Moral Hazard and International Crisis Lending: A Test*

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Abstract

This paper examines how events that change expectations about future international crisis lending modify the relationship between country spreads and fundamentals. If moral hazard is present, such events should affect the level of spreads, the sensitivity with which spreads reflect fundamentals, and their cross-country dispersion. When applied to the Russian crisis of 1998, these tests find strong evidence consistent with the existence of moral hazard. However, this evidence is subject to a fundamental interpretational caveat: the same findings could also be attributed to the perception that international crisis lending reduces the true risk of financial crises in emerging markets.

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1 Introduction

The role of international financial rescue operations in causing "moral hazard"—resulting in overinvestment or insufficient monitoring by investors, bad policies on the side of governments, or both—has been at the center of debate ever since the 1995 Mexican bail-out.[1] Participants in this debate disagree about the extent to which this type of moral hazard has caused problems in the past, with views ranging from the belief that the Mexican rescue "caused" the Asian crisis to the idea that moral hazard due to the expectation of international crisis lending is an isolated phenomenon associated with particular large borrowers. However, concern about its potential impact is shared almost universally, even by those who would defend the large bail-outs of the 1990s. Indeed, "limiting moral hazard to the extent possible" appears to have become an explicit policy objective of the International Monetary Fund. One reflection of this objective is a consensus among official creditors to enforce greater private sector "burden-sharing" as a complement to official assistance.[2]

Given this near-universal concern, it comes as something of a surprise that there exists little empirical work on the subject, and that the few studies that have systematically tested for moral hazard have found either no or highly ambivalent evidence for its existence.[3] As we will argue in this study, some of this ambivalence is intrinsic to the subject and unavoidable, but a good portion of it is not. The objective of this paper is to take a fresh look at the evidence in ways that go beyond the existing literature in three respects: first, by exploiting a wider range of testable implications of moral hazard, second, by making an attempt to disentangle moral hazard from alternative explanations of the phenomena that might be viewed as reflecting moral hazard, and—last not least—by using a broader range of data. Like the

[1]See, for example, Calomiris (1998), Meltzer (1998), and Willett (1999).

[2]See "Report of the Managing Director to the International Monetary and Financial Committee on Progress in Strenghtening the Architecture of the International Financial System and Reform of the IMF", September 19, 2000, "IMF Executive Board Discusses Involving the Private Sector in the Resolution of Financial Crises", Public Information Notice (PIN) No. 00/80, International Monetary Fund, September 19, 2000 (both documents available on the IMF's Website, www.imf.org) .

[3]See Zhang (1999), Nunnenkamp (1999), Willett (1999), Lane and Phillips (2000), and a related paper by Jeanne and Zettelmeyer (2000), who do not take a position on the overall empirical significance of moral hazard, but argue that the subsidy element associated with international bail-outs is small.

previous literature, we exploit the idea that a *change* in moral hazard should translate into a change in emerging market bond spreads if moral hazard was in fact present. Our main methodological innovation is that we do not only examine how this affects the level of spreads, but also their cross-country dispersion, and the sensitivity with which they reflect fundamentals.

Unlike the earlier literature, our tests do find strong evidence consistent with the existence of moral hazard. However, this evidence is subject to a fundamental interpretational caveat which we share with the previous literature. In principle, our findings could be attributed both to the perception that international crisis lending reduces the probability that investors will suffer losses, *conditioning* on a financial crisis in emerging markets, and to the perception that international crisis lending reduces the *true risk* of emerging market crises.[4]

To our knowledge, there are only two earlier studies that attempt a systematic empirical test of moral hazard: Zhang (1999) and Lane and Phillips (2000).[5] Lane and Phillips (2000) examine the reactions of a daily emerging market bond index to a large number of events that might have changed expectations of future international crisis lending. In most instances, they do not find evidence consistent with the presence of moral hazard, in the sense that spreads do not seem to react to the events in question. In some cases—in particular, the Russian default in August 1998, which was notable for the *absence* of an international rescue when it was expected—they do. The problem is that these findings have ambivalent interpretations, as Lane and Phillips themselves point out. Failure to detect a significant reaction of spreads could always be due to the fact that the event was already anticipated. As to the large reaction to the Russian default, this could reflect investor panic, contagion, and liquidity changes, making it impossible to attribute investors' reactions to changes in the perceived probability of future crisis lending, as opposed to momentary financial market turbulence.

In principle, this problem can be tackled through the methodology used by Zhang (1999), who analyzes the longer-term impact of an event that has been often associated with an increase in moral hazard—the 1995 Mexican bail-out—while controlling for changes in some macroeconomic fundamentals and a measure of international liquidity (namely, the spread on high-yield US

[4]This point is made extensively by Lane and Phillips (2000).

[5]Demirguc-Kunt and Huizinga (2000) test for moral hazard in the bank deposit market induced by deposit insurance schemes. Their methodology is analogous to that in Zhang (1999) described below.

corporate bonds). His main result is that a post-Mexico dummy is insignificant and has the wrong sign (positive, rather than negative as one would expect if moral hazard had depressed spreads). However, this result is based on one single event, which arguably is not very well suited to a test of moral hazard. If the Mexican crisis led to a general reassessment of risks related to emerging market lending—as investors learned that even a country with a recent track record of reform and relatively sound fundamentals could experience a disastrous financial crisis—any reduction in spreads due to moral hazard may have been offset by a general increase in the perceived riskiness of sovereign debt. Moreover, Zhang's test fails to exploit testable implications that moral hazard has for the slope coefficients, rather than just the intercept, of his regression equation (see next section).

Our study shares Zhang's basic approach in the sense of testing for moral hazard in the context of a regression model of spread determination. However, we differ along two dimensions, which turn out to (jointly) make a difference to the results.

First, rather than just looking at the impact on the average level of spreads, which is the focus of the previous literature, we test whether the Russian crisis led to (1) changes in the level of spreads in a wide range of individual countries; (2) changes in the *sensitivity* with which spreads react to fundamentals,[6] and finally, (3) changes in the cross-country *variance* of spreads (always controlling for fundamentals). In the context of a simple model of international lending (section 2.2 of this paper), these are shown to be testable implications of the presence of moral hazard (subject to the basic interpretational caveat referred to earlier).

Second, while we also apply our test to the Mexican bail-out to compare our results to the earlier literature, the main focus is on the Russian crisis, which we argue constitutes a better experiment for the purpose of testing for moral hazard. To ensure that our results are not driven by contagion or liquidity effects, we disregard the immediate reaction of spreads to the Russian default, and instead compare monthly or quarterly spreads before and well after the crisis (namely, after emerging market turbulence had subsided in the first quarter of 1999). This requires carefully controlling for "fundamentals" that may affect spreads, and that may have changed in the meantime. We do this using a model of spread determination encompassing most fundamentals

[6] Kamin and Kleist (1999) carry out a similar test in a regression with only one risk factor (credit ratings) without interpreting their procedure as a test for moral hazard.

that have been suggested in the literature on bond pricing.[7]

There are two main findings. First, the Russian crisis led to a significant and sustained increase in spreads in many, but not all, emerging market countries studied, in particular in countries with relatively weak fundamentals. Second, the crisis led to large increase in the cross-sectional dispersion of spreads, controlling for fundamentals. In other words, investors seem to have paid much more attention to differences in individual country characteristics after the crisis than they had done before.

The remainder of the paper is organized as follows. Section 2 derives several alternative testable implications of the presence of moral hazard in the context of a simple model of international lending. Section 3 discusses the implementation of these tests in the context of an empirical model of spread determination, as well as the validity of the Russian crisis as an "experiment" for our purposes. Section 4 presents our results, which are based on two distinct datasets: J.P. Morgan's dataset of secondary market bond spreads contained in the "EMBI Global" Bond Index, and an exhaustive dataset of launch bond spreads based on Capital Data's "Bondware". Section 5 interprets the results, and concludes.

2 A Simple Model

Suppose one had a clear-cut event affecting the perceived likelihood of future official crisis lending to emerging market economies. Then, it should be possible to use financial market reactions to such an event—in particular, changes in emerging market bond spreads—to test for the presence of moral hazard attributable to international financial rescues. This section presents a simple model of a competitive credit market facing heterogenous borrower countries and derives several testable implications of moral hazard. Methodological issues related to the *implementation* of these tests—in particular, what events, if any, could be used as a natural experiment for our purposes, as well as issues related to econometric modeling—are left to the next section.

2.1 Set-Up

Consider a world where multiple, risk-neutral lenders (investors) compete for loans in hard currency (say US$) to borrower countries. Countries are

[7] See, in particular, Cline and Barnes (1997) and Eichengreen and Mody (1998).

heterogeneous in terms of observable country-specific fundamentals, $\mathbf{x}_i$ (a country-specific vector), which in turn affect their perceived probability of default. The latter can be decomposed into the probability of incurring a financial crisis, θ, and investors' perceived probability of being repaid, λ, i.e. avoidance of default, *conditional* on a crisis. This enables us to write the risk from the perspective of the individual investor as $(1-\lambda)\theta$. Denoting the risk free rate as R^* (assumed constant), the equilibrium interest rate then follows from the no-arbitrage condition and can be written as:[8]

$$R_i = \frac{R^*}{1-(1-\lambda(\mathbf{x}_i))\theta(\mathbf{x}_i)}$$

Now introduce the possibility of international crisis lending à la Mexico (1995) or Korea (1997). Let b denote the perceived probability that a country will receive an international rescue package in the event of a crisis. In general, this may affect emerging market yields through three channels:

- it might affect observable fundamentals, in particular through government policies: $\mathbf{x}_i = \mathbf{x}_i(b)$;
- it might affect the conditional repayment probability: $\lambda = \lambda(\mathbf{x}_i, b)$;
- finally, it might affect the probability of a financial crisis, conditioning on fundamentals: $\theta = \theta(\mathbf{x}_i, b)$. For example, the presence of an international financial "safety net" might reduce the probability of liquidity crises.

"Country moral hazard" usually refers to the first of these effects, i.e. the deterioration of the borrower country policies in the face of a financial safety net. "Investor moral hazard" is typically identified with the second effect—an increase in the probability that investors will go scot-free in the event of a crisis—and this is the sense in which the term will be used in the discussion that follows.[9] More formally, we speak of "investor moral hazard"

[8]Throughout the paper R indicates gross interest rates; in other words, $R = 1 + r$, where r is the net interest rate.

[9]Strictly speaking, this is loose language, since "investor moral hazard"—in analogy to the definition of "country moral hazard" just suggested—should refer to socially inefficient investor *actions* (for example, excess lending, or insufficient monitoring) rather than an increase in the conditional repayment probability *per se*. However, it is clear that in a standard set-up that explicitly model these actions, an increase in the conditional repayment probability would have precisely this effect, since it would insulate investors from the risk of a financial crisis, θ.

if the following property holds:

$$\frac{\partial \lambda \left(\mathbf{x}_i, b\right)}{\partial b} > 0 \tag{1}$$

At first sight, this condition might appear to be inevitably satisfied. However, international rescue packages do not necessarily involve the bail-out of private international investors. On the contrary, on a number of occasions private creditors suffered substantial "haircuts". Still, a higher probability of international financial rescues may be perceived as increasing the probability of international bail-outs, and it is through that perception that rescue packages may cause moral hazard. Thus, we speak of investor moral hazard if an increase in the probability of an international rescue increases investors' expectations of being bailed-out in case of a financial crisis.

In the remainder of the paper, we focus on "investor moral hazard" while abstracting from "country moral hazard", i.e. taking $\mathbf{x}_i$ as given (in our empirical work, this means controlling for changes in $\mathbf{x}_i$). The central question is how to test for investor moral hazard when λ is not directly observable. Below, we present a restricted model from which three testable implications of investor moral hazard are derived. In the Appendix, we discuss how the properties of those tests are affected when the restricting assumptions are relaxed.

2.2 Testable Implications of "Investor Moral Hazard"

Consider the following specialization of the model sketched above, which for convenience has been rewritten in terms of emerging market spreads $s_i \equiv R_i - R^*$, rather than yields.

First, assume that the probability of a financial crisis, θ, is not directly affected by changes in b, i.e.:

$$\frac{\partial \theta(\mathbf{x}_i, b)}{\partial b} = 0 \ , \tag{2}$$

so that we can write

$$s_i = R^* \frac{(1 - \lambda\left(\mathbf{x}_i, b\right))\theta(\mathbf{x}_i)}{1 - (1 - \lambda\left(\mathbf{x}_i, b\right))\theta(\mathbf{x}_i)} \ . \tag{3}$$

Second, assume that to the extent that an increase in b affects the expected conditional repayment probability—i.e. generates investor moral hazard—it does so uniformly across countries:

$$\frac{\partial^2 \lambda}{\partial \mathbf{x}_i \partial b} = 0 \ . \tag{4}$$

In this restricted set-up, we can state three equivalent testable implications of investor moral hazard. For a given set of fundamentals, an increase (decrease) in the perceived likelihood of an international rescue *i*) reduces (increases) the level of spreads; *ii*) reduces (increases) the sensitivity of spreads to changes in fundamentals; *iii*) reduces (increases) the difference in the spreads between any pair of countries (with initial spreads "close enough").

More formally, the first result can be written as (omitting the country subscripts)

Proposition 1 *Holding constant the set of fundamentals* $\mathbf{X} = (\mathbf{x}_1, \mathbf{x}_2, ...\mathbf{x}_n)$, *conditions (2) and (4) imply that* $\frac{d\lambda}{db} > 0$ *if and only if* $\frac{ds}{db} < 0$.

Proof: see Appendix. ■

An increase in the probability of rescues results in a lower perceived risk associated with international lending, reducing country spreads across the board. Under the stated conditions, this directly provides a test for moral hazard. Innovations that increase investor moral hazard (like large IMF bail-outs) should result into lower spreads, after controlling for the effect of changes in the fundamentals. We will refer to the test based on proposition 1 as the "*level test*".

Assuming that fundamentals are defined such that θ is increasing in all the components of $\mathbf{x}_i$ (in other words, all fundamentals are expressed as "risk factors") we can state our second result as follows:

Proposition 2 *Conditions (2) and (4) imply that* $\frac{d\lambda}{db} > 0$ *if and only if* $\frac{d^2 s_i}{dx_{ij} db} < 0$ *for every j.*

Proof: see Appendix. ■

From an investor's standpoint, a higher probability of getting off "scot-free" makes the idiosyncratic characteristics of each country less important, weakening the link between fundamentals and interest rate spreads (in the extreme, with $\lambda = 1$, all countries would pay the same risk-free interest rate regardless of their fundamentals). This proposition provides a second test for investor moral hazard. Events that increase moral hazard should reduce the size of the *slope coefficients* linking country spreads and fundamentals. We will refer to this test as the "*slope test*".

Finally, define $\Delta s = s_1 - s_2$, where s_1 and s_2 are the interest rate spreads of any two countries. If s_1 and s_2 are "close enough" in the sense that Δs can be approximated by a Taylor expansion, then we can prove the following proposition:

Proposition 3 *Holding constant the set of fundamentals* $(\mathbf{x}_1, \mathbf{x}_2, ...\mathbf{x}_n)$, *conditions (2) and (4) imply that* $\frac{d\lambda}{db} > 0$ *if and only if* $\frac{d\Delta s}{db} < 0$ *for any* s_1, s_2.

Proof: see Appendix. ■

This proposition shows that, for any given set of fundamentals, the dispersion of the interest rate spreads decreases when investor moral hazard increases. Intuitively, since moral hazard implies that investors pay less attention to differences in fundamentals across countries, the differences between country spreads should also narrow.

This result implies that an increase in investor moral hazard reduces the cross-sectional variance of the spreads. In the empirical part of this paper we exploit this property in constructing our "*variance test*".

Under assumptions (2) and (4), the propositions in this section show three necessary and sufficient conditions for investor moral hazard, providing three alternative and equivalent testable implications. However, when the assumptions are relaxed, the three conditions cease to be sufficient and remain only necessary. At the same time, the equivalence among the three tests ceases to exist.

A particularly interesting case is one where instead of assuming that the probability of a financial crisis, θ, does not depend on the rescue probability b, one allows for an ex-ante beneficial role of international crisis lending. For example, crisis lending may help coordinate investors and prevent panics, reducing the probability of liquidity crises.[10] In the Appendix, we show that in this case, the "level" test will never be able to distinguish the effects of investor moral hazard from those of true risk reduction and that the

[10]In that case, we would have $\frac{\partial \theta(\mathbf{x}_i, b)}{\partial b} < 0$.

"slope" and "variance" tests can make this distinction only under conditions that are not necessarily satisfied in practice. Thus, the inability to unambiguously distinguish moral hazard from true risk reduction attributable to international crisis lending is a fundamental identification problem which is not easily resolved, and must be kept in mind when interpreting the results.

3 Empirical Methodology

3.1 Regression-based tests for moral hazard

We start from a standard model of the determination of bond spreads

$$\begin{aligned} s_{ijt} &= X\beta + u_{ijt} \\ &= \beta_0 + X_{ijt}\beta_1 + X_{it}\beta_2 + X_i\beta_3 + X_t\beta_4 + u_{ijt}, \end{aligned} \tag{5}$$

where s_{ijt} denotes the spread of bond j of country i in time t, and X denotes the matrix of fundamentals that determine the spreads of sovereign bonds. These fundamentals might be bond-, country-, and/or time-specific. The term u represents a random error. This equation will be the basis of all our regressions.

Consider now an event that *reduces* the perceived probability of future bail-outs.[11] The general estimation procedure will be to estimate a pooled model over the whole period, i.e. before and after the event, without restricting the coefficients of the model to be the same before and after the event. Thus, bond spreads before the event can be described by the model

$$s = X\beta + u, \tag{6}$$

while the model changes to

$$s^* = X^*\beta^* + u^* \tag{7}$$

after the event due to a potential structural break. Denoting H_0 the null hypothesis that moral hazard is not present, and H_1 the presence of moral

[11] Since we are looking at the unexpected *absence* of a further international rescue package for Russia in August of 1998, this is the relevant case for our empirical analysis.

hazard, the three tests derived in our theoretical framework can be restated as follows in the context of the empirical model:[12]

1. Under H_0, the slopes of the regression equation should be unaffected by an event that reduces expected international crisis lending. Under H_1, however, we would expect all slopes to increase (in absolute value) after the event because investors bear a larger part of the repayment risk and will price risk factors more than before. This is the test referred to as the *slope test* in section 2. It can be carried out as a simple t test on the significance of the change of each individual slope.[13] In the case of an event that decreases moral hazard, the test can be formulated as follows:

$$\begin{aligned} H_0 &: |\beta_k^* - \beta_k| = 0, \quad k = 1, ...K \\ H_1 &: |\beta_k^* - \beta_k| > 0, \quad k = 1, ...K \end{aligned}$$

   Note that this test refers only to the slopes of the regression and not to the intercept.[14]

2. Under H_0 (i.e. no moral hazard), the *level* of spreads should not be affected by an event that reduces expected international crisis lending. Under H_1 (i.e. moral hazard), however, the level of spreads should increase for every country, holding fundamentals constant. More formally, the change in the level of spreads can be decomposed into three components:

$$\begin{aligned} & s^* - s \\ & = X^*(\beta^* - \beta) + (X^* - X)\beta + (u^* - u) \\ & = X(\beta^* - \beta) + (X^* - X)\beta^* + (u^* - u) \end{aligned} \tag{8}$$

[12]As has been outlined above, we have to assume that the expectation of reduced future crisis lending has no direct risk-increasing effect. If this assumption is not made, all tests have to be reinterpreted as tests of the *joint* hypothesis that either moral hazard or a true risk-increasing effect is present, or both.

[13]A similar test can be found in the paper by Kamin and Kleist (1999).

[14]Our model predicts that the "theoretical intercept", i.e. the spread at $\theta = 0$ is equal to zero irrespective of the occurrence of international bail-outs. The intercept of our regression, however, is not identical to this theoretical intercept. Therefore, the implications for the "empirical intercept" are not obvious.

The first term is the change in the level of spreads induced by the change in β, the second term the change in the level of spreads caused by the change in the fundamentals, and the third term reflects the impact of a change in the error term.[15] Here, we are only interested in the first term, which captures the effect of a change in the pricing of risks on the level of spreads. Thus, in the case where the event entails a potential decrease in moral hazard, the *level test* takes the following form:

$$\begin{aligned} H_0 &: \quad \widetilde{X}(\beta^* - \beta) = 0 \\ H_1 &: \quad \widetilde{X}(\beta^* - \beta) > 0 \end{aligned}$$

The test can be carried out as a linear Wald test in which we compare the fitted spreads that result from the models estimated before and after the event.[16] Note that the above decomposition and thus the choice of $\widetilde{X}$ are not unique: when controlling for fundamentals, one can either use the fundamentals before or after the event. In fact, this choice can affect the results of the test. Therefore, we present the results for both choices.

3. Under H_0, the cross-sectional variance of the spreads should remain unchanged after the event. Under H_1, however, the difference in spreads between each pair of countries should increase, which, in turn, implies an increase in the cross-sectional variance of spreads (controlling for changes in fundamentals).We refer to this test as the *variance test.* More formally, we can write the variance before the event as

$$Var(s) = \beta' Var(X)\beta + \sigma^2 \tag{9}$$

and the variance after the event as

$$Var(s^*) = \beta^{*\prime} Var(X^*)\beta^* + \sigma^{*2}, \tag{10}$$

[15] This is the well-known Oaxaca decomposition that has also been used by Eichengreen and Mody (1998).

[16] This test is very different from the one employed by Zhang (1999) who allows only the intercept to change after the event. Thus, Zhang *assumes* that the coefficients on fundamentals are unchanged before and after the event, which would not be true if moral hazard were in fact present (see Section 2).

where σ^2 and σ^{*2} are the variances of the error terms. The change in the variance of spreads can be decomposed into three components:

$$\begin{aligned} & Var(s^*) - Var(s) \\ = \; & [\beta^{*\prime} Var(X^*)\beta^* - \beta' Var(X^*)\beta] + \\ & [\beta' Var(X^*)\beta - \beta' Var(X)\beta] + \left[\sigma^{*2} - \sigma^2\right] \\ = \; & [\beta^{*\prime} Var(X)\beta^* - \beta' Var(X)\beta] + \\ & [\beta^{*\prime} Var(X^*)\beta^* - \beta^{*\prime} Var(X)\beta^*] + \left[\sigma^{*2} - \sigma^2\right] \end{aligned} \tag{11}$$

The first term is the change in the variance induced by the change in β, the second term the change in the variance caused by the change in the fundamentals, and the third term reflects the impact of a change in the variance of the error term.[17] Again, we are mainly interested in the first term, which captures the effect of a change in the pricing of risks on the variance of spreads. Thus, if the event entails a potential decrease in moral hazard, the variance test takes the following form:

$$\begin{aligned} H_0 \; &: \quad \beta^{*\prime} Var(\widetilde{X})\beta^* = \beta' Var(\widetilde{X})\beta \\ H_1 \; &: \quad \beta^{*\prime} Var(\widetilde{X})\beta^* > \beta' Var(\widetilde{X})\beta \end{aligned}$$

The variance test will be carried out as a nonlinear Wald test (see Appendix for statistical details). Note that the above decomposition is again not unique: the choice of $\widetilde{X}$ can affect the results of the test, and we show results for both alternatives.

It is important to clarify the relations between our three tests. If all slopes increase in absolute value, the variance is also going to increase and so is the level (unless there is a decrease in the intercept strong enough to reverse the effect of the slopes). Thus, there is no point in doing all three tests in this situation. The interesting case is one in which some, but not all slopes show significant increases, while some may even show decreases. In the slope test, this would imply a rejection of H_0, which predicted no change in slopes. However, this rejection would not be very convincing if the increase in some slopes were accompanied by decreases in others. Indeed, H_1 predicts that *all* slopes should increase. The question is whether the slope coefficients showing significant increases "outweigh" those showing decreases, so that

[17] This type of decomposition is well-known in the labor literature on the evolution of the distribution of incomes over time.

we can accept the presence of moral hazard with some confidence instead of concluding, for example, that the regression model is misspecified or the experimental event is ambiguous, so that no lessons can be drawn.

How should one decide whether the positive slope movements outweigh the negative ones? One natural way of weighing the slopes is to look at the impact of the change of the slopes on fitted spreads, controlling for fundamentals. This is the logic behind the level test. Unfortunately, the results from this test also are very unlikely to be unambiguous. First, the results from this test may differ across countries and second, the choice of $\widetilde{X}$ may affect the test results. Therefore, we also employ the variance test, which allows us to summarize the overall effect of the changing slopes on *all* countries in a way suggested by our model.

Some caveats remain with respect to the interpretation of the variance test. First, there continues to be an ambiguity with respect to the choice of $\widetilde{X}$. Second, it is important to note that a rejection of the null hypothesis in the variance test does not require all fitted spreads to go up. For the variance test, the direction of the change in fitted spread is irrelevant as long as the spreads move farther apart from each other. Third, our theoretical model predicts that the increase in the variance is driven by an increase in the distance of neighboring spreads, with the "order" of countries being unchanged. Yet, the order of countries does not enter the variance test. Therefore, the results from the variance test can only be interpreted in combination with the results from the level test. Indeed, while the increase of the cross-sectional variance is a *necessary* condition of moral hazard, it is not a sufficient one.

3.2 The Russian crisis as a valid experiment

A critical element of our testing strategy for moral hazard is the choice of an event that constitutes a valid experiment for the purpose of the test. Such an event has to satisfy three conditions:

1. It has to change the public perception of the extent and/or the character of future international crisis lending.
2. It has to be unexpected.
3. It must not lead to a reassessment of risks other than through the expectations of future international rescues.

We believe that the events following the Russian default in August 1998 satisfy all three conditions reasonably well. The Russian crisis unfolded when the Russian authorities announced a de facto devaluation of the ruble, a unilateral restructuring of ruble-denominated public debt, and a moratorium on foreign debt repayments on August 17, 1998. Clearly, this did not constitute news about the poor state of the Russian economy; in fact, Russia had been downgraded by all three major rating agencies in the first half of 1998, which suggests that investors were well aware of the increasing economic risks.

The real surprise was that the international community did not prevent the default of a country that was widely believed to be "too big to fail", as witnessed by the enormous buildup of Eurobonds outstanding in Russia in the beginning of 1998 - from \$4.6 billion in March to \$15.9 billion in July - and the oversubscription of all new issues in times of worsening fundamentals.[18] Thus, it is highly plausible that the absence of international support during the Russian plight was interpreted as a sign of a generally higher reluctance of the international community to support crisis countries, particularly if these countries had not complied with former reform proposals. On this basis, the first two of the above conditions would seem to be satisfied.

The third condition is harder to satisfy. There is at least one alternative interpretation of the impact of the events in Russia on sovereign bond spreads that has nothing to do with expectations of international bail-outs, namely that the Russian crisis reminded investors of the existing risks in the Russian and other emerging economies, which led to a general repricing of risks (the "wake-up call" interpretation).[19] However, this argument, which is surely valid in the case of the Mexican and the Asian crises, seems less credible for the Russian crisis. First of all, the two preceding emerging market crises (Tequila, and particularly Asia) should have been sufficient to "wake up" investors. Second, the Russian situation was in many respects special and it is far from clear whether the Russian default contained any information with

[18]This suggests that the existence of a moral hazard problem associated with international lending to Russia is undisputable. Indeed this is recognized almost universally and is not the object of our study. The important question is whether the events in Russia led investors to revise their expectations about the riskiness of investments in emerging markets *other* than Russia.

[19]In the literature, one also finds the informal argument that the losses sustained in the Russian crisis might have led to a general reduction in the risk tolerance of investors (the "appetite for risk" interpretation). However, we are not aware of a model formalizing this kind of reasoning.

respect to the risks in other emerging economies. We therefore want to argue that the Russian crisis did not primarily change the investors' evaluation of country risk, but rather their perception about the extent and nature of the international financial safety net.

In using the Russian crisis as a natural experiment for a test of moral hazard, a complication arises from the fact that the Russian crisis was followed by a prolonged period of turbulence in emerging markets. In these high-volatility episodes, one cannot reasonably assume that there was a stable relationship between fundamentals and spreads. To avoid our results being affected by this instability, we have to exclude the periods immediately following the crisis from our regressions.[20] However, this approach makes it more difficult to isolate the potential effect of decreased moral hazard from other events that took place shortly after the Russian crisis. The excluded period includes not only the Russian crisis, but also the LTCM crisis, the IMF-supported private-sector "bail-in" in Ukraine, the IMF quota increase, as well as the Brazilian crisis, which subsided only after the floating of the Real in February of 1999. In interpreting our results, this needs to be taken into account.

4 Empirical Analysis

4.1 Data

In our analysis, we use two different data sources on bond spreads: launch spreads contained in Capital Data's "Bondware" dataset and secondary-market spreads included in J.P. Morgan's Emerging Markets Global Bond Index (EMBI Global). Since both datasets have their strengths and weaknesses, we use both of them in our empirical analysis in order to check the robustness of our results.

The use of the EMBI Global dataset is more straightforward since it is a balanced panel of *secondary* market spreads. While its predecessors (EMBI, EMBI+) have been used extensively in the academic literature on emerging market bond spreads (Cline and Barnes 1997, Zhang 1999, Lane and Phillips 2000), the much broader—albeit shorter—EMBI Global does not appear to have been used so far. It is made up of US-$ denominated sovereign or "quasi-

[20]We excluded the third and fourth quarter of 1998 as well as the first quarter of 1999.

sovereign"[21] bonds that satisfy certain criteria, particularly to guarantee a sufficient liquidity of the bonds. Spreads are available at daily frequency for 21 countries since January 1, 1998, with several countries joining the database in later periods. The instruments in the index are mainly Brady bonds and Eurobonds, but the index also contains a small number of traded loans as well as local market instruments. The spread of a bond is calculated as the difference between the bond's yield and the yield of a US government bond with a comparable issue date and maturity. A country's bond spread is then calculated as a weighted average of the spread of all bonds, that satisfy the above-mentioned criteria, where the weighting is done according to market capitalization. In the case of Brady bonds, "stripped" spreads are provided.

Capital Data's "Bondware" dataset contains launch spreads of sovereign and public[22] foreign currency bonds of 54 emerging countries. Spreads are calculated as the difference between the bonds' yields and the yield of a government bond of the country issuing the respective currency with a similar issue date and maturity. In contrast to the EMBI Global, the Bondware dataset does not include Brady bonds. Therefore, the two datasets are almost disjoint. The use of the Bondware dataset is more complicated, since it contains *primary* spreads that are observed only at the time of issue. Thus, this dataset is a highly unbalanced panel, which raises additional econometric problems due to a potential selection bias (see Eichengreen and Mody 1998). However, "Bondware" has an important advantage over the EMBI Global dataset, which is its much broader coverage of countries. This property is crucial since one of our tests (the variance test) relies on asymptotic results in the cross-sectional dimension. The selection problem can be tackled by estimating a standard Heckman correction model (see below).

On the right hand side of the regressions, we use a rich set of macroeconomic fundamentals that have been compiled from a number of different sources (see Appendix for a complete list of the variables and their description). In choosing the set of right-hand-side variables, we tried to capture the most important aspects of a country's macroeconomic performance. The economic variables can be grouped into the following categories: Domestic economics condition (real GDP growth, inflation, fiscal balance, domestic credit growth, condition of the banking system), external sector (current ac-

[21] "Quasi-sovereign" means that the bond is either guaranteed by a sovereign or that the sovereign is the majority shareholder of the respective corporation.

[22] Public means that the public ownership of the respective corporation is higher than 50%.

count, real effective exchange rate, international reserves, external debt), and international interest rates (Libor, and spreads on high-yield U.S. corporate bonds as a liquidity proxy). In addition, we included some political variables (political instability and violence, corruption), other country characteristics (regional dummies, population), and credit ratings.

In the literature on bond pricing, it has been suggested that it is sufficient to include credit ratings to capture the macroeconomic performance of a country (Cantor and Packer 1996, Kamin and Kleist 1997). This is contradicted by the fact that one usually finds a large number of significant macroeconomic variables even when ratings are included. Conversely, the inclusion of ratings has been shown to be crucial even when macroeconomic fundamentals are included (Cantor and Packer 1996, Eichengreen and Mody 1998). We therefore include both macroeconomic fundamentals and the rating information. We follow Eichengreen and Mody (1998) in including not the ratings themselves, but rather a residual from a regression of the ratings on all included macroeconomic fundamentals. This assumes that the correlation between the included fundamentals and the ratings is entirely due to the fact that the ratings have been calculated on the basis of these fundamentals. The residual impact of the ratings might be due to either other omitted macroeconomic fundamentals that are used in the calculation of ratings or to the ratings themselves.

In the regressions based on the EMBI Global dataset, we use the whole range of right-hand-side variables, while the regressions using the Bondware dataset use a much more parsimonious specification to avoid the exclusion of too many countries from the dataset due to missing data on the right hand side.

4.2 Emerging market bond spreads before and after the Russian crisis: a first impression

Before we start our formal econometric analysis, it is useful to have a look at the raw bond spread data. Figure 1 shows the evolution of daily bond spreads for the emerging market countries contained in JP Morgan's EMBI Global index (EMBIG).[23] The basic pattern is well-known: in August 1998, virtually

[23]The graph shows the spreads for all countries for which data existed at the inception of the index (i.e. since January of 1998), except for Nigeria, which is not used in our analysis due to gaps in the right-hand-side data used for the regressions. The countries

all spreads shot up, and their cross-sectional variance widened sharply. By March or April of 1999, however, most of them—with the exceptions of Russia and Ecuador—seemed to have returned to their approximate pre-crisis levels. From Figure 1, it is thus not obvious that the Russian crisis was followed by a permanent increase in the cross-sectional mean and variance of spreads. However, a much clearer impression emerges once Russia and Ecuador (which had idiosyncratic difficulties in 1999 and 2000) are removed from the sample (Figure 2). Now, the cross-sectional variance of spreads appears to be clearly larger in the post-crisis period and so does the average level of spreads.

These impressions are confirmed by Table 1 (left column), which shows the average cross-sectional mean and standard deviation of spreads, based on monthly data, for the pre-crisis, crisis, and post-crisis periods. Excluding Russia and Ecuador, the mean rises by about 100 basis points and the average standard deviation approximately doubles.

The evolution of launch spreads contained in the "Bondware" database is not as easily graphed, since the data consist of single datapoints for each issue, rather than continuous country-specific lines. Moreover, the selection problem makes the raw data more difficult to interpret. For example, the average level of spreads after the Russian crisis is biased downward by the fact that Russia drops out as an issuer. Nevertheless, after excluding Russia from the sample, the raw data confirm the pattern suggested by the EMBIG spreads (right column of Table 1).[24] In particular, both the cross-sectional average and the cross-sectional standard deviation of spreads remain at substantially higher levels in the post-crisis period than prior to the Russian crisis.

The crucial question is now to what extent these changes are attributable to changes in fundamentals, and whether these changes are statistically significant once fundamentals have been taken into account.

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are: Argentina, Bulgaria, Brazil, China, Colombia, Croatia, Ecuador, Korea, Malaysia, Mexico, Morocco, Panama, Peru, Philippines, Poland, Russia, South Africa, Thailand, Turkey, and Venezuela.

[24] A graphical representation of the Bondware data is available from the authors upon request.

4.3 Tests using Bondware data

4.3.1 Econometric Issues

As Eichengreen and Mody (1998) have pointed out, ordinary-least-squares estimates of the relationship between *launch* bond spreads and fundamentals suffer from a selection bias: a country's spread is observed only when the country actually issues a bond. It is very likely that the issue decision depends on factors that influence the level of the spread as well. For instance, we might think that countries with extremely high (latent) spreads are excluded from the market due to adverse selection issues.[25] Therefore, the observability of the spreads cannot considered to be "random", but it depends on the spreads themselves, which has to be taken into account in the econometric analysis.

We follow Eichengreen and Mody (1998) in solving this problem by estimating a standard sample selection model in the spirit of Heckman (1979). Our econometric model thus consists of two equations. The first equation is the spread equation

$$\widetilde{s} = X\beta + u, \tag{12}$$

where $\widetilde{s}$ denotes the latent spread, which is unobserved. Instead, we do observe the actual spread, s, according to the following observation rule:

$$\begin{aligned} s &= \widetilde{s} \quad if \quad \widetilde{z} > 0 \\ s &= \text{not observed} \quad if \quad \widetilde{z} \leq 0, \end{aligned} \tag{13}$$

where $\widetilde{z}$ is another latent variable that is also unobserved. The relationship between this latent variable and the observed country characteristics is described by the selection equation

$$\widetilde{z} = W\gamma + v. \tag{14}$$

However, instead of $\widetilde{z}$ we observe z and the corresponding observation rule can be written as

$$\begin{aligned} z &= 1 \quad if \quad \widetilde{z} > 0 \\ z &= 0 \quad if \quad \widetilde{z} \leq 0. \end{aligned} \tag{15}$$

[25] This type of argument can be found in the model on credit rationing by Stiglitz and Weiss (1981).

The variable z is a dummy variable indicating whether there was a bond issue in a certain period or not. As usual, we assume that the two errors are jointly normal, with ρ denoting the correlation between u and v. In our case, we would expect ρ to be negative.

The matrix W includes all variables contained in the matrix X. For identification, we have to find at least one additional variable that affects the issue decision, but not the level of the spread (unless we want to rely on functional form identification). We use four such variables in our selection equation:

- *Debt issued* in the form of bonds in the year preceding the observation divided by the debt stock at the beginning of that period. This variable captures the effect that countries are less likely to issue new bonds if they have issued large amounts of debt in the near past.

- The *number* of bond issues in the year preceding the observation, as a proxy for the degree of a country's issue activities. A country that issued twenty bonds in the past year is more likely to issue a bond in the next period than a country that issued only one or two bonds that year.

- The *natural logarithm of per capita GDP* in 1993, taken as a proxy for the economic development of a country. A country with higher per capita GDP typically has a more developed financial sector, increasing the probability of bond issues.

- A dummy variable that is equal to one for the five countries mostly affected by the Asian crisis.[26] The idea is that a country that has experienced a financial crisis in the recent past might be excluded from capital markets regardless of its fundamentals.

The definition of the variable z depends on what we consider to be the relevant period for the issue decision. For many countries in our sample, the issue decision is a low-frequency event, happening once a year or less. For these countries, it does not make sense to try to explain why a country did issue a bond in a certain month and not in another, because the decision

[26] Thailand, Indonesia, Korea, Malaysia, Philippines.

is a longer-term decision with the actual month of the issue being somewhat incidental. We therefore chose to transform our data into quarterly frequency.[27]

The disadvantage of transforming the data into quarterly frequency is that we are left with no more than two quarters after the Asian and before the Russian crisis. Therefore, it is not possible to include more than two control variables that vary only across time and not across countries.[28] The set of macroeconomic fundamentals is also fairly restricted because a number of variables is not available for some countries in our sample. For the reasons mentioned above, our strategy for this dataset was to include as many countries as possible; therefore, we excluded only those countries where one of the most important variables—ratings, GDP, inflation, current account—was not available.

4.3.2 Test Results for the Russian Crisis

Table 2 contains pre- and post-crisis regression results for the Russian crisis and the results from the slope test described above. We show the results for three different specifications. In reference to the existing literature, model (1) is a specification similar to the one found in the paper by Eichengreen and Mody (1998).[29] Model (2) is a variant of model (1) which drops the variable "Total debt/GDP"—which turns out to have the "wrong" sign (see Table 2)—and instead includes inflation and the current account.[30] Model

[27]Eichengreen and Mody (1998) also choose quarterly frequency.

[28]In the regressions shown in Table 2, we included a constant and libor. When libor is replaced by hysp (the bond spread of below-investment grade US companies), the results remain largely unchanged.

[29]The main differences are as follows: Eichengreen and Mody use a debt service variable which we could not use due to missing data. In addition, the rescheduling dummy was replaced by a Brady dummy. Also we did not use the same instruments in the selection equation as Eichengreen and Mody because we consider our way of identification to be more credible. Moreover, we only use public bonds, while Eichengreen and Mody also use private bonds. Finally, Eichengreen and Mody estimate their model in semi-logarithmic form, with the spread (but not all of the right-hand-side variables) expressed in logs. This makes little difference to the substance of our regression results, but does not allow us to perform the variance test, since our model does not make any predictions about the variance of log spreads. Thus our models are all estimated using spreads rather than log spreads.

[30]It is possible that the "wrong" sign of the debt variable is due to a simultaneity problem.

(3) is motivated by the concern that a linear specification might not be appropriate and therefore includes the squares of some of the macroeconomic fundamentals. Note that all macroeconomic variables enter the regressions in a way that takes into account reporting lags. This usually means using the first lag rather than the contemporaneous realization. In some cases, we used moving averages to reflect the fact that past trends rather than the latest realization might affect investors; these are denoted as "MA" in the tables. For the reasons outlined above, we excluded the second half of 1998 and the first quarter of 1999 from our regressions.

The upper panel of the table shows coefficients and p-values for the spread equation, based on regressions which were run on a pooled pre- and post-crisis sample, with all variables in the main equation being interacted with pre-and post-crisis dummies. For each model, the column "test for equality" indicates the p-values of the tests whether the coefficients associated with the pre- and post-crisis samples are significantly different from each other. For models (1) and (2), these are the relevant p-values for the slope test. For model (3), the test is slightly more complicated because of the squares on the right hand side (see below). Rejections at the 5 percent level are typed in boldface. The lower panel of the table presents the estimation results for the selection equation. The coefficient ρ denotes the estimated correlation of the disturbance terms of the two equations.

Looking first at the selection equation (lower panel), we find that the selection variables all show the expected signs, with the variable "number of previous bond issues" being strongly significant. The maximum-likelihood estimates converged after only 2 or 3 iterations, which supports our identification procedure. The coefficient ρ also shows the expected sign, but is not significantly different from zero. Therefore, we also ran the regressions without a Heckman correction. The results for the spread equation are virtually unchanged and are thus not reported.

The coefficients in the spread equations mostly show the expected signs and are generally highly significant for the period after the crisis, while the same is not true for the period before the crisis, presumably due to the relatively small number of observations. The results from the slope test are mixed, in that the null hypothesis of equal slopes can be rejected for some, but not all variables. In particular, the rating residual and real GDP growth (MA) significantly increase their impact on spreads in a way that is consistent with the existence of moral hazard in model (1) and (2), while the null hypothesis cannot be rejected for the other variables. In model (3), the relevant slope for this test is the partial derivative of the spread with respect to the variable, which depends on the coefficients of both the linear and quadratic terms and on the level of the variable itself. Evaluated at the respective mean, the slope test for GDP growth clearly rejects the null hypothesis, while the test for the rating residual fails to reject (the p-values are 0.0123 and 0.1270, respectively).

Consider now the level test, which is particularly instructive in view of the somewhat ambiguous results from the slope test (see Table 3). This test tells us whether the overall effect of the changes in coefficients observed in Table 2 is to increase spreads, as one would expect if the driving force behind those changes were moral hazard. We performed the level test for each country, for each of the seven quarters, and for all three models. Table 3 shows the number of significant increases and decreases of fitted spreads for each country as well as the total number of increases and decreases.

Table 3 contains two noteworthy findings. First, the overall evidence clearly supports the notion that spreads significantly increased after the Russian crisis (controlling for fundamentals) as predicted under the moral hazard H_1. The number of increases of fitted spreads is much larger than the number of decreases, and the significant increases also by far outnumber the decreases. In fact, the number of significant decreases is equal to zero in models (1) and (3). Second, the first finding does not apply equally to all countries. Specifically, for the Eichengreen-Mody model, we find rejections consistent with moral hazard for 24 out of 43 countries. In the alternative model, there are rejections for 21 out of 42 countries, with significant changes in spreads in the *opposite* direction from that predicted under H_1 (namely, post-Russia declines) in five cases. Interestingly, four of these five countries are from Asia, which suggests that the decline in spreads might be due to a previous overshooting in spreads in these countries. Besides the Asian countries, it seems that the more advanced emerging markets with relatively strong policy records (e.g., the Czech Republic, Estonia, Hong Kong, Israel, and Chile) experienced constant spreads or even decreases, while the countries with historically weaker policy records (as, e.g., most Latin American countries, Bulgaria, and Kazakhstan) experienced significant increases in their spreads.[31] Thus, the results from Table 3 are generally consistent with the moral-hazard interpretation, even though the heterogeneity across

[31] Note that two of the Asian crisis countries (Indonesia and Thailand) actually experienced *increasing* spreads.

countries requires some explanation.

Finally, Table 4 presents the results of the variance test, which focuses on the implications of moral hazard on the cross-sectional dispersion of spreads rather than the level of spreads for each country. For each model and each time period, the table compares the variance of fitted spreads using the coefficients from the model estimated on pre-crisis data, with the one based on the model estimated on post-crisis data. The column "test for equality" shows the p-values from the variance test, i.e. it shows whether the two fitted variances are significantly different from each other or not. The results are striking: no matter which period is chosen to calculate the fitted variances, the null hypothesis of equal variances is rejected at high confidence levels. In particular, the post-crisis model always significantly overpredicts the pre-crisis variance, while the pre-crisis model always significantly underpredicts the post-crisis variance. This constitutes strong evidence for a stronger differentiation between countries after the Russian crisis, confirming the impression one first obtains on the basis of the raw data. In combination with the results from the level test, these results can be interpreted as strong evidence in favor of the moral-hazard hypothesis. Not only do we find that the cross-sectional variance increases after the event, but we also find that this increase is driven by a significant increase in the level of spreads of weaker countries, while the spreads of stronger countries typically remain unchanged. Thus, there seems to be a much stronger differentiation between "good" and "bad" countries following the Russia crisis.

4.3.3 Test results for the Mexican and Asian Crises

We now discuss the results from applying the test procedures used above to the Mexican and Asian crises (Appendix tables A1-A3). These results are presented mainly to facilitate a comparison of our procedure with the existing literature, even though we do *not* think that these two episodes constitute valid experiments for a test of moral hazard. Both regressions include the same right-hand-side variables as model (2) in the regressions for the Russian crisis.

After the Mexican crisis, several slope coefficients change significantly. However, the direction of this change is not uniform: while the slopes of inflation and the Brady dummy *increase* in absolute value after the crisis, the coefficient of GDP growth (MA) significantly *decreases* in absolute value. (Note that the moral-hazard interpretation in this case would predict a decrease in the slopes.) The results in the level test are similarly mixed: The share of increasing and decreasing fitted spreads is approximately one half, with the number of significant increases being somewhat larger than the number of significant decreases. The group of countries with significant increases consists of only Latin American countries (Argentina, Brazil, Mexico, Uruguay, and Venezuela), while there are only two countries experiencing significant decreases in fitted spreads (Hungary and Trinidad and Tobago). The results from the variance test again suggest that there was an increase in the cross-sectional variance of spreads, even though the results are less strong than in the case of the Russian crisis.

These results cannot easily be reconciled with a pure moral-hazard interpretation. In fact, according to the moral-hazard hypothesis, most of the above effects would have to go in the *opposite* direction of what is actually observed, at least if one believes that the large Mexican bail-out *increased* expected future crisis lending and thus moral hazard.[32] Instead, the mixed results suggest that there might be opposing effects at work that partly compensate each other. The change in the slopes suggests that there was a reassessment of the relative significance of risk factors, leading to a higher "price" of factors like inflation and former rescheduling (Brady dummy) and a lower "price" for low GDP growth. Moreover, the results from the level and variance tests suggest that there was a stronger differentiation between countries after the crisis. Interestingly, increases in spreads are observed in those countries that were similar to the crisis country and in the crisis country itself, which is consistent with a wake-up call argument. It is well possible that this effect more than compensated an existing moral-hazard effect, so that the latter cannot be detected in the data. This could explain why the results of the level and the variance tests are not as clear-cut as in the case of the Russian crisis.

After the Asian crisis, the results point towards a general increase in the level of spreads irrespective of fundamentals, while the evidence for a stronger differentiation between countries is much weaker than in the other crises. In the slope test, there is only one country-specific variable that changes significantly (GDP growth MA), but this change in sign cannot easily be interpreted because the coefficient changes its sign and is significant in both

[32] Some people have in fact argued that the large bailouts and the following controversial discussions about moral hazard might have *dampened* expectations about future international crisis lending (Willett 1999).

cases. In contrast, there were significant changes in two variables that do not change across countries, but only across time (the constant and Libor). In the level test, 82 percent of the fitted spreads increase (very often significantly), while the share of decreases and particularly significant decreases is very small. These results are also reflected in the variance test that cannot reject the null hypothesis of equal variances.

One explanation for these results, which contrast with the results from both the Mexican and the Russian crisis, is that investors after the Asian crisis generally became more reluctant to invest in emerging markets even if these countries had relatively good fundamentals (as the Asian countries had had before the crisis). This led to a general increase in emerging markets bond spreads, but not to a stronger differentiation between countries. This is also supported by the observation that the constant in the *selection* equation is significantly lower after the Asian crisis than before, which means that the probability of issue went down after the crisis for all countries. Thus, there is no evidence for moral hazard in this case. In our view, this is not surprising since the Asian bail-out most likely was expected, so that this event did not contain any new information with respect to future international crisis lending.

4.4 Tests using EMBI Global data

We now turn to the regressions and tests based on the 18 EMBI Global (EMBIG) countries whose spreads were shown in Figure 2. Unlike the previous dataset, the EMBIG dataset constitutes a balanced panel; thus, there is no selection issue.[33] All regressions are based on monthly data, the highest data frequency for which many of the right-hand-side variables are available. Since the EMBIG spread data starts in January of 1998, only tests on the Russian crisis can be performed with this dataset. The definition of the crisis period which is excluded from the regressions is approximately the same as in the launch-spread dataset, namely from August 1998 until March 1999.

Table 5 contains pre-and post-crisis regression results for three alternative models and show the results from the slope tests. The first two models are analogous to models (1) and (2) of Table 2, i.e. a model based on Eichengreen-Mody,[34] and a modification of that model that omits the variable

[33]One might of course argue that the country selection into the EMBIG itself constitutes a selection problem. This possibility is ignored here.

[34]This model is closer to the original Eichengreen-Mody model in that it includes a

"Total debt/GDP" and instead includes inflation and the current account. Model (3), in contrast, is an entirely new model that attempts to make better use of our rich right-hand-side dataset than models (1) and (2). It was selected by applying a general-to-specific procedure to a very general model containing a "representative" from each of the main categories of variables described in section 4.1. While this model selection process does not yield a unique outcome, so that Model (3) is merely an example of several admissible models consistent with the general-to-specific approach, we did convince ourselves that the test results implied by the model are representative of this class of models.

The results from Table 5 are even more mixed than the ones found with the Bondware dataset. The regression results appear to be more sensitive to the inclusion and exclusion of variables and a number of right-hand-side variables always show the "wrong" signs. In the slope test, there are some variables whose coefficients consistently change significantly in the direction predicted by the moral-hazard hypothesis (as the rating residual and the arrears dummy), but there are also quite a few variables whose coefficients change significantly in the opposite direction.

The results from the level test that are given in Table 6 also are less clear than in the Bondware dataset. Models (1) and (2) essentially confirm the findings of Table 3: Again, the number of increases is larger than the number of decreases, and the same is true for significant increases and decreases. This time we find rejections consistent with moral hazard for 12 (13) out of 18 countries, while there are five countries where the spreads *decrease* significantly. Interestingly, these five countries are again all Asian countries, which supports our former interpretation. More troubling are the results from model (3) which puts the ratio between those countries that experience rising and those that experience falling spreads on its head: the latter outnumber the former. According to this model, only a relatively small group of four Latin American countries, plus possibly Bulgaria, seem to have witnessed a significant increase in spreads following the Russian crisis, while most other countries experienced a significant decrease in their spreads. In sum: Table 6 corroborates the earlier finding that the Russian crisis had a differential effect on different countries, which seems to be related to the economic strength of these countries. However, the finding that the predominant direction is to push spreads up does not appear to be as robust as in the earlier dataset.

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variable capturing arrears (rather than the brady dummy as a proxy).

Finally, consider Table 7, which presents the results of the variance test. This time all models agree, and the results are even stronger than in Table 4. Throughout, the models estimated on pre-crisis data strongly underpredict the post-crisis variance of fitted spreads, while the reverse is true for the models estimated on post-crisis data. The difference between the two sets of fitted variances is always highly significant. Thus, the variance test bears out the first impression obtained on the basis of the raw data: the Russian and Brazilian crises were associated with a structural break whose overall effect was to significantly increase the cross-sectional variance of spreads, conditioning on fundamentals. In light of the results of the level test, this result is not surprising . There we had seen significant increases of spreads for the stronger countries and significant decreases of spreads for the weaker ones. Thus, we would have expected the variance to increase, even if the direction of the change in spreads was not always as predicted by the moral-hazard hypothesis. Summing up, the results from the EMBIG dataset generally support the moral-hazard hypothesis in that we find a stronger differentiation across countries that translates into a significant and very robust increase in the cross-sectional variance of spreads. However, there is much weaker evidence for a general *increase* in the level of spreads than in the Bondware dataset.

5 Conclusions

This paper developed and implemented a set of statistical tests designed to detect moral hazard associated with large international rescue packages. In our empirical analysis, we applied these test to the events surrounding the Russian crisis of 1998.

We obtained two main findings: First, the events between mid-1998 and early 1999 generally led to an increase in the levels of emerging markets bond spreads, controlling for changes in fundamentals. However, this effect was not uniform across countries. Increases in spreads were mainly found in countries with weak fundamentals, while countries with traditionally stronger fundamentals experienced constant and even decreasing spreads. Our results suggest that the first group greatly outnumbered the second, even though this finding is not entirely robust. Second, the events during the crisis period had a large positive effect on the cross-sectional variance of spreads. As suggested by the results from the level test, this is due to an increase in the differences between spreads of “good” and “bad” countries. Thus, after the Russia crisis, investors seem to have paid greater attention to differences in the countries’ risk characteristics. This result is highly robust with respect to changes in the dataset and in the model used to predict spreads.

In the context of our simple model of international lending, these findings can be interpreted as evidence for the existence of moral hazard. However, in that model we made the assumption that international crisis lending does not reduce true economic risk, thus ruling out the ex-ante beneficial role of international rescue packages. In general, the presence of an international financial safety net could affect spreads through both channels: on the one hand, by reducing the probability of liquidity crises and mitigating the depth of crises when they do occur, and on the other hand, by creating moral hazard. Therefore, our findings should be interpreted as a *necessary,* but not sufficient condition for the presence of moral hazard.

Another potential caveat concerns the choice of our experiment. One might argue that Russia’s default drew investors’ attention to the possibility of default in other emerging markets, leading to higher spreads in countries with weak fundamentals and larger cross-sectional differentiation of spreads across countries (the “wake up call” interpretation). For this argument to be consistent with rational decision making, the Russian default must have conveyed some new information about emerging market risk. In our view, this was not the case. One can easily think of such “lessons” with regard to the earlier two crises of the 1990s: the possibility of self-fulfilling runs at the international level, “crony capitalism”, or vulnerabilities due to currency mismatches. In contrast, the Russian default was due to an old-style fiscal crisis which had been looming for a long time. It conveyed no new information about emerging markets other than that the willingness of international official lenders to support an insolvent country—even one widely considered “too big to fail”—was evidently more limited than had been previously assumed.

It still remains to be explained why our findings do not show a uniform increase in emerging market bond spreads, but instead a heterogenous reaction of bond spreads, depending on the country’s strength. One plausible explanation is that investors did not revise their expectations about future crisis lending uniformly for all countries, but that these revisions were undertaken only for countries likely to run into solvency problems. After all, the events during the summer and fall of 1998 did not suggest a general unwillingness of the international community to lend to countries in trouble. Instead, they showed the reluctance to rescue an insolvent country with a poor recent track record of reform and no sign of improvement. This can explain why spreads did not rise across the board, controlling for fundamentals. The observation that some spreads actually *fell* can be explained in several ways. The continued recovery in Asia and the consequent fall in Asian spreads may have been driven by a return in confidence that is not fully picked up by our fundamentals. The fact that investors "got out" of countries with weak fundamentals after the Russian crisis may have benefitted those with relatively strong fundamentals.[35] Moreover, the decision of the U.S. Congress to approve the U.S. contribution to the IMF quota increase in October of 1998 may have led to a perception that the Fund was now better equipped to deal with emerging market crises. Everything else equal, this would have reduced emerging market spreads everywhere. In combination with the signal imparted by the Russian crisis, the effect might have shown only for countries with strong fundamentals.

Finally, one has to be careful in drawing policy conclusions from our analysis. Even if we accept the existence of moral hazard, this does not mean that international rescues should not take place at all. The trade-off between risk-reduction and good incentives is an inevitable fact of life. Thus, to make a judgment about the "right" amount of international crisis lending, it would not be sufficient to just prove the existence of moral hazard. Instead, one would have to quantify both the costs and the benefits related to international crisis lending. We view our paper as a first step towards a better understanding of the implications of international crisis lending, which will hopefully enable us to eventually compare risk-reducing and moral hazard effects and thus allow an overall assessment of its benefits and costs.

Appendix

1 The variance test

The variance test is used to test the equality of variances before and after an event, controlling for fundamentals. The null hypothesis can be written as

$$H_0: \quad \beta^{*\prime} Var(X) \beta^* - \beta' Var(X) \beta = 0, \tag{16}$$

[35]This argument requires some degree of segmentation between emerging and advanced capital markets, so that funds withdrawn from one emerging market countries have an effect on emerging market liquidity elsewhere.

which is a nonlinear function of the parameter vector $\binom{\beta}{\beta^*}$. This function will be named $f(\beta, \beta^*)$ in the following. In order to find the distribution of $f(\hat{\beta}, \hat{\beta}^*)$ we approximate it by the Delta method around the true parameter values:

$$f(\hat{\beta}, \hat{\beta}^*) \approx f(\beta, \beta^*) + \frac{\partial f}{\partial \widehat{\beta}} \cdot (\hat{\beta} - \beta) + \frac{\partial f}{\partial \widehat{\beta}^*} \cdot (\hat{\beta}^* - \beta^*) \tag{17}$$

Since $(\hat{\beta}, \hat{\beta}^*)$ are jointly normal under the null, the above expression is also normal since it is a linear combination of $(\hat{\beta}, \hat{\beta}^*)$. The variance of the expression can be easily calculated, leading to the following Wald test statistic:

$$W = f(\hat{\beta}, \hat{\beta}^*)' \left[GVG'\right]^{-1} f(\hat{\beta}, \hat{\beta}^*) \overset{as}{\sim} \chi^2(1) \text{ under } \mathrm{H}_0, \tag{18}$$

where

$$G = \left(\frac{\partial f}{\partial \widehat{\beta}}, \frac{\partial f}{\partial \widehat{\beta}^*} \right), \tag{19}$$

$$V = \widehat{Var} \begin{pmatrix} \hat{\beta} \\ \hat{\beta}^* \end{pmatrix}, \tag{20}$$

and $(\hat{\beta}, \hat{\beta}^*)$ the estimators from the pooled model, allowing for different coefficients before and after the event. Note that this test can be carried out as a one-sided test, using the alternative hypothesis

$$H_1: \quad \beta^{*\prime} Var(X) \beta^* - \beta' Var(X) \beta > 0. \tag{21}$$

2 Proofs for the Restricted Model

Proposition 1 *Holding constant the set of fundamentals* $(\mathbf{x}_1, \mathbf{x}_2, ...\mathbf{x}_n)$, *conditions (2) and (4) imply that* $\frac{d\lambda}{db} > 0$ *if and only if* $\frac{ds}{db} < 0$.

Proof. Consider our main country spread equation (subscripts are omitted to simplify the notation)

$$s = R^* \frac{(1 - \lambda(\mathbf{x}, b))\theta(\mathbf{x})}{1 - (1 - \lambda(\mathbf{x}, b))\theta(\mathbf{x})},$$

by condition (2), we can write

$$\frac{ds}{db} = -R^* \frac{\theta(\mathbf{x}) \frac{d\lambda}{db}}{\left(1 - (1 - \lambda(\mathbf{x}, b))\theta(\mathbf{x})\right)^2}.$$

Hence, $\frac{ds}{db} < 0 \Leftrightarrow \frac{d\lambda}{db} > 0$, q.d.e.■

Proposition 2 *Conditions (2) and (4) imply that* $\frac{d\lambda}{db} > 0$ *if and only if* $\frac{d^2 s_i}{dx_{ij}db} < 0$ *for every* j.

Proof. Starting from equation (3), we can write (omitting i and j subscripts)

$$\frac{ds}{dx} = \frac{R^* \left(1 - \lambda\left(\mathbf{x}, b\right)\right) \frac{d\theta(\mathbf{x})}{dx}}{\left(1 - (1 - \lambda\left(\mathbf{x}, b\right))\theta(\mathbf{x})\right)^2} \ ,$$

and by condition and (4), we have

$$\frac{\partial^2 s}{\partial b \partial x} = -\frac{R^* \frac{d\theta(\mathbf{x})}{dx} \frac{d\lambda(\mathbf{x},b)}{db} \left(1 + \theta(\mathbf{x}) \left(1 - \lambda\left(\mathbf{x}, b\right)\right)\right)}{\left(1 - \theta(\mathbf{x}) + \theta(\mathbf{x})\lambda\left(\mathbf{x}, b\right)\right)^3},$$

that, noting that $\frac{d\theta(x,I)}{dx} > 0$, implies $\frac{\partial^2 s}{\partial b \partial x} < 0 \Leftrightarrow \frac{d\lambda}{db} > 0$, q.d.e.■.

Proposition 3 *Holding constant the set of fundamentals* $(\mathbf{x}_1, \mathbf{x}_2, ...\mathbf{x}_n)$, *conditions (2) and (4) imply that* $\frac{d\lambda}{db} > 0$ *if and only if* $\frac{d\Delta s}{db} < 0$ *for any* s_1, s_2 *for which we can write* $s_2 - s_1$ *as a Taylor expansion.*

Proof. Consider the general case where

$$s_i = s\left(\mathbf{x}_i, b\right) \ ,$$

and define $\Delta s = s_2 - s_1$, and assume WLOG $\Delta s > 0$, and $\Delta x_j = x_{2j} - x_{1j}$. Then, we can write the approximation

$$s_2 \cong s_1 + \sum_{j=1}^{N} \frac{ds\left(\mathbf{x}_1, b\right)}{dx_{1j}} \Delta x_j \ ,$$

That using Eq. (3), becomes

$$s_2 \cong s_1 + \sum_{j=1}^{N} \frac{R^* \lambda\left(\mathbf{x}, b\right)}{\left[1 - (1 - \lambda\left(\mathbf{x}, b\right))\theta(\mathbf{x})\right]^2} \frac{d\theta(\mathbf{x}_i, b)}{dx_{1j}} \Delta x_j \ ,$$

or, rewriting

$$\Delta s \cong \sum_{j=1}^{N} \frac{R^* \lambda\left(\mathbf{x}, b\right)}{\left[1 - (1 - \lambda\left(\mathbf{x}, b\right))\theta(\mathbf{x}_i, b)\right]^2} \frac{d\theta(\mathbf{x}_i, b)}{dx_{1j}} \Delta x_j \ , \tag{22}$$

that means

$$\sum_{j=1}^{N} \frac{d\theta(\mathbf{x}_i, b)}{dx_{1j}} \Delta x_j > 0 \ . \tag{23}$$

Now consider $\frac{d\Delta s}{db}$, from Eq. (22), after defining $D = \frac{R^*}{[1-(1-\lambda(\mathbf{x},b))\theta(\mathbf{x}_i,b)]^3}$, we can write (with a more parsimonious notation)

$$\begin{aligned}\frac{d\Delta s}{db} \quad &\cong \quad D\sum_{j=1}^{N}\Delta x_j\left\{\left[(1-\lambda)\frac{\partial^2\theta(\mathbf{x}_i,b)}{\partial b\partial x_{1j}} - \frac{d\theta(\mathbf{x}_i,b)}{dx_{1j}}\frac{d\lambda}{db}\right](1-\lambda(\mathbf{x},b))\right.\\ &\left. +2(1-\lambda)\frac{d\theta(\mathbf{x}_i,b)}{dx_{1j}}\left[(1-\lambda)\frac{d\theta(\mathbf{x}_i,b)}{db} - \theta(\mathbf{x}_i,b)\frac{d\lambda}{db}\right]\right\}.\end{aligned}$$

That imposing conditions (2) and (4) becomes

$$\frac{d\Delta s}{db} \cong -D(1-\lambda)\frac{d\lambda}{db}(1+2\theta)\sum_{j=1}^{N}\Delta x_j\frac{d\theta}{dx_{1j}},$$

that because of Eq. (23) implies

$$\frac{d\Delta s}{db} < 0 \Leftrightarrow \frac{d\lambda}{db} > 0\ .$$

q.d.e. ■

3 True Risk Reduction

Condition (2) assumes that the probability of a financial crisis, θ, does not depend on the rescue probability b. This is not innocuous: it rules out any benefits international crisis lending may have in reducing market imperfections, for example, by coordinating investors and preventing panics. Suppose one abandons this assumption, and instead assumes

$$\theta = \theta(\mathbf{x}_i, b), \quad \text{where} \quad \frac{\partial\theta(\mathbf{x}_i,b)}{\partial b} < 0, \tag{24}$$

a property we henceforth refer to as "true risk reduction". It is easily shown, that under condition (24) (and no change in the other previous assumptions) the equivalence between moral hazard and the three properties of spreads referred to in the propositions—a reduction in the spreads, a weakening of the link between spreads and fundamentals, and a reduction in the cross-sectional dispersion of spreads—breaks down. Moral hazard still implies that spreads must behave as described in the propositions, but the reverse is no longer true, in the sense that spreads may behave as described even if moral hazard is *not* present ($\frac{\partial\lambda}{\partial b} = 0$). As it turns out, however, this problem arises with less force in the case of the "coefficient test" and "variance test" than in the case of the "level test":

- It can be shown (see the Appendix) that (24) inevitably implies $\frac{\partial s}{\partial b} < 0$, regardless of whether moral hazard is present or not. Thus, the "level test" is *never* able to discriminate between moral hazard and true risk reduction. This is the fundamental interpretational problem one faces when observing a reduction in spreads in response to an event that increases the chances of future crisis rescues, as extensively argued by Lane and Phillips (2000).

- In contrast, whether or not condition (24) implies $\frac{d^2 s_i}{dx_{ij}db} < 0$ even in the absence of moral hazard depends on the behavior of the cross-derivative $\frac{\partial^2\theta(x,b)}{\partial b \partial x}$. Specifically, if $\frac{\partial^2\theta(x,b)}{\partial b \partial x} \leq 0$—meaning that the true risk reduction associated with crisis rescues either benefits all countries equally, or benefits countries with worse fundamentals more than others—then $\frac{d^2 s_i}{dx_{ij}db} < 0$, regardless of whether moral hazard is present or not. In that case, the "coefficient test" is no better than the "level test". In contrast, if $\frac{\partial^2\theta(x,b)}{\partial b \partial x}$ is sufficiently positive—so that the presence of a financial safety net makes a bigger difference for relatively "better" emerging market economies—then $\frac{d^2 s_i}{dx_{ij}db} < 0$ only in the presence of moral hazard, so that the coefficient test is valid. The intuition is that true risk reduction by itself would tend to weaken the link between fundamentals and spreads, just like moral hazard, but if countries with better fundamentals and lower spreads experience a much larger risk reduction than countries with worse fundamentals, the overall effect would leave the link between fundamentals and risk unchanged, or even strengthened. In that case, an observed weakening of the link could only be due to moral hazard. The same arguments apply to the "variance test", which in linear models is equivalent to the level test.

In sum: while the level test is incapable to distinguish between true risk reduction and moral hazard, the coefficient and variance tests may be able to do so, but only if the additional assumption is made that true risk reduction (if it exists at all) is positively correlated with the quality of fundamentals. Since there is no way of telling whether the latter is true (and one might reasonably argue the opposite), this is only a modest improvement. It does suggest, however, that the tests should always be performed jointly. If all reject (in the sense of finding $\frac{\partial s}{\partial b} < 0$ and $\frac{d^2 s_i}{dx_{ij}db} < 0$ and a reduction in cross-sectional dispersion), then this is evidence that moral hazard or true risk reduction (or both) are present. If none reject, this would be interpreted as evidence that neither moral hazard nor true risk reduction are present. However, if only the level test rejects ($\frac{\partial s}{\partial b} < 0$) but not the coefficient/variance test ($\frac{d^2 s_i}{dx_{ij}db} \geq 0$) then this could be interpreted as evidence that moral hazard is not present, and that the driving force between the decline in average spreads is true risk reduction. What follows is a formal proof of this discussion.

Proposition 4 *Holding constant the set of fundamentals* $(\mathbf{x}_1, \mathbf{x}_2, ...\mathbf{x}_n)$*, and assuming* $\frac{d\theta(\mathbf{x}_i,b)}{db} < 0$, $\frac{d\lambda}{db} = 0$ *implies* $\frac{ds}{db} < 0$.

Proof. If we assume $\frac{d\theta(\mathbf{x}_i,b)}{db} < 0$, we can write

$$\frac{ds}{db} = R^* \frac{(1 - \lambda(\mathbf{x}, b) \frac{d\theta(\mathbf{x}_i,b)}{db} - \theta(\mathbf{x}_i, b)\frac{d\lambda}{db}}{(1 - (1 - \lambda(\mathbf{x}, b))\theta(\mathbf{x}))^2} ,$$

that under $\frac{d\lambda}{db} = 0$ becomes

$$\frac{ds}{db} = R^* \frac{(1 - \lambda(\mathbf{x}, b) \frac{d\theta(\mathbf{x}_i,b)}{db}}{(1 - (1 - \lambda(\mathbf{x}, b))\theta(\mathbf{x}))^2} > 0 .$$

q.d.e.■

Proposition 5 *Holding constant the set of fundamentals* $(\mathbf{x}_1, \mathbf{x}_2, ...\mathbf{x}_n)$*, and assuming* $\frac{d\theta(\mathbf{x}_i,b)}{db} < 0$*, there exist* $\mu \geq 0$ *such that for* $\frac{\partial^2\theta(\mathbf{x}_i,b)}{\partial b\partial x_{1j}} > \mu$ *,* $\frac{d\lambda}{db} = 0$ *implies* $\frac{d^2 s_i}{dx_{ij}db} \geq 0$.

Proof. Define $D = \frac{R^*}{(1-\theta(\mathbf{x})+\theta(\mathbf{x})\lambda(\mathbf{x},b))^3}$, then under the assumptions we can write (omitting the subscripts)

$$\frac{\partial^2 s}{\partial b\partial x} = D\left\{-\frac{d\theta}{dx}\frac{d\lambda}{db}(1 + \theta(1 - \lambda)) + (1 - \lambda)\left[\frac{\partial^2\theta}{\partial b\partial x}(1 - \theta(1 - \lambda)) + 2\frac{\partial\theta}{\partial b}\frac{\partial\theta}{\partial x}(1 - \lambda)\right]\right\},$$

that, imposing $\frac{d\lambda}{db} = 0$, becomes

$$\frac{\partial^2 s}{\partial b\partial x} = D(1 - \lambda)\left[\frac{\partial^2\theta}{\partial b\partial x}(1 - \theta(1 - \lambda)) + 2\frac{\partial\theta}{\partial b}\frac{\partial\theta}{\partial x}(1 - \lambda)\right] ,$$

that is positive if and only if

$$\frac{\partial^2\theta}{\partial b\partial x} > \mu = -\frac{2\frac{\partial\theta}{\partial b}\frac{\partial\theta}{\partial x}(1 - \lambda)}{(1 - \theta(1 - \lambda))} > 0 .$$

q.d.e.■

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Figure 1: EMBI Global Daily Strip Spreads, 20 Countries (includes Russia and Ecuador)
(in basis points)

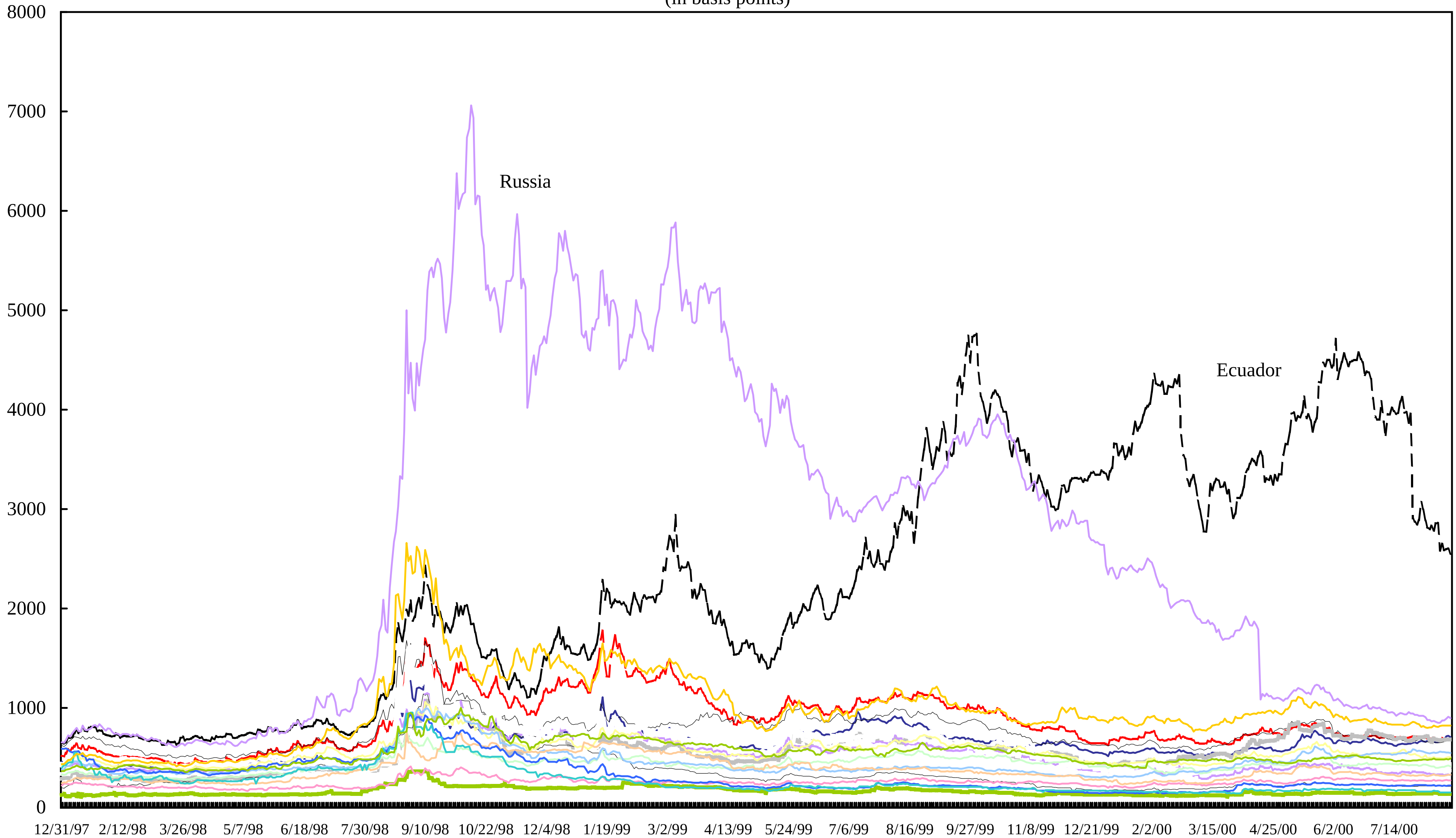

Figure 2: EMBI Global Daily Strip Spreads, 18 countries (excludes Russia and Ecuador)
(in basis points)

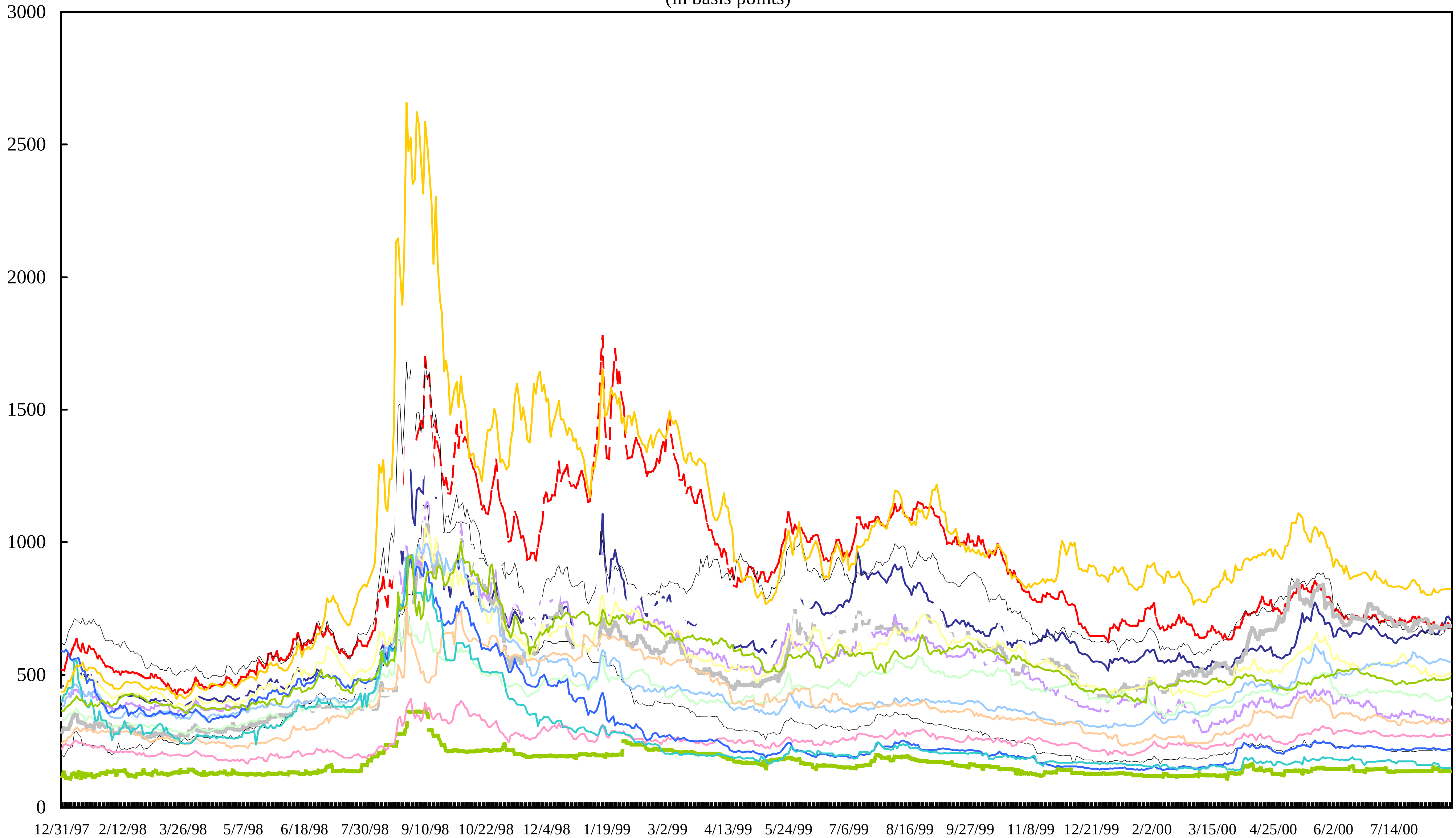

Table 1. Mean and Cross-sectional Dispersion of Spreads before and after the Russia Crisis: Summary Statistics

		18 EMBIG countries (excluding Russia and Ecuador) 1/		37 Bondware countries (excluding Russia and Ecuador) 2/	
Period		mean	std. dev. 3/	mean	std. dev. 3/
pre-	1998:Q1	354	108	337	96
crisis	1998:Q2	393	122	280	125
crisis	1998:Q3	776	333	267	243
	1998:Q4	668	295	460	208
	1999:Q1	561	237	488	223
post-	1999:Q2	532	258	417	195
crisis	1999:Q3	567	283	426	154
	1999:Q4	438	217	415	169
	2000:Q1	406	207	432	155
	2000:Q2	479	230	379	172

1/ Argentina, Bulgaria, Brazil, China, Colombia, Croatia, Korea, Morocco, Mexico, Malaysia, Panama, Peru, Philippines, Poland, Thailand, Turkey, Venezuela, South Africa.
2/ Argentina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, El Salvador, Estonia, Hong Kong, Hungary, India, Israel, Kazakhstan, Korea, Latvia, Lebanon, Lithuania, Malaysia, Malta, Mexico, Morocco, Pakistan, Philippines, Poland, Singapore, Slovak Republic, Slovenia, South Africa, Taiwan, Thailand, Tunisia, Turkey, Uruguay, Venezuela. Ecuador, Indonesia, Jordan, Romania, and Saudi Arabia did not issue bonds during this period.
3/ Refers to average cross-sectional standard deviation during period

Table 2. Launch Spread Data: Estimation of Alternative Models Before and After Russian Crisis, and Results for "Coefficients Test"

Variable	(1) "Eichengreen-Mody" 1/					(2) Alternative specification 1/					(3) Alternative including squares 1/				
	before crisis 2/		after crisis 3/		Test for equality	before crisis 2/		after crisis 3/		Test for equality	before crisis 2/		after crisis 3/		Test for equality
	Coef.	*p*	Coef.	*p*	*p* 4/	Coef.	*p*	Coef.	*p*	*p* 4/	Coef.	*p*	Coef.	*p*	*p* 4/
Constant	27190.79	0.43	1177.15	0.00	0.45	3461.78	0.23	815.35	0.00	0.36	2583.30	0.35	881.40	0.00	0.54
Real growth (MA)	26.04	0.23	-44.64	0.00	**0.00**	33.82	0.16	-43.52	0.00	**0.00**	20.42	0.89	-110.25	0.00	0.38
(Real growth)^2											0.41	0.98	2.36	0.20	0.89
Inflation						1.28	0.28	0.50	0.56	0.60					
Current account (MA)						-1.08	0.76	-4.73	0.02	0.36					
Total Debt/GDP	-0.05	0.98	-0.90	0.00	0.64										
Brady dummy	74.39	0.23	60.38	0.07	0.82	63.54	0.35	60.94	0.04	0.97	56.23	0.71	207.81	0.00	0.35
Rating (residual)	-27.95	0.01	-62.46	0.00	**0.00**	-24.36	0.10	-66.33	0.00	**0.01**	-25.03	0.67	-127.20	0.00	0.12
(rating residual)^2											-0.01	1.00	3.66	0.00	0.23
LIBOR						-593.06	0.24	-58.85	0.01	0.29	-428.46	0.37	-98.61	0.00	0.49
US ten year yield	-4847.57	0.44	-111.27	0.00	0.45										
F test (p)					**0.00**					**0.00**					**0.00**
No. quarters	86		215			84		210			86		215		
No. bond quarters	19		86			19		84			19		86		
No. countries 5/	43		43			42		42			43		43		

Selection Equation 6/	(1) Coef.	*p*	(2) Coef.	*p*	(3) Coef.	*p*
Debt issued in preceding year	-0.12	0.86	-0.20	0.79	-0.61	0.42
Number of issues preceding	0.17	0.00	0.19	0.00	0.18	0.00
GDP per capita (1993)	0.19	0.38	0.22	0.38	0.15	0.52
dummy for Asian crisis countries	-0.13	0.66	-0.26	0.41	-0.23	0.48
rho	0.17	0.64	-0.08	0.78	-0.09	0.80

1/ Estimated on pooled sample 1998:Q1 - 2000:Q2, excluding 1998:Q3 - 1999:Q1, and allowing for different coefficients for pre- and post crisis periods
2/ 1998:Q1 - 1998:Q2
3/ 1999:Q1 - 2000:Q2
4/ p values based on two-sided tests; boldface indicates rejection of equality at the 5 percent level in the direction consistent with H1 (see text).
5/ Argentina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Ecuador, El Salvador, Estonia, Hong Kong, Hungary, India, Indonesia, Israel, Jordan, Kazakhstan, Korea, Latvia, Lebanon, Lithuania, Malaysia, Malta, Mauritius, Mexico, Pakistan, Philippines, Poland, Romania, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Africa, Taiwan, Thailand, Tunisia, Turkey, Uruguay, Venezuela. Model (2) excludes El Salvador.
6/ Reports only coefficients for instruments and correlation coefficient of disturbance terms of the two equations (rho).

Table 3. Launch Spread Data: Summary Results for "Levels Test" (Russia Crisis)

	Eichengreen-Mody: Rejections indicating ...		Alternative model: Rejections indicating ...		Alternative incl. squares Rejections indicating ...	
	significant increase of spreads 1/	significant decline of spreads 2/	significant increase of spreads 1/	significant decline of spreads 2/	significant increase of spreads 1/	significant decline of spreads 2/
Argentina	2	0	3	0	1	0
Brazil	2	0	4	0	4	0
Bulgaria	2	0	5	0	0	0
Chile	0	0	0	2	0	0
China	0	0	0	2	0	0
Colombia	2	0	2	0	0	0
Costa Rica	2	0	2	0	1	0
Croatia	2	0	1	0	1	0
Cyprus	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0
Ecuador	2	0	4	0	3	0
El Salvador	2	0	...	...	0	0
Estonia	0	0	0	0	0	0
Hong Kong	0	0	0	0	0	0
Hungary	2	0	2	0	1	0
India	0	0	0	0	0	0
Indonesia	1	0	3	0	2	0
Israel	0	0	0	0	0	0
Jordan	2	0	4	0	2	0
Kazakhstan	2	0	3	0	4	0
Korea	0	0	0	0	0	0
Latvia	2	0	1	0	0	0
Lebanon	2	0	0	0	3	0
Lithuania	2	0	2	0	0	0
Malaysia	0	0	0	2	0	0
Malta	0	0	0	0	0	0
Mauritius	0	0	0	0	0	0
Mexico	2	0	2	0	2	0
Pakistan	2	0	4	0	5	0
Philippines	0	0	0	0	0	0
Poland	0	0	0	0	0	0
Romania	2	0	5	0	2	0
Saudi Arabia	2	0	4	0	0	0
Singapore	0	0	0	2	0	0
Slovak Republic	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0
South Africa	2	0	3	0	1	0
Taiwan Province of China	0	0	0	2	0	0
Thailand	0	0	2	0	0	0
Tunisia	1	0	1	0	0	0
Turkey	2	0	0	0	3	0
Uruguay	1	0	0	0	0	0
Venezuela	2	0	5	0	3	0
Sum rejections	45	0	62	10	38	0
... out of total: 3/	254	47	202	92	222	79
No. countries showing rejection 4/	24	0	21	5	16	0
Total no. of countries	43		42		43	

1/ No. of periods in which fitted spread based on post-crisis model is significantly *higher* than fitted spread based on pre-crisis model (potential maximum: 7).
2/ No. of periods in which fitted spread based on post-crisis model is significantly *lower* than fitted spread based on pre-crisis model (potential maximum: 7).
3/ Total number of periods in which fitted spread based on post-crisis model is higher than fitted spread based on pre-crisis model (left columns) or vice versa (right columns), regardless of significance.
4/ No. of countries showing several periods with significant change in spreads in one direction and no more than one period showing a significant change in opposite direction.

Table 4. Launch Spread Data: Cross-sectional Variances of Fitted Spreads before and after Russian Crisis, and Results for "Variance Test"

	(1) Eichengreen-Mody			(2) Alternative specification			(3) Alternative including squares		
	Fitted variance using coefficients estimated		Test for equality	Fitted variance using coefficients estimated		Test for equality	Fitted variance using coefficients estimated		Test for equality
Quarter	before crisis 1/	after crisis 2/	(*p*) 3/	before crisis 1/	after crisis 2/	(*p*) 3/	before crisis 1/	after crisis 2/	(*p*) 3/
1998:Q1	10107	34704	***0.017***	9761	33942	***0.009***	8568	27933	***0.014***
1998:Q2	10547	35692	***0.017***	11149	37021	***0.008***	8952	30532	***0.008***
1999:Q2	8330	43921	***0.000***	9568	46481	***0.000***	8180	47922	***0.000***
1999:Q3	8317	43909	***0.000***	9541	46894	***0.000***	8198	48008	***0.000***
1999:Q4	8455	45844	***0.000***	9550	48917	***0.000***	8261	51102	***0.000***
2000:Q1	7344	46706	***0.000***	8266	47994	***0.000***	6852	52017	***0.001***
2000:Q2	7301	48657	***0.000***	8155	50440	***0.000***	6809	56007	***0.000***

1/ Regression coefficients estimated on the basis of pre-crisis data (see Table 2).
2/ Regression coefficients estimated on the basis of post-crisis data (see Table 2).

Table 5. EMBIG Data: Estimation of Alternative Models Before and After Russia Crisis, and Results for "Coefficients Test"

	(1) "Eichengreen-Mody" 1/					(2) Alternative specification (A) 1/					(2) Alternative specification (B) 1/				
	before crisis 2/		after crisis 3/		Test for equality	before crisis 2/		after crisis 3/		Test for equality	before crisis 2/		after crisis 3/		Test for equality
Variable	Coef.	p	Coef.	p	p 4/	Coef.	p	Coef.	p	p 4/	Coef.	p	Coef.	p	p 4/
Constant	1051.16	0.28	1405.95	0.00	0.73	932.99	0.33	1450.96	0.00	0.60	1904.13	0.00	2399.78	0.00	0.30
Real growth	-11.01	0.00	-3.36	0.03	0.00	-10.78	0.00	-1.48	0.52	0.00	-5.06	0.00	-18.03	0.00	**0.00**
Inflation						0.52	0.00	-1.17	0.07	0.01					
Fiscal balance											12.93	0.00	25.45	0.00	**0.03**
Current account (MA)						13.53	0.00	24.95	0.00	**0.05**	8.53	0.03	32.56	0.00	**0.00**
Growth of the Real Exchange Rate											-0.23	0.62	-5.43	0.00	**0.00**
Relative price of non-fuel, non-manufacturing goods											-1146.30	0.00	-1650.88	0.00	0.28
Reserves/Short Term Debt						-0.14	0.00	-0.11	0.11	0.75	-0.34	0.00	-0.39	0.00	0.60
Total Debt/Exports											0.00	0.00	0.00	0.52	**0.00**
Total Debt/GDP	-0.51	0.0	-0.74	0.00	**0.02**										
Short Term Debt/Total Debt											-2.30	0.00	-6.45	0.00	**0.00**
Brady dummy											75.53	0.00	227.09	0.00	**0.00**
Arrears dummy	61.29	0.00	267.24	0.00	**0.00**	35.28	0.00	190.14	0.00	**0.00**					
Rating (residual)	-37.81	0.00	-63.43	0.00	**0.00**	-32.00	0.00	-58.01	0.00	**0.00**	-56.23	0.00	-75.07	0.00	**0.02**
Real credit growth (MA)											-2.04	0.01	-2.24	0.04	0.88
Political Instability and Violence											-59.68	0.00	-183.70	0.00	**0.00**
Asia dummy	-30.78	0.09	-207.42	0.00	**0.00**	-15.58	0.42	-230.88	0.00	**0.00**					
Latin dummy	115.49	0.00	249.77	0.00	**0.00**	103.17	0.00	233.67	0.00	**0.00**					
US ten year yield	-199.63	0.16	-132.90	0.00	0.65	-180.31	0.19	-131.44	0.00	0.73					
US high-yield bond spread	142.36	0.03	-31.11	0.51	0.03	154.57	0.01	-27.94	0.55	0.02					
log of US$ GDP											-8.14	0.06	5.54	0.40	0.09
F-test (*p*)					**0.00**					**0.00**					**0.00**
N	124		162			124		162			124		162		
No. countries 4/	18		18			18		18			18		18		
k	10		10			11		11			14		14		
R Sq.	0.74		0.81			0.77		0.82			0.82		0.89		

1/ Estimated on pooled sample allowing for different coefficients for pre- and post crisis periods
2/ January 1998 to July 1998, using monthly data
3/ April 1999 to December 1999, using monthly data
4/ p values based on two-sided tests; boldface indicates rejection of equality at the 5 percent level in the direction consistent with H1 (see text).
5/ Full sample of 18 countries: Argentina, Bulgaria, Brazil, China, Colombia, Croatia, Korea, Morocco, Mexico, Malaysia, Panama, Peru, Philippines, Poland, Thailand, Turkey, Venezuela, South Africa.

Table 6. EMBIG Data: Summary Results for "Levels Test"

	Eichengreen-Mody Rrejections indicating ...		Alternative model A: Rejections indicating ...		Alternative model B: Rejections indicating ...	
	significant increase of spreads 1/	significant decline of spreads 2/	significant increase of spreads 1/	significant decline of spreads 2/	significant increase of spreads 1/	significant decline of spreads 2/
Argentina	7	0	7	0	0	7
Brazil	7	0	7	0	9	0
Bulgaria	10	0	9	0	9	4
China	0	2	0	2	0	16
Colombia	7	0	7	0	2	0
Croatia	7	0	7	0	3	5
Korea	0	7	0	7	1	9
Malaysia	0	7	0	8	0	15
Mexico	7	0	7	0	2	0
Morocco	0	0	3	0	0	4
Panama	7	0	7	0	0	0
Peru	7	0	7	0	0	5
Philippines	0	2	0	4	0	9
Poland	5	0	7	0	0	12
South Africa	3	0	5	0	0	13
Thailand	0	7	0	8	0	9
Turkey	7	0	5	0	0	7
Venezuela	7	0	7	0	10	0
Sum rejections	81	25	85	29	36	115
... out of total: 3/	200	88	177	111	104	184
No. countries showing rejection 4/	12	5	13	5	4	12
Total no. of countries	18		18		18	

1/ No. of periods in which fitted spread based on post-crisis model is significantly *higher* than fitted spread based on pre-crisis model (potential maximum: 16).
2/ No. of periods in which fitted spread based on post-crisis model is significantly *lower* than fitted spread based on pre-crisis model (potential maximum: 16).
3/ Total number of periods in which fitted spread based on post-crisis model is higher than fitted spread based on pre-crisis model (left columns) or vice versa (right columns), regardless of significance.
4/ No. of countries showing several periods with significant change in spreads in one direction and no more than one period showing a significant change in opposite direction.

Table 7. EMBIG Data: Cross-sectional Variances of Fitted Spreads before and after Russian Crisis, and Results for "Variance Test"

		(1) Eichengreen-Mody			(2) Alternative specification (A)			(2) Alternative specification (B)		
		Fitted variance using coefficients estimated		Test for equality	Fitted variance using coefficients estimated		Test for equality	Fitted variance using coefficients estimated ...		Test for equality
Month	Actual Variance 1/	before crisis 1/	after crisis 2/	(*p*) 3/	before crisis 1/	after crisis 2/	(*p*) 3/	before crisis 1/	after crisis 2/	(*p*) 3/
1998:01	14474	11438	64210	***0.000***	12520	90302	***0.006***	15233	36846	***0.000***
1998:02	11714	11340	65771	***0.000***	12002	67257	***0.000***	14663	33563	***0.000***
1998:03	8909	10782	62403	***0.000***	11123	63492	***0.000***	13523	33311	***0.000***
1998:04	10099	10329	60648	***0.000***	10714	62593	***0.000***	11517	32243	***0.000***
1998:05	14559	10329	60648	***0.000***	10716	62427	***0.000***	11665	33415	***0.000***
1998:06	20586	10329	60648	***0.000***	10710	62707	***0.000***	11879	34562	***0.000***
1998:07	23638	9356	56498	***0.000***	9148	59008	***0.000***	11095	40041	***0.000***
1999:04	53108	9449	53503	***0.000***	9846	53393	***0.000***	12056	53903	***0.000***
1999:05	80188	9449	53503	***0.000***	9841	53609	***0.000***	12240	53166	***0.000***
1999:06	67609	9748	54126	***0.000***	10160	54180	***0.000***	12784	57795	***0.000***
1999:07	78276	9349	52807	***0.000***	10111	54511	***0.000***	12633	58504	***0.000***
1999:08	95792	9309	52639	***0.000***	10035	53882	***0.000***	12011	57081	***0.000***
1999:09	66819	10106	54630	***0.000***	10755	55624	***0.000***	13041	59801	***0.000***
1999:10	50033	10248	55428	***0.000***	10878	56755	***0.000***	13699	62338	***0.000***
1999:11	52809	10273	56507	***0.000***	10824	57604	***0.000***	14149	65678	***0.000***
1999:12	38487	10710	58895	***0.000***	11168	59702	***0.000***	15159	66471	***0.000***

1/ Sample of 18 countries excluding Russia and Ecuador (see Table 5)

2/ Regression coefficients estimated on 1998:01 to 1998:07 data.

3/ Regression coefficients estimated on 1999:03 to 1999:12 data.

Table A1. Launch Spread Data: Estimation Results Before and After the Mexican and Asian Crises, and "Coefficients Test" 1/

	(1) Mexican Crisis					(2) Asian Crisis				
	before crisis 2/		after crisis 3/		Test for equality	before crisis 4/		after crisis 5/		Test for equality
Variable	Coef.	*p*	Coef.	*p*	*p* 6/	Coef.	*p*	Coef.	*p*	*p* 6/
Constant	203.1	*0.06*	387.9	*0.07*	*0.44*	841.0	*0.01*	5650.7	*0.01*	*0.02*
Real growth (MA)	-15.91	*0.00*	-6.38	*0.02*	*0.05*	-10.78	*0.00*	69.31	*0.00*	***0.00***
Inflation	39.51	*0.09*	171.46	*0.00*	***0.01***	184.38	*0.00*	257.88	*0.04*	*0.57*
Current account (MA)	-0.84	*0.56*	0.42	*0.70*	*0.49*	-2.30	*0.14*	-12.52	*0.14*	*0.23*
Brady dummy	32.29	*0.40*	164.34	*0.00*	***0.00***	88.91	*0.00*	50.66	*0.28*	*0.44*
Rating (residual)	-18.06	*0.01*	-16.88	*0.00*	*0.88*	-18.57	*0.00*	-20.01	*0.04*	*0.89*
LIBOR	7.37	*0.74*	-43.27	*0.25*	*0.25*	-112.59	*0.06*	-1004.3	*0.01*	*0.02*
F test (p)					***0.01***					***0.00***
No. quarters	69		184			198		66		
No. bond quarters	25		104			90		17		
No. countries 7/	23		23			33		33		

Selection Equation 8/	Coef.	*p*	Coef.	*p*
Debt issued in preceding year	-3.99	*0.04*	-3.15	*0.02*
Number of issues preceding	0.20	*0.00*	0.19	*0.00*
GDP per capita (1993)	-0.06	*0.79*	-0.02	*0.91*
dummy for Asian crisis countries			-0.75	*0.24*
rho	-0.24	*0.26*	-0.69	*0.00*

1/ Using model (2) of Table 2 in both cases. Regression (1) is based on the sample 1994:Q1 - 1997:Q2, regression (2) on the sample 1996:Q1 - 1998:Q2.
2/ 1994:Q1 - 1994:Q3
3/ 1995:Q3 - 1997:Q2
4/ 1996:Q1 - 1997:Q2
5/ 1998:Q1 - 1998:Q2
6/ p values based on two-sided tests; boldface indicates rejection of equality at the 5 percent level in the direction consistent with H1 (see text).
7/ Sample in model (1): Argentina, Brazil, Chile, China, Colombia, Cyprus, Hong Kong, Hungary, India, Indonesia, Israel, Korea, Malaysia, Malta, Mexico, Philippines, Singapore, Taiwan, Thailand, Trinidad and Tobago, Turkey, Uruguay, Venezuela. Sample in model (2): Argentina, Brazil, Chile, China, Colombia, Cyprus, Czech Republic, Hong Kong, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Malta, Mauritius, Mexico, Pakistan, Philippines, Poland, Romania, Saudi Arabia, Singapore, Slovak Republic, South Africa, Taiwan, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, Venezuela.
8/ Reports only coefficients for instruments and correlation coefficient of disturbance terms of the two equations (rho).

Table A2. Launch Spread Data: Summary Results for "Levels Test", Mexican and Asian Crises 1/

	Mexican Crisis Rejections indicating ...		Asian Crisis Rejections indicating ...	
	significant increase of spreads 2/	significant decline of spreads 3/	significant increase of spreads 2/	significant decline of spreads 3/
Argentina	3	0	5	0
Brazil	4	0	2	0
Chile	0	0	8	0
China	0	0	8	0
Colombia	0	0	6	0
Cyprus	0	0	4	0
Czech Republic	...	...	5	0
Hong Kong	0	0	1	0
Hungary	0	2	0	1
India	0	0	8	0
Indonesia	0	0	8	0
Israel	0	0	8	0
Jordan	...	...	5	0
Korea	0	0	8	0
Malaysia	0	0	8	0
Malta	0	0	7	0
Mauritius	...	...	6	0
Mexico	4	0	0	2
Pakistan	...	...	5	0
Philippines	0	0	2	0
Poland	...	...	7	0
Romania	...	...	1	0
Saudi Arabia	...	...	0	2
Singapore	0	0	5	0
Slovak Republic	...	...	3	0
South Africa	...	...	0	0
Taiwan	0	0	6	0
Thailand	0	0	8	0
Trinidad and Tobago	0	3	0	0
Tunisia	...	...	6	0
Turkey	0	0	6	0
Uruguay	9	0	3	1
Venezuela.	10	0	0	2
Sum rejections	30	5	149	8
... out of total: 4/	128	125	216	48
No. countries showing rejection 5/	5	2	27	5
Total no. of countries	23		33	

1/ Using models presented in Table A1.

2/ Periods in which fitted spread based on post-crisis model is significantly *higher* than fitted spread based on pre-crisis model (potential maximum: 7).

3/ Periods in which fitted spread based on post-crisis model is significantly *lower* than fitted spread based on pre-crisis model (potential maximum: 7).

4/ Total no. of periods in which fitted spread based on post-crisis model is higher than fitted spread based on pre-crisis model (left columns) or vice versa (right columns),regardless of significance.

5/ No. of countries showing several periods with sig. change in spreads in one direction and no more than one period with sig. change in opposite direction.

Table A3. Launch Spread Data: Cross-sectional Variances of Fitted Spreads before and after Mexican and Asian Crises, and Results for "Variance Test"

	(1) Mexican Crisis			(2) Asian Crisis		
	Fitted variance using coefficients estimated ...		Test for equality	Fitted variance using coefficients estimated ...		Test for equality
Quarter	before crisis 1/	after crisis 2/	(*p*) 3/	before crisis 1/	after crisis 2/	(*p*) 3/
1994:Q1	6044	27609	***0.021***			
1994:Q2	6300	30873	***0.026***			
1994:Q3	6462	31550	***0.026***			
1995:Q3	6178	12162	***0.049***			
1995:Q4	6006	12118	***0.039***			
1996:Q1	5969	12357	***0.032***	7244	38819	*0.120*
1996:Q2	5987	12490	***0.030***	7206	39032	*0.119*
1996:Q3	6005	12666	***0.028***	7260	38733	*0.120*
1996:Q4	5937	12584	***0.027***	7264	38736	*0.118*
1997:Q1	5741	12550	***0.024***	7317	27017	*0.158*
1997:Q2	5592	11657	***0.036***	7185	27756	*0.157*
1998:Q1				6213	20860	*0.119*
1998:Q2				6239	21973	*0.108*

1/ Regression coefficients estimated on the basis of pre-crisis data (see Table A1).
2/ Regression coefficients estimated on the basis of post-crisis data (see Table A1).
3/ p values based on two-sided tests.

Variable name	Variable description	Unit	Frequency	Source
Arrears dummy	= 1 if Arrears/total debt > 5% in any of the past 3 years	Dummy	A	GDF
Asia dummy	= 1 if country is in Asia	Dummy		Own calculations
Dummy for Asian crisis countries	= 1 if Asian crisis country (Thailand, Indonesia, Korea, Malaysia, Philippines)	Dummy		Own calculations
Brady dummy	= 1 if Brady debt > 0 at some point	Dummy		BIS
Latin dummy	= 1 if Western Hemisphere	Dummy		Own calculations
US high-yield bond spread	= High yield – LIBOR	% p.a.	M	Bloomberg
High yield	Yield of Merrill Lynch J0A0 index (US high-yield corporations with below investment grade rating), end of month (EMBIG) or monthly average (Bondware)	% p.a.	M	Bloomberg
Fiscal balance	Fiscal balance / GDP, lagged	%	A	IFS
Current account (MA)	Current account / GDP, 4-year moving average, lagged	%	A	IFS
Real growth (MA)	Real GDP growth, 4-year moving average, lagged	%	A	IFS
GDP per capita (1993)	Logarithm of PPP adjusted GDP per capita in 1993	GDP in USD		WEO
LIBOR	LIBOR, monthly average (EMBIG) or end of month (Bondware)	%	M	IFS, Bloomberg
Inflation	Consumer price inflation, lagged	%	M	IFS
Number of issues preceding	Number of bond issues in the past year		Q	Bondware
Real credit growth (MA)	Real domestic credit growth, 4-year moving average, lagged	%	M	IFS
Growth of Real Exchange Rate	Annual growth rate of real effective exchange rate, lagged	%	M	INS
Relative price of non-fuel, non-manufacturing goods	Relative price of non-fuel non-manufacturing goods vs. manufacturing goods, lagged		M	internal IMF data
Reserves/Short-term Debt	International reserves minus gold / total debt, lagged	%	SA	IFS, BIS (consolidated)
Real growth	Real GDP growth, lagged	%	A	IFS
Short-term Debt/Total Debt	Short-term debt / total debt, lagged	%	SA	BIS (consolidated)
Total debt/exports	Total debt / exports, lagged	%	Q	BIS (locational), IFS
Total debt/GDP	Total debt / GDP, lagged	%	A	BIS, IFS
Debt issued in preceding year	Total amount of bonds issued in the past 4 quarters/ total debt at the beginning of the first quarter	Million USD	Q	BIS (locational), Bondware
Political instability and violence	"Instability and violence" in 1997	Index, -2.5 (very unstable), 2.5 (very stable)		World Bank Governance Database
Rating	= average of available ratings or only available rating	Index (1 = Caa3/CCC-, 19 = Aaa/AAA)		Standard and Poor's, Moody's
Rating (residual)	Residual from regression of ratings on fundamentals (cf. ratings)			Own calculations
US ten year yield	Yield of 10-year US government bonds, end of month (EMBIG) or monthly average (Bondware)	% p.a.	M	IFS, Bloomberg
Log of US$ GDP	Log of nominal GDP in US$	GDP in US$	A	IFS

BIS = Bank for International Settlements
GDF = Global Development Finance (World Bank)
IFS = International Financial Statistics (IMF)
INS = Information Notice System (IMF)
WEO = World Economic Outlook Database (IMF)