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To: Members of the Executive Board

From: The Acting Secretary

Subject: **Fund Financial Support and Moral Hazard—Analytics and Empirics**

Attached for the **information** of Executive Directors is a paper on Fund financial support and moral hazard—analytics and empirics. Conclusions appear on page 27.

It is intended that this paper will be published on the Fund's external website after **Friday, March 9, 2007**. Questions or comments may be referred to Mr. Ghosh (ext. 36288) and Mr. Zalduendo (ext. 39362) in PDR.

This document will shortly be posted on the extranet, a secure website for Executive Directors and member country authorities.

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Fund Financial Support and Moral Hazard: Analytics and Empirics

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In consultation with other Departments

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EXECUTIVE SUMMARY

One concern with providing official financing to help resolve a crisis—or contingently, in anticipation of a possible crisis—is the “moral hazard” it may engender. Since Fund financial support helps reduce the expected cost of crises—making it less likely that a liquidity run will develop into a full blown crisis or, if a crisis occurs, by allowing the member to adjust “without resorting to measures destructive of national or international prosperity”—the prospect of such support may result in greater risk-taking by members and by markets. In the strict sense of the term, this constitutes “debtor moral hazard” or “creditor moral hazard” respectively if decisions are distorted by the prospect of an expected transfer/subsidy that corresponds to expected losses of the Fund.

Empirically, however, the Fund’s rate of charge has adequately reflected the default risk it faces—though it does not necessarily follow that the members or private creditors did not expect the Fund to make losses in any individual case. Moreover, the term “moral hazard” is sometimes used more loosely to refer to any greater risk-taking in response to the prospect of Fund financial support. This prospect may lead to too much risk-taking from the Fund’s perspective (even if the Fund does not make expected losses on the financial support it provides) if national authorities do not maximize the member country’s welfare or they do not take adequate account of possible contagion effects of crises across members.

In practice, the high economic, social and political costs of crises—together with the Fund’s surveillance activities—are likely to limit debtor moral hazard. As regards the design of a contingent, crisis prevention instrument, the use of qualification standards—which require the member to have pursued and to remain committed to strong macroeconomic management and to policies directed at reducing remaining vulnerabilities—can help address issues of debtor moral hazard directly.

In addition, the relatively small amounts of Fund financial support in relation to the country’s external debt suggest that creditor moral hazard—in the sense of risk-taking by creditors in the expectation of a direct “bailout” from the Fund—is also likely to be limited. This is not to suggest that Fund support—including by providing liquidity and a commitment device for the member—does not reduce the probability of a crisis. But unless creditors believe that the Fund will make expected losses on its financial support, the response of creditors—including in terms of interest rates, volumes of capital flows, and the maturity structure of loans—to this reduction in risk will be welfare enhancing.

While existing empirical tests are far from definitive (and further empirical work is required), the evidence presented in this paper suggests that creditor moral hazard is less likely to be a concern after the Fund sent the signal in mid-1998 that it would interrupt its support—even to systemically important members—when program success is unlikely.

I. INTRODUCTION¹

1. One concern with providing official financing to help resolve crises—or contingently, in anticipation of a possible crisis—is the “moral hazard” it may engender. In the insurance industry, from which the term is borrowed, moral hazard refers to the provision of insurance raising the likelihood of the event being insured against because the insured party has less incentive to take preventive actions. Unless the insurer can price out or stop this endogenous behavioral response—for instance, by monitoring or by imposing a sufficiently large deductible or co-payment requirement—the premium will not be actuarially fair, leading to expected financial losses for the insurance company and a corresponding expected economic transfer to the insured party.²

2. By analogy, the *prospect* of Fund financial support in the event of a crisis could lead to behavioral changes by national authorities in setting policies (*debtor* moral hazard) or by private creditors underpricing lending risks (*creditor* moral hazard).³ Though oft-invoked, the analogy is far from exact—for instance, members do not receive compensation in the event of a crisis, they receive a loan conditional on taking corrective measures (and, except for a small commitment fee, they only pay the “premium” in the form of the Fund’s rate of charge if they ever draw). Indeed, the Fund’s relationship to its members is rather more complex—perhaps akin to a combination of mutual insurance company, fire brigade, and fire inspector—with some aspects of that relationship tending to increase risk-taking and others to deter it.⁴ Like a mutual insurance company, Fund members pool resources (foreign exchange reserves) to assist a member in difficulty, and like a fire brigade, the Fund seeks to minimize the

¹ This paper was prepared by a staff team headed by Atish Ghosh and comprising Jun Kim, Lupin Rahman, and Juan Zalduendo, assisted by Siba Das and Olivia Carolin. The team benefited from discussions with numerous Fund colleagues, in particular G. Russell Kincaid and Jeromin Zettelmeyer.

² A typical example is an insurance company that seeks to provide home insurance at an actuarially fair rate by charging a premium that reflects the ex ante probability of a fire. But the very knowledge that the home owner has insurance may lead him to be less careful (e.g., smoking in bed) because he no longer bears the full consequences of his actions, resulting in a higher likelihood of a fire. The insurance company therefore makes expected losses, which correspond to the transfer to the homeowner (in the sense that he is able to purchase insurance too cheaply). This transfer acts as a subsidy, distorting the decisions of the insured party (in particular towards taking on too much risk).

³ Moral hazard is thus an ex ante concept: it is the prospect of possible Fund support in the event of a crisis that may lead to greater risk-taking before the crisis—and indeed that makes a crisis more likely.

⁴ Interestingly, the first property insurance company in the United States—the Philadelphia Contributorship—was established by Benjamin Franklin who also set up one of the first fire brigades. Franklin and nineteen neighbors collectively purchased a pump, hooks, and ladders—to be used to limit damage to a house on fire and to stop the fire from spreading to neighboring houses. Franklin was also instrumental in designing a safer fireplace, and the Philadelphia Contributorship pushed for safer building standards; see Franklin (1734).

damage to the affected member (and to neighboring members through contagion)—both of which could increase risk-taking. At the same time, through its surveillance activities—peer monitoring—the Fund acts as an inspector of building codes and fire regulations, which—together with the high economic, social and political costs of crises (a form of deductible)—helps deter risk-taking. In any event, the Fund faces the Samaritan’s Dilemma—the desire to help someone even though the accident may be the result of past poor choices by the accident victim.⁵

3. Since Fund financial support helps reduce the expected cost of crises—making it less likely that a liquidity run will develop into a full blown crisis or, if a crisis occurs, by allowing the member to adjust “without resorting to measures destructive of national or international prosperity” (Articles of Agreement, Article I (v))—the possibility of Fund financing may naturally elicit endogenous behavioral responses by members and by private creditors. In the strict sense of the term, this constitutes moral hazard if it implies *risk-taking that results in the Fund making expected losses on the financial support it provides, thus resulting in private lending decisions that are distorted by the prospect of the corresponding expected transfer from the Fund, or member policies whose expected costs (taking account of both the likelihood and severity of a crisis) exceed their benefits.*

4. But the term “moral hazard” could also be used more loosely to refer to *any* greater risk-taking in response to the possibility of Fund financial support—though in this case, the welfare implications (i.e., whether it is an appropriate response) are less clear.⁶ In particular, the possibility of Fund financial support may lead members to adopt policies that result in a higher likelihood of a balance of payments crisis but possibly a lower probability of other economic problems. Indeed, the very existence of the Fund is intended to allow members to pursue policies that entail less risk of deflation and global depression—albeit at the possibly greater risk of individually experiencing balance of payments difficulties. Nevertheless, the endogenous policy response to the prospect of Fund financial support could entail too much risk-taking (from the Fund’s perspective)—for instance if national authorities do not take full account of the economic costs and benefits of their policies to the member country, or if they do not take adequate account of spillovers onto other members (i.e., contagion). The welfare implications of moral hazard in this broader sense (i.e., of any greater risk-taking in response to the prospect of Fund support) are thus far from clear cut, and are discussed further in this paper.

⁵ Of course, any pooling arrangement—not just the Fund—is likely to face these issues. In particular, given the free-rider problem that any coinsurance mechanism faces, the Fund—including in its surveillance activities—acts as a delegated monitor of the membership; see Chami, Sharma, and Shim (2004).

⁶ See Jeanne and Zettelmeyer (2005).

5. While the possibility that the prospect of Fund financial support could lead to moral hazard has long been hypothesized, such concerns came to the fore in the mid-1990s in the context of the major capital account crises—and exceptionally large Fund arrangements.⁷ More recently, in informal discussions, Executive Directors have emphasized that the design of any crisis prevention instrument needs to minimize the risk of moral hazard. Since identifying such moral hazard is a first step, this paper surveys the analytics and empirical evidence associated with Fund financial support. Section II considers the conditions under which the prospect of Fund support provided to help resolve crises—or contingently, in anticipation of a possible crisis—could lead to greater risk-taking, and the plausibility of debtor or creditor moral hazard in practice. Section III turns to the empirical evidence, surveying the literature and presenting the results of a test of creditor moral hazard based on the sensitivity of spreads to economic fundamentals. This test identifies evidence consistent with creditor moral hazard during the early years of capital account crises and exceptional Fund arrangements, but moral hazard appears to have diminished after the Fund’s decision in 1998 to interrupt its support for Russia’s program (a systemically important member to which the Fund had significant balance sheet exposure). Moreover, applying the same test to the post-Russia 1998 period does not find similar evidence consistent with creditor moral hazard. Section IV concludes.

II. FUND FINANCIAL SUPPORT AND MORAL HAZARD: SIMPLE ANALYTICS

A. Moral Hazard, Endogenous Behavioral Responses, and the Mussa Theorem

6. In economics, moral hazard refers to the risk that one party to a contract can behave to the detriment of the other party once a contract has been concluded.⁸ Implicit in this definition are two conditions for moral hazard to obtain: first, the insurer cannot ex ante fully observe the endogenous behavioral response of the insured party, and second, as a result, the insurer suffers some detriment—that is, some form of expected loss (with a corresponding economic transfer to the insured party). This definition forms the basis of the “Mussa theorem” (Mussa (1999, 2004)); namely, *if the Fund does not make expected losses on the financial support it provides* (its rate of charge adequately covers default risk and loans take place under adequate safeguards) *and the debtor government is fully benevolent* (maximizes the member’s welfare), *then the prospect of Fund financial support cannot lead to moral hazard in the strict sense of the term*. Intuitively, if the Fund does not make expected losses, then there is no expected transfer (either to the borrowing member or to private creditors); without an

⁷ For an early discussion see Vaubel (1983, 1991). From a broader perspective, Directors have noted in earlier Board meetings that, “while some moral hazard is bound to be present in Fund lending, there is little evidence that the use of exceptional access in general has had large effects on moral hazard by increasing investor or country risk-taking” (Public Information Notice (PIN) No. 03/37).

⁸ Kreps (1990, Chapter 6) defines the problem of moral hazard as a situation in which “one party to a transaction may undertake certain actions that (a) affect the other party’s valuation of the transaction but that (b) the second party cannot monitor/enforce perfectly”; see Jeanne and Zettelmeyer (2005).

expected transfer, there is no subsidy, and therefore incentives are not distorted and there can be no moral hazard.⁹

7. As an empirical matter, Zettelmeyer and Joshi (2005) show that, on average, GRA-financial support has not involved any quantitatively significant transfer from the Fund (for emerging market countries, the *cumulative* transfer over thirty years is less than 1 percent of their 2002 GDP)—in the sense that the rate of charge covers the Fund’s own cost of funds (including administrative expenses and precautionary balances) plus a premium that reflects the probability of not being repaid (Box 1).¹⁰ While this would appear to indicate that one of the key assumptions of the Mussa theorem (that Fund financial support does not involve expected transfers) is fulfilled, it is an ex-post result: given the (historically, excellent) track record of repayments to the Fund, the rate of charge has adequately covered the risk of default. But this does not necessarily imply that the member or its creditors did not *expect* a net transfer from the Fund—and what matters for moral hazard (which is an ex ante concept) is expectations, not realizations. Relatedly, the actuarial fairness of Fund financing refers to the average across the GRA portfolio, not necessarily to every individual case, which is perhaps more closely related to the marginal incentives faced by creditors and debtors (even if, ex post, there was no default).¹¹

8. More importantly, the term “moral hazard” in the context of the use of Fund resources is sometimes used more loosely to mean *any* greater risk-taking in response to the prospect of Fund support (even if this response is not distorted by the expectation of an implicit transfer/subsidy). It bears emphasizing that the Mussa theorem—even if its assumptions hold—does not rule out this possibility: on the contrary, since Fund financial support helps reduce the expected cost of balance of payments crises, both members and private creditors are likely to respond with

⁹ Viewing moral hazard as an implicit economic transfer/subsidy also provides a useful insight on the *incidence of the benefit* of Fund-induced moral hazard (to the extent that it exists). As with any other tax or transfer, the incidence depends upon the relative elasticities of supply and demand—in this case, supply and demand elasticities of private capital flows (the form of moral hazard—i.e., debtor or creditor—still matters inasmuch as it affects these elasticities). Suppose that (contrary to the empirical evidence) the Fund makes expected losses because it lends at an actuarially unfair interest rate to members, who use the resources to bail out private creditors in the event of a crisis. At first glance, this benefits private creditors. But if private capital is supplied perfectly elastically at an interest rate that reflects the risk faced by private creditors, then the full benefit of the creditor moral hazard accrues to the borrowing country, which is able to borrow at a correspondingly lower interest rate. Conversely, if capital is supplied inelastically, then private creditors derive the benefit.

¹⁰ See Jeanne and Zettelmeyer (2001) and Zettelmeyer and Joshi (2005).

¹¹ Based on this, Haldane and Taylor (2003) suggest that the growing concentration of the Fund’s GRA portfolio towards a small number of repeated users is some indication of a distortion of marginal incentives due to Fund lending.

different policies and different lending terms.¹² What Mussa argues is that—under the conditions of the theorem—this response will be appropriate (without entailing any expected cost to the Fund).¹³

9. Indeed, the difficulty with this looser definition of moral hazard (i.e., as any greater risk-taking by members or by markets) is that the welfare implications of the behavioral response are not clear. In particular, if members respond to the possibility of Fund financial support by adopting riskier policies, they presumably do so because they have objectives other than simply avoiding balance of payments crises. “Riskier policies” should therefore be understood as meaning policies that entail a greater risk of a balance of payments crisis—but possibly *less* risk of other economic problems. Indeed, the very existence of the Fund is *intended* to allow members to adopt policies that entail less risk of deflation and global depression—albeit at the possibly greater risk of individually experiencing balance of payments difficulties.

10. It follows that the prospect of Fund financial support may create moral hazard in this loose sense of the term, but it is less clear whether moral hazard thus defined should be of concern. A standard assumption in economics is that—in the absence of a tax or subsidy that distorts behavior—agents will make optimal decisions given their objective functions. Hence the *Mussa theorem*: *in the absence of an expected transfer from the Fund (i.e., there is no ex ante Fund subsidy), the prospect of Fund financial support may alter members’ (and markets’) behavior—but in ways that enhance their welfare*. In other words, the endogenous behavioral response to the prospect of Fund financial support would be problematic only if either (i) members’ and markets’ decisions are distorted because of an expected transfer from the Fund (so the conditions of the Mussa theorem do not hold); or (ii) the Fund’s objective function differs from those of national authorities.

¹² Fund financial support can reduce the expected cost of crises in two ways: by lowering the likelihood that an incipient liquidity run develops into a full blown crisis and economically inefficient default (see Jeanne and Zettelmeyer (2005) and Kim (2007)), or by easing the burden of adjustment in the event of a crisis.

¹³ Thus, if national authorities in the borrowing country respond by adopting policies that entail more risk, these will not be creating moral hazard in a strict sense—i.e., the expected costs will not exceed the benefits. To take an example, suppose that by eschewing international borrowing, a country can avoid any possibility of a capital account crisis so the expected cost of a crisis is 0. Suppose, further, that international borrowing would bring expected economic benefits of \$100 but—because crises are so costly—expected costs of \$150, so the country would choose not to borrow. In such a world, if Fund financial support—by reducing the likelihood or severity of a crisis—lowered the expected cost of crises to \$80, it would now be worthwhile for the country to borrow. Notice that the country is engaging in more risky behavior (relative to the status quo of no Fund support and a no international borrowing)—but doing so brings welfare enhancing benefits (equal to \$20 in this example). Likewise, if private creditors respond by changing the terms of their lending, these would not be *inappropriately* larger volumes or lower interest rates—i.e., reflecting distorted choices because creditors expect an implicit transfer from the Fund.

11. Since the Fund is a membership organization, it pursues certain objectives for the collective good of the membership. Accordingly, the Fund's objectives should generally coincide with the objectives of its individual members (in areas of interest to the Fund).¹⁴ Nevertheless, there are two reasons why the endogenous behavioral response of national authorities to the prospect of Fund financial support—while rational given their own objectives—may entail too much risk-taking from the Fund's perspective even in cases where the Fund does not make expected losses on the financing it provides. First, national authorities may be maximizing their own—not the member country's—welfare, violating a key assumption of the Mussa theorem, and obviously inconsistent with the Fund's goal of assisting its members. Second, even if authorities maximize the member's welfare, they may not take adequate account of spillovers onto other members. For instance, if individual members ignore contagion effects, they may choose policies that—while optimal from their own perspective—entail too much risk-taking from the perspective of the whole membership.

12. To summarize, the prospect of Fund financial support by reducing the expected cost of crises could result in greater risk-taking by members and by markets. In the strict sense of the term, this constitutes moral hazard if decisions are distorted by the prospect of an expected transfer/subsidy that corresponds to expected losses of the Fund. Although, on average, the Fund's rate of charge has adequately reflected the default risk it faces, it does not necessarily follow that the Fund did not make expected losses in any individual case. Moreover, the prospect of Fund financing may lead to too much risk-taking either because national authorities do not maximize the member's welfare or because they do not take adequate account of possible contagion. For these reasons, it is worth considering further the conditions under which the prospect of Fund financing may lead to moral hazard—and what factors may help deter excessive risk-taking.

¹⁴ The Fund also has the objective of safeguarding its—i.e. the entire membership's—resources.

Box 1: Is There an Implicit Transfer in Fund Financial Support?

One of the key assumptions of the Mussa theorem is that the Fund provides financial support at an actuarially fair rate or, equivalently, that there is no expected transfer in the use of Fund resources. Early studies compare the Fund's rate of charge to the interest rates on private capital flows to crisis countries in normal times (Haldane (1999)), or immediately before a crisis (Higginbotham and Schuler (2002)). They find that the Fund's rates of charge are lower, suggesting an expected transfer. However, the Fund's rate of charge is lower than market interest rates because the Fund typically faces lower default risk on its support, exercises selectivity (i.e., does not support programs that it considers unlikely to succeed), and limits access. Therefore, these findings therefore cannot be taken as conclusive evidence that Fund support entails an expected transfer.

Jeanne and Zettelmeyer (2001) observe that the Fund's non-concessional rates of charge are close to the international risk-free rate and instead focus on whether Fund support to emerging countries can be viewed as risk free. They argue that since historically the Fund has virtually always been repaid, and as current lending patterns are statistically similar to those in the past which resulted in repayment, lending to middle-income countries does not embody a subsidy.

Zettelmeyer and Joshi (2005) examine this issue further by computing realized transfers implicit in all Fund support over 1973-2003 for various regions, time periods and types of arrangements. The approach is to calculate both internal rates of return and net present value transfers based on realized cash flows (disbursements+charges-repayments) between the Fund and debtor countries, as well as repayment projections for lending cycles which had not been complete by 2003. They make the simplifying assumption that all obligations are repaid to avoid evaluating the riskiness of outstanding obligations (but check the robustness of their results to this assumption). For emerging market countries using GRA resources, they use a short-term market interest rate—the SDR 3-month interest rate—to discount the Fund cash flows because GRA lending since May 1989 carries a floating interest rate. To account for the liquidity premium given the commitment of Fund resources over several years, an upper bound of 200 basis points (based on the penalty the Fund imposes for large scale support exceeding 300 percent of quota) and lower bound of 30 basis points (based on the magnitude of the observed term premium of industrial country floating rate bonds) are used for the term premium. 1/

Internal Rate of Return and Cumulative Implied Transfers for GRA Support (in NPV terms): 1973–2003

	Rates of Return			Cumulative Implied Transfers			
	IRR 1/	Alternate	IRR 2/ Spread (in bps)	SDRs +30 3/ In share of 2002 GDP	SDRs +200 3/ In share of 2002 GDP	SDRs +30 In bill., 2002 US\$	SDRs +200 In bill., 2002 US\$
High income: OECD	6.62	7.41	-80	0.02	0.06	3.1	10.8
High income: non-OECD	6.3	7.77	-147	0.17	0.47	0.3	0.7
Upper middle- income	6.42	6.73	-31	0.02	0.58	0.3	9.1
Lower middle- income	5.82	6.57	-145	0.06	0.60	1.9	20.2
Low- income	4.32	8.84	-390	0.4	1.51	4.7	17.6

1/ Using IMF repurchase projections, net of promised debt relief.

2/ Rates of return if IMF disbursements had been used to buy 3 month bills in the SDR currencies.

3/ Discounting based on SDR 1 year (1973–1989) and SDR 3 month rate (after 1990), plus a margin of 30 basis points or 200 basis points.

Box 1: Is There an Implicit Transfer in Fund Financial Support? (continued)

Zettelmeyer and Joshi's results imply that transfers implicit in Fund GRA support are miniscule and could not have been a source of moral hazard (see Table). They find *cumulative* transfers over the past 30 years for emerging market countries were in the range of 0.2–0.7 percent of 2002 GDP. Moreover, rates of charge were about 100 basis points lower, on average, than the rate that would have fully compensate IMF creditor countries for their borrowing costs—the subsidy being attributed mainly to the concessional IMF lending terms prior to 1987. Zettelmeyer and Joshi therefore conclude that there are essentially no implicit transfers in GRA support (except to low-income countries) and thus confirm one of the assumptions of the Mussa theorem.

1/ Members with arrears which had been settled by the end of their sample period are treated like other members, while members with outstanding arrears are included on the basis of full repayment given the experience of most arrears cases (Z&J also check the robustness of their results to the full repayment assumption against the assumption of no payment and note that this does not significantly change the order of magnitude of total transfers in percent of GDP, although it reduces the internal rates of return to low-income countries by 50–90 bps). Some GRA support to low-income countries was forgiven or replaced by concessional resources and eventually forgiven by HIPC/MDRI.

B. Debtor Moral Hazard

13. As discussed above, the prospect of Fund support may lead national authorities to adopt more risky policies. But there are also factors that help deter excessive risk-taking. First, while Fund support makes adjustment after a crisis somewhat less painful,¹⁵ capital account crises are nevertheless very costly—economically, socially, and politically. Table 1 presents estimates of the output cost (in terms of the present value of real GDP growth foregone) of some recent capital account crises: on average, these crises may potentially cost, in net present value terms, 34 percent of GDP over the first three years. This suggests that national authorities would require a heavy discount rate to engage in risky policies on account of possible Fund support. In effect, because Fund support only lessens, rather than eliminates, the cost of a crisis, there is a large “deductible” whereby the insured party still has the incentive to take preventive measures because it bears a significant portion of the consequences of its actions.¹⁶

¹⁵ By allowing members facing balance of payments difficulties to pursue less contractionary policies (“destructive of national prosperity” in the parlance of the *Articles*) than would be required in the absence of Fund lending. Empirically, countries with Fund-supported programs have achieved a given improvement in the current account balance at lower output cost than countries without programs; see IMF (2005), “The Design of IMF-supported Programs,” OP 241.

¹⁶ Crises are also politically costly, which may deter moral hazard (in a strict sense) risk-taking by national authorities. Updating Richard Cooper's classic (1971) study, Frankel (2005) finds that a currency crisis doubles the likelihood of a change within six months in the top political leadership of the
(continued...)

14. Second, Fund financial assistance does not take the form of a grant, but rather a loan that should be repaid with interest, and that is provided *conditional* on the member taking corrective policies. Although the analogy is not exact, this is akin to requiring “co-payments” from the insured party—which should limit moral hazard.¹⁷

15. Third, Fund surveillance is intended to ensure that members maintain sound policies *ex ante*. Indeed, surveillance by the Board is a form of peer pressure from other members on the authorities to follow appropriate policies, which is enhanced by market discipline and the transparent reporting of economic data.¹⁸ Such peer pressure is important because, as discussed above, one reason why members may choose excessively risky policies is if they ignore contagion and spillover effects; the Fund is currently engaged in efforts to strengthen the effectiveness of surveillance.

16. Does the design of a contingent, crisis prevention instrument raise additional issues of debtor moral hazard? Since this instrument would provide larger amounts of Fund financing, it would seem, *ceteris paribus*, to increase the quantitative relevance of debtor moral hazard. But there is a crucial difference between traditional Fund financing—which provides financial assistance conditional on the member taking corrective measures *after* a crisis—and the proposed instrument, which provides contingent support *conditional* on the authorities maintaining strong policies *before* a crisis.¹⁹

country, while the probability that the Finance Minister or Central Bank Governor loses office within 12 months increases by 63 percent (both effects are highly statistically significant).

¹⁷ As discussed in IMF (2005), programmed macroeconomic and structural policies are geared towards the initial conditions and economic problems facing the member; see also the IEO Report on Fiscal Adjustment in Fund-supported Programs.

¹⁸ Fund surveillance may also be accompanied by the provision of technical assistance, including the promotion of standards and codes.

¹⁹ As laid out in the Reserve Augmentation Line example (SM/06/276), qualification under the proposed new liquidity instrument would require that “the member has pursued and remains committed to strong macroeconomic management and to policies directed at reducing remaining vulnerabilities ... giving confidence that the member will react appropriately in the event of a crisis. These policies are described in a forward-looking economic and financial program prepared by the member, that would include a quantified framework for the period covered by the RAL.” The qualification criteria also include “a commitment to transparent reporting of economic data, including through subscription to the Special Data Dissemination Standard.”

Table 1. Present Value of Output Losses in a Capital Account Crises 1/

	Output losses									Output difference
	Period $t-4:t-1$	Potential output 2/				Actual output 3/				
		Period (quarters)			3-year total	Period (quarters)			3-year total	
		$t+1:t+4$	$t+5:t+8$	$t+9:t+12$		$t+1:t+4$	$t+5:t+8$	$t+9:t+12$		
Average	100	105	104	103	312	94	94	94	282	-30
Argentina 2001	100	105	104	104	313	88	87	87	262	-52
Brazil 1998	100	103	101	99	304	100	99	97	295	-9
Bulgaria 1996	100	102	99	96	297	84	86	83	253	-43
Ecuador 2000 4/	100	102	98	95	295	105	106	105	316	21
Indonesia 1997	100	108	110	113	331	87	83	85	256	-75
Korea 1997	100	108	110	113	331	93	97	99	289	-41
Malaysia 1997	100	110	114	118	342	97	93	96	286	-56
Mexico 1994	100	103	101	99	304	94	94	92	280	-25
Russia 1998 4/	100	100	95	90	285	101	106	101	308	23
Thailand 1997	100	107	109	111	326	90	87	88	265	-61
Turkey 2000	100	105	105	105	316	93	95	95	283	-33
Uruguay 2002	100	102	99	96	297	95	103	99	297	0

1/ Calculations based on simple average of quarterly growth rates. Assumes a discount rate of 5 percent. Quarterly data.

2/ Potential growth rates based on average growth rates since early 1990s until market pressures begin.

3/ Actual growth rates constructed assuming period $t+9:t+12$ returns to the long-run growth rate.

4/ The rapid recovery reflects in large measure the positive effect of oil price developments following the crisis.

17. Kim (2006) analyzes the authorities' incentives to such a contingent financing instrument. In his model, crises are costly but national authorities also face costs of implementing policies that would minimize the likelihood of a crisis (Box 2). In the absence of Fund contingent support, national authorities trade off the cost of a crisis against the political cost of implementing strong policies to arrive at an optimal effort given *their* objective function. The Fund's contingent financial support, by helping to avoid liquidity runs, makes a crisis less likely. But if the Fund makes its resources unconditionally (albeit contingent on a crisis), then in general, national authorities will relax their policy efforts somewhat, so that the Fund's support has a less than corresponding impact on crisis prevention. This is a form of debtor moral hazard (even if it does not imply an expected cost to the Fund) because national authorities are assumed not to be maximizing the borrowing country's welfare—thus violating one of the assumptions of the Mussa theorem—as they face political costs of implementing strong policies that do not correspond to the economic costs faced by the country. As a result, the national authorities sub-optimally relax their policy efforts because of the contingent support by the Fund.

18. This analysis, however, also suggests the remedy to this debtor moral hazard. Specifically, the model shows that if the Fund makes its support conditional on the authorities maintaining a *stronger* policy effort than they would in the absence of Fund support, then—despite the political costs of implementing strong policies—national authorities would prefer such a program to not receiving the Fund's contingent support. Therefore, by conditioning its financial support, the Fund can contribute to crisis prevention in two ways: making available liquidity and providing the incentive to authorities to maintain stronger policies. Moreover, the qualification criteria for the new liquidity instrument can address directly the problem of debtor moral hazard that

Box 2. A Model of Fund Support, Policy Endogeneity, and Crisis Prevention

Kim (2006) develops a model where *conditional Fund financial support* can prevent debtor moral hazard. In his model, the likelihood of a liquidity crisis, π , depends negatively on the country's foreign exchange reserves. Given costs of holding reserves, the country chooses a desired level of reserves, R^* , that trades off these costs against the expected output cost of a crisis. Suppose that the country starts with a level of reserves R_0 below R^* because of an adverse shock to the current account. In the absence of Fund financial support, the country can acquire additional reserves through strong policies, P , that (without loss of generality) improve reserves by an amount equal to P . But such policies are assumed to be politically costly. Therefore, national authorities, trading off the risks of a crisis against the policy costs, will choose optimal policies, P_0 , resulting in reserves $R_1 = R_0 + P_0$ (in general, this level of reserves may be below R^* because of the costs of implementing strong policies), with an associated probability of a crisis, π_0 . This is shown in the Figure, where the country's existing reserves (owned or borrowed) is plotted along the horizontal axis, and its policy effort along the vertical axis; the technological trade-off for crisis prevention between having more reserves and implementing stronger policies is given by \overline{PP} .

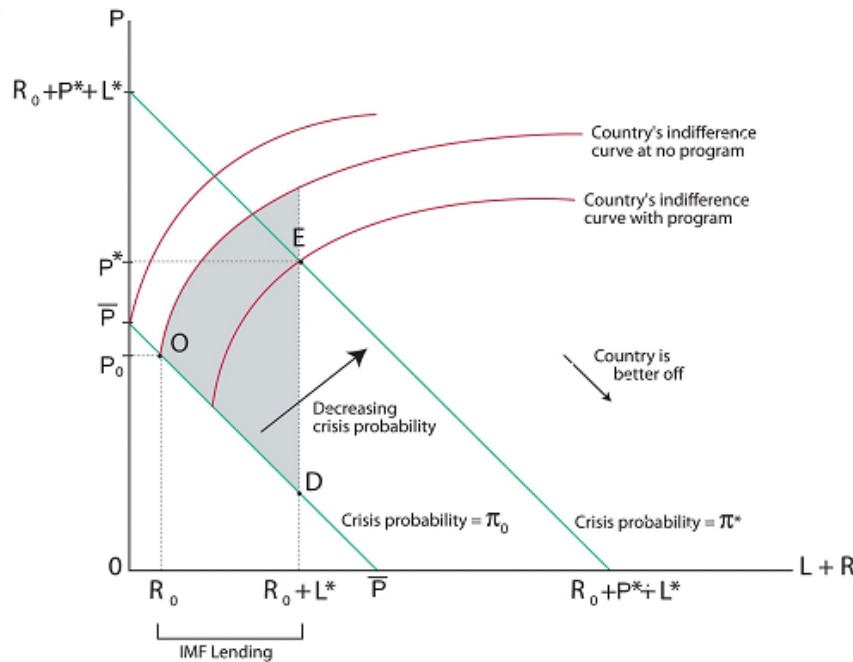
What happens if the country now receives *unconditional* liquidity support (e.g., from the Fund) in the amount L ? Since following strong policies is assumed to be politically costly, national authorities will use part of this support to augment reserves (thus lowering the likelihood of a crisis) but also in part to offset their own policy effort. Hence, the increase in reserves (relative to no Fund resources) will be less than the amount the Fund provides:

$\partial P / \partial L < 0$ and $\partial R_1 / \partial L < 1$. This is depicted in the Figure by a movement along the straight line \overline{PP} (from point O to point D) for the simplest (and most extreme) case, where Fund resources are provided as pure grant (i.e., do not need to be repaid) and adjustment costs are linear. The line \overline{PP} is also an iso-probability line, so that along that line the likelihood of a crisis is constant. In this case, the offset—or debtor moral hazard—is full, with $\partial P / \partial L = -1$ and $\partial R_1 / \partial L = 0$, and unconditional resources do not lower the probability of a crisis because they are offset by weaker policies. More generally, when Fund resources have to be repaid and/or policy adjustment costs are convex, this offset will not be full and at least part of the Fund financing will be used to augment reserves.

Now consider *conditional* Fund financing. Since the country benefits from a lower likelihood of a crisis but faces costs of implementing strong policies, its indifference curves are as depicted in the text figure—along the indifference curve, a lower likelihood of a crisis (an outward shift of the iso probability line) compensates for the costs of stronger policies. In particular, if Fund financing is denoted by L^* , then the shaded area denotes possible welfare-improving programs. The program given by the point E, for example, entails policies P^* (which are stronger than P_0 , the policies in the absence of a program), Fund financing in the amount L^* , and resulting in reserves $R_1^* = R_0 + P^* + L^*$. Therefore:

$$\partial P / \partial L > 0 \quad \text{and} \quad \partial R_1 / \partial L > 1$$

with a correspondingly lower likelihood of a crisis, $\pi^* < \pi_0$.

Box 2. A Model of Fund Support, Policy Endogeneity, and Crisis Prevention (continued)


such an instrument might create. Indeed, members that meet the qualification criteria are unlikely to want to jeopardize their economic performance or their policy track-record by weakening policies simply because of the existence of a contingent financing facility.

C. Creditor Moral Hazard

19. Concerns with creditor moral hazard center on the possibility that Fund financing could lead private creditors to underprice the risk of international lending in the expectation of a financial bail out by the Fund in the event of a crisis. The mechanics of such a bailout would be that the member borrows from the Fund and uses those financial resources to repay fully or partially its private creditors—allowing them to exit, and thus reducing their risk *ex ante*. As emphasized above, if the Fund lends at an actuarially fair rate (given the risk of default it faces), then necessarily there is no creditor moral hazard in the strict sense of the term. In particular, private creditors would only accept an interest rate that does not reflect true lending risks if they expect a transfer that corresponds to their expected losses. However, if the Fund does not make expected losses on the use of its resources by member countries, then that transfer must come from the borrowing country—which is equivalent to the borrowing country paying private creditors the higher interest rate in the first place.

Box 3. Mussa Theorem under Uncertainty: An Example

The text considers the ex ante effect of Fund financial support on private creditors when the borrower's debt-servicing capacity is known with certainty. Here, the example is made stochastic, so debt-servicing capacity is known only probabilistically and (in equilibrium) there is a possibility of default on use of Fund resources.

These results show that private investors' expected return remains unaffected by the prospect of being "bailed out" by the Fund, so long as the Fund provides its resources at an actuarially fair rate, as implied by the Mussa theorem.

Risk-neutral private investors lend 100 dollars at an interest rate r to an emerging market country. The country's debt servicing capacity (DS) is stochastic: 150 dollars in good state and 50 dollars in bad state. Denoting by p the *perceived* probability of bad state, the expected debt service is given by $E(DS) = 150(1 - p) + 50p = 150 - 100p$. Assuming, without loss of generality, that the risk-free interest rate is zero and $p = 0.5$ at the time of lending, it is straightforward to show that $r = 0.5$ is an actuarially fair lending rate, for which the expected rate of return for private investors equals the zero risk-free rate. Suppose that the perceived probability is revised upward to $p = 0.6$ as the country's economic fundamental deteriorates. The expected debt service falls to 90 dollars ($= 150 - 100 \times 0.6$) and, as a result, private investors expect a 10 dollar loss on their lending.

What would be the expected return for private investors if the Fund provide the country L dollars at an actuarially fair interest rate q , and the country repays private investors with that loan? Given the Fund's preferred creditor status, it could provide resources up to the same amount as the expected debt service (i.e., $L \leq 90$). There are many possible actuarially fair rate of charges according to the amount of resources provided, L . For instance, $q = 2/3$ if $L = 90$ and $q = 0$ if $L \leq 40$. Without loss of generality, consider the case with $L = 90$ and $q = 2/3$. In this case, the Fund expects no loss while private investors' expected loss is still 10 dollars as they recover nothing after being repaid 90 dollars before maturity.

But if the Fund does not have a preferred creditor status, it must compete with private investors for the country's debt servicing capabilities. Since the Fund resources were used to repay private investors, the country's total debt at maturity is given by

$TD = (1 + q)L + (150 - L) = 150 + qL$. Given the zero risk-free rate, the zero profit condition for the Fund is $L = E(DS) \cdot s = 90 \cdot s$ where $s = (1 + q)L / TD$ is the Fund's share in total debt services. Without loss of generality, consider $L = 30$. Substituting $L = 30$ into the zero profit condition for the Fund yields $q = 1$ and $s = 1/3$. Since private investors are repaid 30 dollars before maturity, and are expected to recover 60 dollars ($= 90 \cdot (1 - s) = 90 \cdot (2/3)$) at maturity, their expected loss remains unchanged at 10 dollars.

20. An example makes this clear. Suppose that a country has US\$100 of private debt but—due to an adverse shock—its maximum debt-servicing capacity becomes US\$40 (in this example, the country's debt servicing capacity is assumed to be exogenous and known with certainty—making it stochastic does not alter the results; see Box 3). Therefore, in the absence of Fund financial support, private creditors would receive 40 cents on the dollar. Now suppose there is a possibility of Fund financing. If the Fund is to provide financial support without incurring any expected

losses, the maximum loan it could make would be US\$40 (equal to the country's debt-servicing capacity). The member borrows US\$40 from the Fund and uses it to bailout US\$40 of private sector claims—leaving it with US\$60 of private debt and US\$40 of debt to the Fund. When the debt matures, the country has only US\$40 of debt servicing capacity. Because of its preferred creditor status, the Fund is repaid its \$40 and private creditors receive nothing more than the original US\$40 bailout—which is what they would have received in the absence of Fund financing. Knowing this *ex ante*, there is no reason for private creditors to change their behavior because of the possibility of Fund financial support.

21. This is not to suggest that Fund involvement cannot make international borrowing and lending less risky by reducing the likelihood or severity of a crisis. In Jeanne and Zettelmeyer (2005), the Fund is assumed to have an enforcement advantage relative to private creditors (perhaps because of conditionality or the costliness of defaulting on Fund credit) such that the borrowing country can credibly commit to undertaking more adjustment (if necessary) in the context of a Fund-supported program than it could with just a loan contract to private creditors. Therefore, Fund support in effect provides a better commitment device for the borrowing country (overcoming a market imperfection), enabling it to borrow more cheaply from private creditors and raising its welfare (at no cost to the Fund, which lends at an actuarially fair interest rate).

22. The enforcement advantage assumed by Jeanne and Zettelmeyer (2005) is one way in which Fund financing may have a useful role in removing market imperfections and reducing risk. Kim (2007) develops a model in which the Fund does not enjoy any enforcement advantage but nevertheless, by providing contingent liquidity support, reduces the likelihood of a liquidity run by short-term creditors developing into an (economically inefficient) default by the country on its short- and long-term obligations.²⁰ (Here the market imperfection is that private creditors are atomistic and subject to liquidity runs, while the Fund is not.) Fund support therefore lowers the risks of international lending—in equilibrium, lowering the borrowing costs for the debtor country. Interestingly, Kim's model allows for a different effect of Fund support on short-term and long-term creditors (short-term creditors get bailed out, while long-term creditors benefit from Fund financial support but also have their claims diluted by the Fund's preferred creditor status)—a concern of critics of Fund financing (see Mina and Martinez-Vasquez 2002). However, in Kim's model, this differential impact on short-term and long-term creditors, which in equilibrium alters the borrower's optimal maturity mix, is the efficient and welfare-enhancing response to the reduced liquidity risk of short-term borrowing that Fund support engenders.

²⁰ See also Chami, Sharma, and Shim (2004), who argue that, given the dual goals of the IMF (helping members while safeguarding IMF resources), an *ex ante* loan contract is more likely to create the right incentives for member countries than an *ex post* loan contract. The proposed RAL, with its qualification criteria, would come closer to an *ex ante* contract than traditional Fund financing instruments.

23. Both Jeanne and Zettelmeyer's and Kim's models show that what may *appear* to be creditor moral hazard—larger private capital flows, at lower interest rates, and possibly shorter maturities because of the prospect of Fund financing—may simply be Fund financial support helping to remove a market imperfection, leading to more efficient and desirable outcome (at no expected cost to itself). Empirical studies that focus on the behavior of sovereign bond spreads or capital flows to emerging market countries may, therefore, be picking up nothing more than the prospect of Fund financing lowering the risks of international borrowing and lending—in other words, a reduction in real hazard that, in equilibrium, is reflected in lower interest rates.

24. As with debtor moral hazard, the analysis here breaks down if the Fund makes expected losses on the use of its resources—more precisely, if creditors *expect* that the Fund makes losses on the financing it provides. Yet how large could this effect be? Even in the exceptionally large capital account crisis arrangements, Fund financial support was a relatively small fraction of the private sector's exposure (Table 2). Fund disbursements in the first program year averaged 16 percent of short-term debt, while the full amount approved was, on average, 11 percent of total net external debt. (Even this probably overstates the importance of Fund financing as domestic treasury bills, including those held by non-residents, are not included in the denominator.) Therefore, even if private creditors had expected that these resources would be transferred fully to them (i.e., the Fund would not be repaid and the borrowing member would use the resources exclusively to bail out private creditors rather than to allow a wider current account deficit or build up reserves), the effect would be small in relation to the private sector's exposure.

Table 2. IMF Financial Packages in Capital Account Crisis Countries 1/

	Year and quarter of crisis	Year of original program approval	Approved access		Actual IMF financial assistance as a percent of short-term debt (disbursements over four quarters)			
			Mill. of US\$)	In percent of net ext. debt 2/	Period	Period	Period	Period
					<i>t-8:t-5</i>	<i>t-4:t-1</i>	<i>t:t+3</i>	<i>t+4:t+7</i>
Average			11397	11	2	3	16	8
Argentina 3/	2001-Q3	2000	21784	15	0	17	17	4
Brazil	1998-Q3	1998	17283	9	0	0	12	1
Bulgaria	1996-Q1	1996	584	6	19	0	6	29
Ecuador	2000-Q1	2000	307	2	0	0	6	2
Indonesia	1997-Q4	1997	11250	9	0	0	19	9
Korea	1997-Q4	1997	20913	14	0	0	28	2
Mexico	1994-Q4	1995	17824	13	0	0	29	0
Russia 3/	1998-Q3	1996	9220	5	8	7	18	2
Thailand	1997-Q3	1997	3959	5	0	0	6	1
Turkey 3/	2000-Q4	1999	19593	20	0	3	26	37
Uruguay 3/	2002-Q3	2002	2645	20	0	11	13	4

1/ Total and short-term debt based on t-1 quarterly data.

2/ Net of foreign exchange reserves.

3/ Includes subsequent SRF augmentations; September 2001 for Argentina, July 1998 for Russia, February 2001 for Turkey, and June 2002 for Uruguay.

III. EMPIRICAL EVIDENCE

A. Literature Survey

25. A growing body of literature seeks to identify whether there is moral hazard associated with Fund financing—though most papers do not distinguish carefully between moral hazard in the strict sense of the term and endogenous behavioral responses more generally (that may or may not be welfare-enhancing). This empirical literature has developed along five main strands.²¹

26. The first—which tests both for debtor and for creditor moral hazard in the strict sense of the term—examines whether the Fund lends at an actuarially fair rate—i.e., whether the “no expected transfer” condition assumed in the Mussa theorem is fulfilled. These papers generally find that, compared to the interest rates charged by the market, the Fund’s non-concessional charges are significantly lower. However, the Fund’s rate of charge is close to the international risk-free rate and—in this sense—the implicit transfers in GRA financial support are small (Box 1). As noted earlier, while this suggests that a key assumption of the Mussa theorem is fulfilled, the results are not conclusive evidence against expected losses on the use of Fund resources as they are necessarily based on the ex post performance of the GRA portfolio (averaged across time periods and members), which may not coincide with ex ante expectations of borrowing members and private creditors and may not hold in every individual case.

27. The second includes papers that try to identify whether members engage in more risky policies by examining macroeconomic performance during, after, and in-between a member’s Fund-supported programs.²² Evrensel (2002) finds that as countries receive subsequent Fund-supported programs, they seem to implement increasingly inconsistent macroeconomic policies during interprogram years, which may be an indication of debtor moral hazard. Dreher and Vaubel (2004) examine Fund financial support in relation to monetary and fiscal policies in recipient countries. They find that a country’s government budget deficit and its rate of money growth are higher the larger its potential borrowing from the Fund; while this finding is consistent with debtor moral hazard, it could also be interpreted as Fund support having its intended effect of lowering the burden of adjustment when members face a balance of payments crisis.

28. A third strand²³ looks at the long- and short-term behavior of emerging market bond spreads following IMF-supported programs and events that could be associated with changes in creditor moral hazard, such as the 1994 Mexican crisis, the 1997–98

²¹ For a survey of the literature see Dreher (2004).

²² For instance, Gai and Taylor (2003), Evrensel (2002), and Dreher and Vaubel (2004).

²³ See Zhang (1999), Lane and Phillips (2000), Eichengreen and Mody (2001), Kamin (2004), and Evrensel and Kutan (2004).

Asian crises, and the Russia “non-bailout” in 1998. The main finding of these papers is that the level of bond spreads often reacts to IMF-supported programs and crisis events in ways that may—but need not—indicate the existence of creditor moral hazard in the strict sense of the term. But these empirical strategies cannot separately identify the effects of creditors making distorted decisions (i.e., moral hazard) from the effects of the existence of the Fund in reducing risks associated with international borrowing and lending (and its attendant effects on volumes, maturities, and terms of capital flows).

29. Relatedly, some studies examine the behavior of capital flows—both the volume and the maturity structure and terms—under the hypothesis that creditor moral hazard should increase capital flows to emerging market countries and lead creditors to perceive lower lending risks.²⁴ The findings are mixed. Mina and Martinez-Vasquez (2002) find some evidence that IMF financial support leads to a shift in the composition of foreign debt towards long-term debt which is taken as evidence for the moral hazard hypothesis. They also find that total private capital flows and long-term capital increased after Mexico crisis and decreased after Russian default, though this could also reflect developments in real hazard. By contrast, Kamin (2004) examines trends in private capital flows to emerging market countries and finds limited evidence for creditor moral hazard in the post-Mexican crisis period. One explanation for these mixed results may be omitted variables, which affect the magnitude and structure of capital flows but that cannot be adequately controlled for.

30. A fourth strand looks at the *responsiveness* of spreads to macroeconomic fundamentals, under the hypothesis that if creditors expect to be bailed out by the Fund, then they would look less carefully at the borrowing country’s fundamentals. These studies find evidence consistent with moral hazard before the Russian non-bailout—in particular, the Russian default was associated with greater sensitivity of spreads to macroeconomic fundamentals, with spreads increasing the most among countries with poor fundamentals.²⁵ The authors emphasize that their findings are a necessary but not sufficient test for strict moral hazard. In particular, the interpretation of the results depends upon the signal the Fund sent by interrupting its support for Russia’s program. If this signaled that the Fund would not support a program which it thought was unlikely to meet its goals, then indeed these findings suggest (strict) moral hazard—at least prior to the “non-bailout” of Russia in 1998. Conversely, if it simply signaled that the Fund would no longer help prevent crises (or do so to a lesser degree)—or the Russian crisis was a “wake up call” on the risks of international lending—then their findings do not necessarily imply moral hazard in the strict sense of the term.

31. Using a similar methodology, Lee and Shin (2005) examine whether spreads are less sensitive to fundamentals for countries with closer political and economic ties

²⁴ See papers by Mina and Martinez-Vasquez (2002) and Kamin (2004).

²⁵ See Kamin and von Kleist (1999) and Dell’Arricia, Schnabel, and Zettelmeyer (2002, 2006).

(as measured by UN votes and trade shares) to the Fund's major shareholders. They find that spreads for these countries are indeed less sensitive to fundamentals and conclude that this represents evidence that there is moral hazard associated with Fund financing; however, the lower sensitivity of spreads to fundamentals may also be driven by other factors excluded from the analysis²⁶ or simply reflect the welfare enhancing reduction in risk that Fund financial support might engender.

32. Finally, the fifth strand studies how the stock market valuation of banks that have emerging market country exposure changes in response to events that might engender creditor moral hazard. Haldane and Scheibe (2004) examine the response of the market valuation of UK banks to Fund financing taking into account the possible risk-reducing effects of Fund support. They find a significant positive response such that returns are greater, the larger is the size of the Fund's support and the larger is the size of the creditor banks' emerging market portfolio. They interpret this finding as Fund interventions giving greater incentive for risk-taking by lenders. But their findings are difficult to understand if markets are rational, since it is not clear why banks should benefit by more than the implied reduction in default risk.²⁷

33. Overall, the empirical literature contains some suggestive evidence that the prospect of Fund financial support may lead to greater risk-taking. However, as noted by some of the authors, without ancillary assumptions, empirical tests cannot distinguish between moral hazard and Fund financing having its intended effect of reducing the riskiness of international borrowing and lending—and the welfare-enhancing response of members and markets to that lower risk. They are therefore necessary—but not sufficient—tests of moral hazard in the strict sense of the term.

B. Testing for Creditor Moral Hazard

34. In this section, the empirical methodology of Dell'Ariccia, Schnabel, and Zettelmeyer (hereafter referred to as DSZ) is used to test for creditor moral hazard in the recent (post-Argentina's 2001–02 crisis) period. DSZ's tests are based on the idea that if the Fund was willing to support financially a program despite a low likelihood of success (incurring expected losses on the financial support it provides because of the systemic and political importance of major emerging market members), then private creditors would not need to worry about the borrower's fundamentals because

²⁶ It is also worth noting that Lee and Shin's assertion that members with stronger political ties to major shareholders are more likely to receive Fund support (or larger access) does not hold in better specified models of program selection and access (see Ghosh, Goretti, Joshi, Thomas, and Zalduendo, 2007).

²⁷ One possibility is that the country's average borrowing costs reflect the forward-looking default risk on loans that will mature in the future, whereas the bank's existing portfolio is primarily subject to current liquidity risk. In that case, if the Fund provides financing to solvent but illiquid members, then the risk reduction on the existing loan portfolio would indeed be greater than the fall in future default risk. But this would not be evidence of creditor moral hazard, but rather of Fund financing having its intended liquidity support effect.

they expect to be bailed out. However, to the extent that there was such moral hazard in creditor behavior, spreads should have become more sensitive to fundamentals following the Fund's decision to interrupt its support for Russia's program in the summer of 1998. In particular, the *variance test* they propose allows to assess the effect of moral hazard on the cross-sectional variance of spreads.²⁸

35. However, as was the case with the empirical tests discussed in the previous section, the DSZ test requires some ancillary assumptions to be interpreted as indicating (strict) moral hazard. Indeed, the test is predicated on the event—the Russia “non-bailout”—*changing* investors' perceptions about the willingness of the Fund to continue supporting a program that it does not believe will succeed, but not otherwise affecting assessments of lending risks. In other words, to be valid, the event should send a signal about a change in the Fund's willingness to tolerate expected losses on the financial support it provides (that is, to create moral hazard), but not in its willingness to reduce real hazard. The Russia non-bailout provides a natural experiment in this regard. First, it interrupted the Fund's support to a systemically and politically important member, not long after a significant augmentation—suggesting that it should indeed have changed perceptions. Second, it was soon followed by exceptionally large arrangements (e.g., to Brazil in late-1998)—indicating that the Fund would continue assisting members facing balance of payments difficulties when it believed those programs would succeed. But it must be recognized that, even though the Russia non-bailout appears well suited to test for moral hazard, it is only a necessary—not a sufficient—tests as it could be merely a reflection of real hazard developments.

36. With this caveat in mind, the DSZ approach to test for moral hazard prior to the Russian “non-bailout” in 1998 is replicated using a larger sample of quarterly data and a somewhat different model specification. More importantly, a natural question is whether creditor moral hazard persisted following the Russia episode. The Fund's decision to interrupt its support to Argentina in late-2001 provides, therefore, a similar experiment for testing whether this is the case. As in the case of Russia, this “non-bailout” of Argentina—a systemically important member to which the Fund had substantial balance sheet exposure—in December 2001 followed a substantial augmentation in September 2001, and was itself followed by the Fund continuing to support other members facing balance of payments difficulties, including through exceptional arrangements (e.g., Turkey, Brazil, Uruguay). Following the logic of DSZ, therefore, if there was creditor moral hazard (post-Russia 1998), then spreads should have become more sensitive to fundamentals after the Argentine “non-bailout” and

²⁸ The DSZ paper proposes two additional moral hazard tests, both of which are based on the sensitivity of spreads to fundamentals; namely, a *slope test* (the coefficient estimates), according to which a decline in moral hazard leads to an increase in the absolute value of the coefficient estimates; and a *level test* (the coefficient estimates weighted by the regressor values; that is, the fitted spreads), which assumes that a reduction in moral hazard increases spreads as there is an increase in investors' perceived risk of lending. The advantage of the variance test is that it relies solely on country-specific factors.

cross-sectional variances should have increased. Indeed, as discussed later, there is no statistically significant evidence of a change in the role of economic fundamentals in determining spreads following the Russia non-bailout.

37. To implement the tests, two separate events—the Fund’s decision not to provide financial support to Russia in July 1998 and its decision to interrupt its support for Argentina’s program in late-2001—and thus three different time periods need to be taken into account. Conceptually, therefore, the test consists of estimating three different models based on data prior to the Russia event (Period 1 or pre-Russia model), on data after the Russia event but before Argentina (Period 2 or interim period), and on data following Argentina’s political and economic crisis (Period 3 or post-Argentina model):²⁹

$$S_{it} = \alpha^j + \beta^j X_{it} + \gamma^j Z_t + \varepsilon_{it} \quad j=1, 2, 3 \quad i=1, \dots, N \\ t=1, \dots, T_1; T_1+1, \dots, T_2; T_2+1, \dots, T_3$$

where j indexes the three sub-periods, t indexes quarters within each sub period, and i indexes countries; X is a vector of fundamentals (or other country-varying variables), Z is a vector of global variables (common to all countries—such as U.S. treasury bill and G7 corporate interest rates), and ε represents a random error. As in Eichengreen and Mody (2001), vector X includes the residuals of a ratings regression on the same regressors that serves to control for unobserved determinants of spreads that also affect country ratings.

38. An (extreme) example helps clarify the intuition for the test. Suppose that creditors expect to be bailed out by the Fund, then they would not care about the country’s fundamentals so $\beta^j = 0$ and there is no (or little) sensitivity of spreads to country-specific variables. If following some event (e.g., the Russia or Argentine non-bailouts) creditors no longer expect this moral hazard, then country performance will matter for spreads, $|\beta^j| > 0$, and there will thus be differentiation across countries (according to their performance). This can be tested for directly by examining whether there is a statistically significant increase in the variance of fitted spreads when the coefficients for each of the three models being estimated is applied to the *entire* sample of explanatory variables.³⁰

²⁹ The dataset includes Brazil, Bulgaria, Chile, Hungary, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, South Africa, Thailand, Turkey, and Venezuela. The period before Russia has six quarters (from 1997Q1 to 1998Q2), the interim period includes nine quarters (from 1999Q2 to 2001Q2), and the post-Argentina crisis period covers eleven quarters (from 2002Q2 to 2004Q4). To maximize econometric efficiency, the models for the three sub-periods are estimated in a single regression.

³⁰ The test thus takes the form $\beta^1 Var(X_t) \beta^1 - \beta^0 Var(X_t) \beta^0 > 0$, where X is the stacked vector over the whole sample and $Var(X)$ refers to the cross sectional variance within any quarter. The difficulty with testing whether the estimated β coefficients increase in absolute value across estimation periods is

(continued...)

39. The sample, using a balanced panel of quarterly data, includes 15 emerging market economies and excludes (i) three high spread volatility quarters over each event period, which are likely to be the most affected by contagion factors,³¹ and (ii) the countries experiencing these two events—in other words, neither Russia nor Argentina are included in the estimated spreads equations in this section.

40. The regressors can be classified into economic fundamentals, international economic factors, internal political regressors, and other factors (such as regional dummies). To keep the specification parsimonious, a regressor is kept in the estimation only if it is statistically significant in any of the three period estimations implicit in the full sample; the model fit is good—an adjusted R^2 of 0.75 (Table 3).

41. The coefficient estimates in general have the expected sign, though differences do exist across the three sample periods (e.g., fewer coefficients are statistically significant in the post-Argentina period). Low output growth and a large current account balance are typically associated with higher spreads, the latter perhaps reflecting the effect of large external adjustment forced on countries by the withdrawal of private financing during crises. Solvency and liquidity regressors (debt-to-GDP and foreign exchange reserves-to-GDP) both have the expected sign; although these regressors have weakened over the post-Argentina period, the difference is not statistically significant. In addition, a good political environment helps to reduce spreads and high global liquidity conditions, captured by corporate interest rates in G7 countries, are also an important factor affecting spreads.³²

42. Regional dummies suggest that Asian countries have lower spreads than the rest of the countries in the sample, while the opposite is the case for the five Latin American countries in the dataset.³³ Finally, as other research has found, the residuals of a ratings regression is highly significant; namely, factors that typically result in

that some coefficients may increase while others decrease; thus, some weighting of the coefficients is required. The regressors (X) provide this weighting. The advantage of the variance test over the other tests described in the DSZ paper is that it is unaffected by movements in factors that would be common across countries (e.g., U.S. interest rates), including factors that are unobserved (and captured by each estimation period's constant). The variance test is therefore robust to the omission of factors that could explain the average level of spreads across countries, including the recent decline in spreads.

³¹ As a robustness test, the exclusion period for each event is extended to include an additional quarter at each end; for example, the Russia event excludes the data for the period 1998Q2–1999Q2 compared to the 1998Q3–1999Q1 period excluded in the regression estimates discussed in this section. The results are unaltered by the use of longer exclusion periods in the estimation.

³² Although the U.S. interest rate variable does not always have the expected sign, the conclusions of this section—in particular, the results regarding the aggregate variance test—are robust to dropping the interest rate regressors from the estimated specification.

³³ Since the regional dummies are specific to each of the three periods in the joint econometric estimation, they also serve to reveal contagion factors that might play a role at a regional level.

better country ratings also lead to a reduction in spreads. It is worth noting, however, that the role of residual ratings in the model fit is limited—specifically, the adjusted R^2 of a regression without interactive regressors and without ratings residuals is still high (0.62)—suggesting that ratings do not provide much additional information for the determination of spreads beyond that contained in the other independent variables included in the regression.

43. As previously discussed, based on the coefficients estimated over each of the three sub-periods, the final step involves calculating quarterly cross-sectional variances using the coefficients for each of the three periods but applied to the full sample. The test thus consists of comparing the variance implied by each model for any *given* quarter in the full sample of data. As shown in Table 4, the post-Russia event model (i.e., the coefficient estimates for the interim period) shows a statistically significant increase in cross-country variance in all quarters of the dataset when compared with the cross-section variance of the model estimated using the coefficient estimates of the pre-Russia period. This result replicates the findings presented in the DSZ paper but using quarterly data for a longer period and a different list of regressors. It provides evidence *consistent with* a decline in creditor moral hazard effects on investor behavior following the Fund’s decision to interrupt its support of Russia’s program in mid-1998.³⁴ Assuming that the ancillary assumptions needed for the DSZ test to reflect evidence of moral hazard are met, then one possible explanation in terms of the Mussa theorem is that—prior to the Russia non-bailout—creditors expected the Fund to support members regardless of their performance and *therefore to incur expected losses on the financial support it provides*.³⁵ In other words, when the Fund interrupted its support for Russia’s program, creditors no longer expected the Fund to tolerate losses on its financing.

³⁴ Moreover, the aggregate variance test discussed in Appendix I confirms that, when all quarters are considered as a group, there is a significant increase in the cross section variance of the post-Russia model relative to those derived using coefficient estimates calculated using pre-Russia data.

³⁵ As discussed above, another explanation—which would not be consistent with creditor moral hazard—is that the interruption of support was interpreted as an increase in real hazard.

Table 3. Estimation Results (1997–2004)

Dependent variable: EMBI Spreads	Pre-Russia (Period 1)	Interim (Period 2)	Post-Argentina (Period 3)	Difference in coefficient estimates b/w Period 1 and 2	Difference in coefficient estimates b/w Period 2 and 3
Real GDP growth, percent	-0.65	-1.01	-5.42 *	-0.4	-4.40
Current account balance; in percent of GDP	6.54 ***	20.71 ***	14.41 **	14.2 ***	-6.30
Private sector credit growth; in percent	0.01	3.01 ***	-0.53	3.0 ***	-3.54 *
Debt to GDP ratio	6.64 ***	7.13 ***	7.00 ***	0.5	-0.13
Reserves to GDP ratio	-5.92 **	-8.46 ***	-4.54 *	-2.5	3.92
REER overvaluation	-158.25 **	-572.81 **	-1486.93 ***	-414.6 *	-914.12 *
Strong political factors	-340.02 ***	-1140.36 ***	-779.50 **	-800.3 ***	360.86
GDP as share of US GDP	24.84 ***	30.65 ***	46.70 ***	5.8	16.06
US TB interest rate	-170.30 ***	-47.44 *	47.39	122.9 ***	94.83 *
G7 corporate interest rate	262.30 ***	30.21 **	45.41 **	-232.1 ***	15.19
Asia dummy	-67.43 **	-336.15 ***	-217.36 ***	-268.7 ***	118.79
Latin America dummy	130.00 ***	89.77 ***	92.00	-40.2	2.22
Ratings residual	-24.06 ***	-67.62 ***	-41.97 ***	-43.6 ***	25.65
Period constant	-1108.52 *	919.40 ***	-59.60	2027.9 *	-979.00 ***
Number of observations; each period	90	135	165		
Number of observations; total	390				
F test, p-value	62.28 ***				
Adjusted R-squared	0.75				

Note: *** significant at 1 percent; ** significant at 5 percent; and * significant at 10 percent. Regressions with robust standard errors.

Table 4. Cross-Country Variances and Aggregate Variance Test

Period	Actual variance	Variance pre-Russia model (Period 1)	Variance interim period model (Period 2)	Variance post-Argentina model (AP (Period 3)	p-value of diff. in variances (Period 1 & 2)	p-value of diff. in variances (Period 2 & 3)
1997Q1	76584	45842	181372	239455	0.00 ***	0.18
1997Q2	36760	35634	145997	146468	0.00 ***	0.50
1997Q3	15606	27365	119984	92957	0.00 ***	0.17
1997Q4	22152	18671	59870	37901	0.00 ***	0.06 **
1998Q1	19306	17085	137345	150925	0.00 ***	0.45
1998Q2	26314	21176	141316	132563	0.00 ***	0.46
1999Q2	82376	19868	49711	39537	0.00 ***	0.31
1999Q3	98191	18936	45015	39965	0.00 ***	0.38
1999Q4	58984	19835	51762	38134	0.00 ***	0.15
2000Q1	54703	20752	52188	37547	0.00 ***	0.06 *
2000Q2	63617	29777	79076	65149	0.00 ***	0.29
2000Q3	56706	28549	80326	65193	0.00 ***	0.26
2000Q4	78506	18873	48926	36201	0.00 ***	0.08 *
2001Q1	81910	18702	52916	38988	0.00 ***	0.08 *
2001Q2	90496	21054	72292	74236	0.00 ***	0.45
2002Q2	104757	24424	101304	52170	0.00 ***	0.01 ***
2002Q3	306544	25377	108323	95679	0.00 ***	0.32
2002Q4	181711	24269	100684	98950	0.00 ***	0.47
2003Q1	164466	27101	103005	119593	0.00 ***	0.25
2003Q2	99729	25437	83824	76395	0.00 ***	0.30
2003Q3	66494	22557	68005	54076	0.00 ***	0.09 *
2003Q4	38929	22510	64088	48890	0.00 ***	0.06 *
2004Q1	37887	20833	67426	41875	0.00 ***	0.02 **
2004Q2	46024	21145	70139	47044	0.00 ***	0.03 **
2004Q3	31013	21413	67868	40333	0.00 ***	0.01 ***
2004Q4	22251	23774	77180	44164	0.00 ***	0.01 ***
Aggregate variance test (p-value)					0.00 ***	0.55

Note: *** significant at 1 percent; ** significant at 5 percent; and * significant at 10 percent. Horizontal lines reveal exclusion periods.

44. By contrast, the results for the Argentina “non-bailout” are less clear. In particular, the difference in variances are statistically insignificant for most quarters and the aggregate variance test confirms that there are no statistically significant differences between those estimated using the interim period data and those estimated using the post-Argentina model (if anything, while the differences are statistically insignificant, the variances using the post-Argentina coefficient estimates tend to be *lower*—the opposite of what would be expected if this event had reduced creditor moral hazard). In addition, were the exclusion period between the pre- and post-Argentina non bailout be extended to include the SRF augmentation to Turkey, the results still hold; that is, the cross-sectional variance before Turkey’s augmentation and after Argentina’s non-bailout are statistically indistinguishable.

45. While caution is required in interpreting the results, it is perhaps telling that an empirical test finds evidence consistent with a decline in creditor moral hazard following the Russia non-bailout but cannot detect any change following the Argentina non-bailout. In particular, the results imply that—in contrast to the Russia non-bailout—the

interruption of support to Argentina's program did not change investors' perceptions. Although not definitive, it suggests that investors were not expecting the Fund to support Argentina regardless of its policy performance—that is, to be willing to tolerate expected losses on its financial support. Thus, evidence of creditor moral hazard following the Fund's decision to interrupt its support for Russia's program in 1998 appears considerably weaker.

IV. CONCLUSIONS

46. As has long been hypothesized, the prospect of Fund financial support—by reducing the expected cost of crises—may result in greater risk-taking by members and by markets. In the strict sense of the term, this constitutes moral hazard if decisions are distorted by the prospect of an expected transfer/subsidy that corresponds to expected losses of the Fund. Although, on average, the Fund's rate of charge has adequately reflected the default risk it faces, it does not necessarily follow that the Fund did not make expected losses in any individual case. Moreover, the prospect of Fund financing may lead to too much risk-taking either if national authorities do not maximize the member's welfare or they do not take adequate account of possible contagion.

47. In practice, however, the high economic, social, and political costs of crises together with the Fund's surveillance activities are likely to limit risk-taking (although direct empirical evidence either for or against debtor moral hazard is extremely difficult to obtain). As regards the design of a contingent, crisis prevention instrument, the use of qualification standards that require the member to have pursued and remain committed to strong macroeconomic management and to policies directed at reducing remaining vulnerabilities can help address issues of debtor moral hazard directly.

48. The relatively small amounts of Fund financial support in relation to the country's external debt suggest that creditor moral hazard—in the sense of risk-taking by creditors in the expectation of a direct bailout from the Fund—is also likely to be relatively limited. This is not to suggest that Fund support—including by providing liquidity and a commitment device for the member—does not reduce the probability of a crisis. But unless creditors believe that the Fund will make expected losses on its financial support, the response of creditors—including in terms of interest rates, volumes of capital flows, and the maturity structure of loans—to this reduction in risk will be welfare enhancing. Moreover, while existing empirical tests are far from definitive (and further empirical work is required), the evidence presented here suggests that creditor moral hazard is less likely to be a concern after the Fund sent the signal in mid-1998 that it would interrupt its support—even to systemically important members—when it believes program success to be unlikely.

Appendix I. Aggregate Variance Test

The difference in cross-country variance of fitted spreads in the DSZ paper is given by

$$f_t(\beta^0, \beta^1) \equiv \beta^{1'} \text{Var}(X_t) \beta^1 - \beta^{0'} \text{Var}(X_t) \beta^0$$

where $\text{Var}(X_t)$ is the cross-country variance of economic fundamentals and other country-specific factors in period t , and β^0 and β^1 are the vectors of estimated coefficients from the pre-event (denoted by a 0 superscript) and post-event (denoted by a 1 superscript) models, respectively. The hypotheses tested in the DSZ paper is given by

$$(1) \quad H_0: f_t(\beta^0, \beta^1) = 0 \quad \text{and} \quad H_A: f_t(\beta^0, \beta^1) > 0$$

For an aggregate cross-country variance test, the null hypothesis can be written as:

$$(2) \quad \tilde{H}_0: f_a(\beta^0, \beta^1) \equiv \frac{1}{T} \sum_{t=1}^T f_t(\beta^0, \beta^1) = 0$$

where $f_a(\beta^0, \beta^1)$ is the sample average of $f_t(\beta^0, \beta^1)$. Obviously, the revised null \tilde{H}_0 is less restrictive than H_0 in (1); indeed, H_0 implies \tilde{H}_0 but not the converse. Nonetheless, \tilde{H}_0 would be more appropriate if the individual period variance test results are not uniform across periods. In this case, the sample counterpart of $f_a(\beta^0, \beta^1)$ is given by

$$f_a(\hat{\beta}^0, \hat{\beta}^1) \equiv \frac{1}{T} \sum_{t=1}^T f_t(\hat{\beta}^0, \hat{\beta}^1)$$

and the Taylor expansion of $f_a(\hat{\beta}^0, \hat{\beta}^1)$ yields

$$f_a(\hat{\beta}^0, \hat{\beta}^1) - f_a(\beta^0, \beta^1) \approx \frac{1}{T} \sum_t \left[\frac{\partial f_t}{\partial \hat{\beta}^0} \cdot (\hat{\beta}^0 - \beta^0) + \frac{\partial f_t}{\partial \hat{\beta}^1} \cdot (\hat{\beta}^1 - \beta^1) \right].$$

Since the expression in between brackets is normal, the left hand side, which is the simple average of the linearized $f_t(\hat{\beta}^0, \hat{\beta}^1)$, is also normal. It can then be shown that

$$(3) \quad W_a = f_a(\hat{\beta}^0, \hat{\beta}^1)' [G_a' V G_a']^{-1} f_a(\hat{\beta}^0, \hat{\beta}^1) \square \chi^2(1) \text{ under } \tilde{H}_0,$$

where V is the variance-covariance matrix of the coefficient estimates and G_a is given by

$$G_a = \left(\frac{\partial f_a}{\partial \hat{\beta}^0}, \frac{\partial f_a}{\partial \hat{\beta}^1} \right) = \frac{1}{T} \sum_{t=1}^T G_t = \frac{1}{T} \sum_{t=1}^T \left(\frac{\partial f_t}{\partial \hat{\beta}^0}, \frac{\partial f_t}{\partial \hat{\beta}^1} \right).$$

The Wald test (3) is applied to the full dataset using the coefficient estimates of the pre- and post-event data, where the superscript 0 and 1 relate to the period immediately before and immediately after an event, be this the Russia or the Argentina non bailout. Also, while the test is calculated for all X 's over the period 1997–2004, the three quarters over which events are assumed to have resulted in increased volatility (1998Q3 to 1999Q1 for the Russia event and 2001Q3 to 2002Q1 for the Argentina event) are excluded from the aggregate variance test. As noted earlier, longer exclusion periods do not alter the results.

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