adding a mass point to a N(10,1) distribution; 1-p is the probability of this mass point. The frequency distribution in the upper panel has been generated by 10^6 random draws from a Normal distribution N(10,1).