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Getting Shut Out of the International Capital Markets: It Doesn't Take Much

Robert Flood and Nancy Marion

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Prepared by Robert Flood and Nancy Marion¹

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Abstract

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We use a simple model of international lending to show that an emerging market borrower who might default can be shut out of international capital markets without warning. A modest haircut on obligations, for example, can shut down lending.

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Author(s) E-Mail Address: rflood@imf.org; nancy.marion@dartmouth.edu

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I. INTRODUCTION

Emerging markets can find themselves suddenly cut off from international capital markets. Mexico found itself cut off after it defaulted in 1982; seven years passed before it regained full access. During the financial crisis of 1994–95, Mexico was again shut out of the international capital markets, but this time for only seven months. Korea and Indonesia, and other Asian emerging markets, faced a similar situation in late 1997, unable to obtain new private foreign financing when they needed it desperately. And, of course, Argentina was shut out of international capital markets months before it defaulted formally in December, 2001.

Shutdowns, extreme versions of sudden stops, can be very simple affairs.² They happen when potential lenders cannot find a price at which they can lend profitably to a potential borrower. The absence of a profitable price can occur when investors need to charge a higher price as default risk increases, but a higher price, in turn, makes default more likely. Sometimes the default-risk and loan-price changes result in continued lending, sometimes not.

We present below a simple model showing how easily an emerging market borrower can be shut out of international capital markets. The shut out can occur without markets first signaling problems through exorbitant lending rates. It also appears that even a modest haircut can shut down lending. This outcome is at odds with the view of economists such as Charles Calomiris (2001), who reasoned that a modest 10–15 percent haircut for Argentina's creditors might have reduced Argentina's debt burden sufficiently to allow it to obtain additional resources from the international capital markets.³ Our model suggests that it may not take a very large shock to shut down international lending completely.

² The term “sudden stop” has been used by Calvo, Izquierdo, and Mejia (2004) to mean a severe contraction in international lending. Operationally, they define a sudden stop if the year-on-year fall in capital flows to an emerging market is at least two standard deviations below its sample mean. Additionally, the start of a sudden stop is determined by the first time the annual change in capital flows falls one standard deviation below the mean and it ends once the annual change in capital flows exceeds one standard deviation below its sample mean. A “shutdown” is an extreme type of sudden stop, where the supply of international credit dries up completely.

³ In April, 2001, Calomiris (2001) wrote in the *Wall Street Journal* that the fallout from an immediate write-down on Argentina's debt would be small if coupled with a credible reform package that reduced fiscal expenditures and labor costs. With Argentine bond prices already depressed, he suggested a 25 to 30 percent write-down of the face value on Argentine obligations, which would translate into a market-value decline of roughly 10 to 15 percent. He noted that such a debt write-down, even with reform, could have a worrisome effect on capital flight immediately after the default, but he believed it would not lead to a massive debt sell-off. He warned that postponing the debt write-down would increase the risk of a crisis.

Shutdowns in international capital markets are associated with a market phenomenon known as “country risk.” Country risk is the risk that loans made by outside financiers to private or government borrowers in a particular country may not be paid off at agreed upon terms. Country risk requires lenders to incorporate a default premium into the price of loans. This “default premium” is not necessarily a “risk premium.” A loan’s risk premium is the covariance of the loan payout with the lender’s discount rate. In our framework, lenders are risk neutral—they have constant discount rates—so it would be inconsistent for them to demand a risk premium.

One more caveat—country risk is separate from “currency risk,” which is the risk stemming from currency-price fluctuations. In the model described below, lending will be denominated in the lenders’ currency, so lenders face no currency risk.

The model portrays the equilibrium of a risk-neutral and very well financed group of lenders who set the terms for their lending to individuals or governments in emerging markets (EM). The distinguishing feature of these EM actors is that they default sometimes.⁴ Because lenders to EM countries understand that default is possible, they require a “spread” above the off-shore safe rate to make EM lending profitable over the long run.

A default is any loan payment by borrowers to lenders less than the contractually agreed upon payment. This does not mean that the borrower pays zero when a positive amount is due. Indeed the payment may be \$0.99 for \$1.00 owed. No matter. If the payment is less than that agreed upon, it is a default. Rescheduling can be a default also. If instead of paying \$1.00 at the agreed upon time, a borrower delays payment of the \$1.00, this too, is a default.

II. THE MODEL

There are two parts to the model: (1) the risk-neutral lender’s pricing/lending condition; and (2) the EM production/payoff process. The borrower gets a loan from the lender and uses the loan to purchase productive capital. The borrower puts the capital to work producing output stochastically. After production, the borrower compares the amount of output to the size of the debt. If there is enough output to sell and pay the debt, the borrower does so. If the sold output will not cover the debt, the borrower defaults. In a default, the lender gets local title to the produced output and other assets. This is a commonly told story that can become much more complicated.⁵

Let us now tell this story mathematically. Our first equation is the loan-pricing equation of the risk-neutral lender:

⁴ Developed countries also default on occasion, but they have not done so recently. See Reinhart, Rogoff, and Savastano (2003).

⁵ See Aizenman and Marion (2000, 2004) and Gai, Hayes, and Shin (2004).

$$R^* = (1 - p)z + pR^L, \quad (1)$$

where $R^* = (1 + i^*)$ is the safe return and i^* the safe interest rate – think of R^* as the U.S. dollar return on U.S. Treasury bills, with i^* the t-bill interest rate. The probability of default is $(1 - p)$ and return the lender receives in the event of default is $z < 1 + i^*$.⁶ In the no-default state, the borrower repays $R^L = (1 + i^L)$, where i^L is the lending rate. The probability of the no-default state is p . Equation (1) says that the risk-neutral lender is indifferent between lending at the risk-free rate and lending to the EM when the default payment is z , the probability of default is $(1 - p)$ and the interest paid in the no-default state is i^L .⁷

The EM production process works as follows: There is no explicit owner's equity, labor or raw materials. The EM goes to the world capital market and borrows k . Then k produces output, y , stochastically:

$$y = k(1 + \delta), \quad (2)$$

where δ is the stochastic return on production.⁸

With equation (2) giving the production process, it follows that:

$$p = \text{prob}(\delta \geq i^L). \quad (3)$$

The more likely it is that the return on production exceeds the interest owed on the loan, the greater the probability of repayment, p .

δ is determined exogenously. To keep things simple, δ is assumed to be distributed uniformly, with mean $\bar{\delta} \geq i^*$, upper boundary $\bar{\delta} + \frac{a}{2}$ and lower boundary $\bar{\delta} - \frac{a}{2}$.⁹ The frequency distribution for δ , $f(\delta)$, is therefore a rectangle centered on $\bar{\delta}$ with base a and height $1/a$. It follows that the variance of δ is $a^2/12$.

⁶ The default payment, z , can come from a variety of sources and need not be tied to the investment outcome only. Though we treat z as exogenous, it is generally the outcome of bargaining between creditors and the defaulter.

⁷ We treat EM borrowing as if it were done entirely by one borrower. In fact, there are many borrowers – some government, some private.

⁸ The term k contains all of the nonstochastic elements in the production process.

⁹ We shall consider other distributions later.

Output must be positive, which means the lowest possible value of δ is $\delta = \bar{\delta} - \frac{a}{2} \geq -1$.

With this model, therefore, we can study only a range for a equal to $0 \leq a \leq 2(\bar{\delta} + 1)$. We can make output nonstochastic, $a = 0$, but we cannot let output variance become any larger than $(1 + \bar{\delta})^2/3$. The uniform distribution constrains us at bit, but it makes p a linear function of i^L .

From equations (2) and (3):

$$p = \frac{1}{2} + \frac{\bar{\delta} - i^L}{a} \quad (4)$$

Equations (1) and (4) are depicted in Figure 1 for given values of i^* , $\bar{\delta}$, z and a .¹⁰

Explicit solutions for p and i^L as functions of i^* , $\bar{\delta}$, z and a are:

$$\hat{p} = \frac{1 + \bar{\delta} + (a/2) - z}{2a} \pm 0.5 \sqrt{\left(\frac{1 + \bar{\delta} + (a/2) - z}{a}\right)^2 - \frac{4(1 + i^* - z)}{a}} \quad (5a)$$

$$\hat{i}^L = \bar{\delta} + \frac{a}{2} - a\hat{p}, \quad (5b)$$

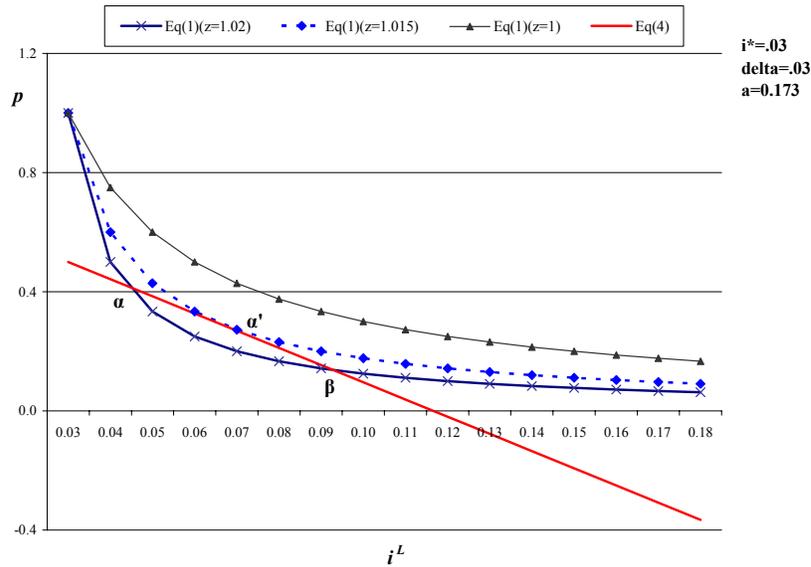
where hats over variables, e.g., \hat{p} , refer to solution values of those variables.

Notice from Figure 1 that the solutions are not unique. Equation (4) is linear in \hat{p} and i^L , but equation (1) is nonlinear in those variables. There are three possibilities. First, the two lines may be tangent to each other, in which case there is a unique lending rate and probability of repayment. Second, the two lines may intersect twice, in which case there are two possible outcomes, a “good” equilibrium, α , and a “bad” one, β . Third, the two lines may not intersect at all, in which case lenders cannot find a price at which to lend.

¹⁰ In the figure, the risk-free interest rate is set at $i^* = 0.03$ and the expected return from production at $\bar{\delta} = 0.03$. The default payment is set at $z = 1.02$, which is 99 percent of the risk-free return [$1.02 = 0.99(1 + 0.03)$]. Using data from the 1870–2002 period, the standard deviation of real GDP growth is found to be around 0.05 for the United States and seven other developed countries. For an output shock that is uniformly distributed, having a standard deviation of 0.05 implies $a = 0.173$. Catao and Kapur (2005) found the standard deviation of real GDP growth for emerging markets over the 1970–2001 period to be in the range 0.025–0.065, with South Africa and Colombia at the low end and Russia at the high end. That implies a range for a of $0.0866 \leq a \leq 0.225$. The output volatility in advanced countries over the last 30 years has been about half that of emerging markets.

In Figure 1, parameter values are $i^* = 0.03$, $\bar{\delta} = 0.03$, and $a = 0.173$. When $z = 1.02$ (so creditors take a 1 percent haircut on the risk-free return), there are two solutions, when $z = 1.015$, there is one solution, and when $z = 1$ (a 3 percent haircut), there are no solutions.¹¹ For our parameter values, a fairly modest haircut shuts down access to the foreign private capital markets.¹² We also observe that the no-equilibrium outcome occurs even for a reasonable parameter range. In other words, for sensible values of i^* , $\bar{\delta}$, z and a , there is no equilibrium and hence a sudden stop of lending to the EM.¹³

Figure 1: The Lending Rate (i^L) and Probability of Repayment (p) as the Haircut Varies



¹¹ When z falls below 1.015, the market shuts down. A value of $z = 1.01$, for example, represents a haircut, or loss, of 2 percent on the risk-free return and a haircut of 5 percent on the total return owed to creditors, less than half that suggested by Calomiris (2001) as a way to preserve Argentina's access to the markets. We analyze the impact of a haircut absent other reforms; the Calomiris proposal included elements intended to increase $\bar{\delta}$.

¹² There are several ways to specify the haircut. In the text, we let $z = (1 + i^*)(1 - h)$, where h is the effective "haircut" creditors take when the EM defaults, with $0 < h < 1$. It is computed for known values of i^* and z . Alternatively, and without changing the analysis in any substantive way, we could let $z = k - h$, where $k = 1 + i^*$ (the risk-free return) and $0 < h \leq k$, or we could set $k = 1$ (the face value of the loan ignoring interest) and $0 < h \leq 1$.

¹³ We focus on the pricing decision of international lenders per unit lent. Our model is silent on the role of debt quantities in market shutdowns.

III. ADDITIONAL COMPARATIVE STATICS

We begin our investigation by assuming the default payment is $z=1.02$ and the economy is initially in equilibrium at point α in the two-solution case illustrated in Figure 1. We analyze what happens when a particular parameter value changes. Suppose, for example, that the risk-free interest rate, i^* , increases. Then the nonlinear curve (Equation (1)) in Figure 1 shifts out. The economy moves to a new equilibrium with a higher lending rate and reduced chance of repayment.¹⁴ Observe that continued increases in i^* shift out the nonlinear curve until there is no intersection. In our simulation, an increase of about 100 basis points over the initial $i^* = 0.03$ is enough to shut down lending.

Next consider what happens when there is an increase in $\bar{\delta}$, the return to production. The increase in $\bar{\delta}$ shifts out the straight line (Equation 4) in Figure 1. If the economy had initially been in equilibrium at α , the increased return to production sensibly reduces the lending rate and increases the probability of repayment. Reforms that actually raise productivity may therefore mitigate the risk of increasing the haircut, since successful reforms increase $\bar{\delta}$, shifting up the straight line in Figure 1, while the increased haircut reduces z and shifts up the nonlinear curve. Note that a market shutdown (no intersection of the two lines) requires a *decrease* in $\bar{\delta}$ so that the straight line shifts below the nonlinear one.¹⁵

Now consider what happens when there is an increase in output variance, a . Higher output variance rotates the straight line (Equation 4) counter-clockwise. It moves the economy from equilibrium at point α to a new equilibrium with a higher probability of repayment and a lower lending rate. While such a response seems odd, it makes sense for our set of parameter values.¹⁶ We have assumed the average return to production is 0.03, the same as the risk-free interest rate and less than the lending rate. On average, then, the return to production will be less than the lending rate and the EM will default. As output variance increases, however, there is at least the possibility that the economy will have such a good output draw that it can repay its loans. Hence the increase in output variance may actually increase the

¹⁴ If the economy were initially in equilibrium at β in Figure 1, with a relatively high lending rate and low chance of repayment, then a small increase in i^* would perversely lower the lending rate and increase the probability of repayment. Hence the equilibrium at β leads to implausible comparative statics.

¹⁵ If the economy were initially in equilibrium at β , the increase in $\bar{\delta}$ perversely lowers the probability of repayment and increases the lending rate.

¹⁶ For these same parameter values, if the economy had initially been in equilibrium at β , then increased output variance would lower the probability of repayment and increase lending rates.

chance of repayment and lower the lending rate.¹⁷ In these circumstances, increased output volatility may increase the incentive to borrow.¹⁸

IV. THE VALUE OF FINANCING

In this model, emerging-market entrepreneurs invest no capital of their own, yet they sometimes participate in a positive payout. Domestic agents are the recipients of this extraordinary opportunity because international lenders allow them access to the fruits of domestic production. While somewhat unrealistic, examining the value of this arrangement from the perspective of domestic agents reveals some lessons about borrower incentives.

Let us call the expected value of the payout to domestic borrowers per unit of capital, EV . According to previous notation,

$$EV = (1 - p) * 0 + p[E(\delta | \delta \geq i^L) - i^L]. \quad (6)$$

Equation (6) says the expected payout to domestic borrowers per unit of borrowed capital acquired for production equals the probability of default, $1-p$, times the payout to defaulting borrowers, 0, plus the probability of no default, p , times the expected net payout to borrowers who do not default. The expected net payout to non-defaulters equals the expected value of the return on capital goods conditional on its being larger than i^L , namely $E(\delta | \delta \geq i^L)$, less i^L , the amount paid to lenders. By lending to an emerging market country that might default, international lenders are granting a call option to domestic borrowers. The option goes “in the money” when $\delta > i^L$.

Since the distribution of δ is uniform, there is a closed form expression for EV in terms of the underlying parameters. The expected net payout to non-defaulters is

$E(\delta | \delta \geq i^L) = 0.5 (\bar{\delta} + a/2 - i^L)$. Substituting this expression into (6) and using our earlier expressions for p and i^L in (6), we find that $EV = \frac{a\hat{p}^2}{2}$.

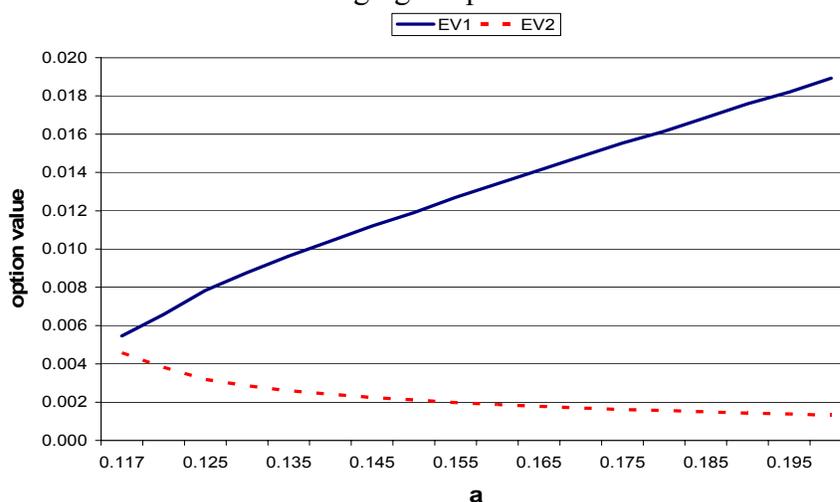
¹⁷ It follows that if the average return to production exceeds the lending rate, increased output volatility will reduce the chance of repayment and increase the lending rate.

¹⁸ The results are not dependent on our assumed uniform distribution for the output shock. Even if the output shock has a thin-tailed exponential distribution or one characterized as a trapezoid (with one fat tail and one not), it is possible to have multiple equilibria, a unique equilibrium, or no equilibrium—a market shutdown—for a similar sensible range of parameter values. The comparative statics are also similar under these alternative distributions.

Since EV is an option, its value should be sensitive to the variance of the underlying shock. Other things equal, more variance should increase the call option's value. In Figure 2, EV is plotted against a , the width of the uniform output shock density, for $i^* = 0.03$, $\bar{\delta} = 0.03$, and $z = 1.02$. The variance of the output shock ($a^2/12$) increases as a increases. Because there are two possible solutions for p and i^L when the default payment is $z = 1.02$, there are two possible values for EV. EV1 is an expected payout to borrowers per unit of capital borrowed when the lending rate is relatively low and the probability of repayment is relatively high. EV2 is an expected payout when the lending rate is relatively high and the probability of repayment is relatively low.

Figure 2 indicates that the value of EV1 increases as output variance increases. Intuitively, the increased output variance increases the chance of a higher output return and it reduces the lending rate, making it more likely that the realized return on output will exceed the lending rate.¹⁹

Figure 2: The Option Value of Borrowing with Changing Output Variance



The behavior of the expected payout gives some insight into the incentives for borrowers. Assuming the EM borrower is in the equilibrium with a relatively high repayment probability

¹⁹ The second possible value for EV, EV2, is near zero and is essentially nonresponsive to output variance. Recall that EV2 is the expected payout when lending rates are relatively high and the probability of repayment is relatively low. While greater output variance ceteris paribus increases the chance of a higher output return, it also increases the lending rate since the probability of repayment was already quite small. Consequently the chance that the return on output will exceed the lending rate does not improve. The higher output variance also reduces the probability of repayment. The net effect is to keep the expected payout close to zero.

(about 40 percent in our EV1 example as opposed to about 10 percent in our EV2 example), greater output variability will induce borrowers who can default try to take on the riskiest projects they can in order to increase the option value of the loan.

V. CONCLUSION

Two general points are worth re-emphasizing. First, emerging market borrowers who might default can be shut out of international capital markets without lending rates becoming exorbitant. At some point, risk-neutral lenders stop lending because they recognize that higher lending rates only increase the default risk. Our model, calibrated for a reasonable set of parameter values, shows that it may not take a very large shock to shut down international lending completely. Relatively small changes in foreign interest rates, returns to production (output growth), output variance, or the haircut offered creditors can completely shut down international lending to the emerging market borrower.

Second, when countries default from time to time, the option value of not defaulting gives borrowers a systematic incentive to choose high-variance projects for foreign financing. It is, therefore, no surprise that they have higher output variance than developed countries who seldom default.

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