

# Country Insurance\*

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## Abstract

In this paper, we examine how the presence of country insurance schemes affects policymakers' incentives to undertake reforms. Such schemes (especially when made contingent on negative external shocks) are more likely to foster than to delay reform in crisis-prone volatile economies. The consequences of country insurance, however, hinge on the nature of the reforms being considered: "buffering" reforms, aimed at mitigating the cost of crises, could be partially substituted for, and ultimately discouraged by insurance; by contrast, "enhancing" reforms that pay off more generously in the absence of a crisis are likely to be promoted.

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# 1 Introduction

The recent wave of financial crises has challenged the role of International Financial Institutions' (IFIs) as crisis managers. IFIs' rescue packages have faced criticism for different, and often opposite reasons. Whereas antiglobalizers accuse IFIs of providing distressed countries with insufficient resources to protect the poor, free-marketers blame the same IFIs for undermining market discipline through their excessive *largesse*. While difficult to reconcile ideologically, these views can be encompassed in a framework that, using Mussa's [1999] terminology, trades off the *real hazard* arising as a combination of financial vulnerabilities and adverse external shocks, and the *moral hazard* induced by international financial assistance. Evaluating the role of the IFIs and its moral hazard consequences, however, requires a clear understanding of how international safety nets influence emerging markets' incentives to undertake politically costly reforms that may, in turn, affect their financial vulnerability in the future. This paper puts forward a stylized analytic framework to identify these effects, and assess their implications.

As Haldane and Taylor [2003] clearly point out, "IMF facilities can usefully be considered as a kind of insurance policy. [...] Liquidity crises represent a *real hazard* that such insurance can help mitigate. In this role, IMF insurance is clearly welfare enhancing. As with any insurance policy, however [...] mitigating the real hazard of crises might at the same time aggravate the *moral hazard* of distorted incentives" (p.122). The question of whether such moral-hazard costs are so large that "the IMF might consider changing its name to IMH—the Institute for Moral Hazard" (Barro [1998]) or so small that "Argentina's difficulty in obtaining IMF lending has to do with an overstating of the problem of moral hazard" (Griffith-Jones [2003]) is an empirical one that, while already the subject of a growing literature, remains elusive.

Zhang [1999] studies the emerging market bond spreads before and after the Mexican bailout, and finds no evidence of moral hazard. Lane and Philips [2000] look at how emerging market bond spreads, between 1995 and 1999, reacted to a number of IMF-related news, and only find two (out of 22) episodes in which interest rate spread behavior was consistent with the moral hazard hypothesis. One of these two episodes is the increase in emerging market spreads in the aftermath of the Russian 1998 default. This event is analyzed by Dell'Ariccia et al. [2002] who estimate a structural model for emerging market bond spread and, in line with the moral hazard hypothesis, show that the failed Russian bailout increased spread levels, their sensitivity to fundamentals, and their cross-country dispersion.

Even if one accepts that international safety nets may create investor moral hazard, this does not imply, as often suggested, that such moral hazard is necessarily at the expenses of global taxpayers. Indeed, Jeanne and Zettelmeyer [2001] show that official crisis lending de facto involves virtually no cost to the rest of the world. If this is the case, from a social planner's perspective (alternatively, for the country as a whole) rescue packages should not be considered as state-contingent transfers (as in a standard insurance policy) but rather as

state-contingent loans, closer to a textbook lender of last resort with limited moral hazard consequences.

However, as the borrower is ultimately the government, bailouts can still introduce an agency problem between a borrowing government that does not fully internalize the future repayment of the bailout, and the domestic taxpayers who ultimately foot the bill. Thus, even in the absence of a subsidy component, one could point at a *government moral hazard*, namely at “a discrepancy between the policymaker’s objective and the domestic taxpayers’ long-term interests,” (Jeanne and Zettelmeyer [2001], p.412). In this case, inasmuch as only a fraction of the bailout cost is paid during his period in office, bailouts preserve their insurance nature from the government’s standpoint.

An additional aspect – increasingly emphasized in the recent literature on emerging markets crises – that needs to be brought into the picture is the incidence of external shocks largely beyond the government’s control. Some observers have stressed the exogenous nature of sharp capital flow reversals (“sudden stops”) attributable, *inter alia*, to financial contagion, changes in global liquidity or interest rates movements.<sup>1</sup> Others have pointed to the role of large terms of trade shocks that, when combined with embedded vulnerabilities, may render an emerging country’s debt unsustainable, triggering a run on the country’s assets.<sup>2</sup> Indeed, in financially vulnerable emerging economies, liquidity runs can be prompted by self-fulfilling pessimistic expectations, with little if any relation with a fundamental change in the economy.<sup>3</sup>

At any rate, the presence of exogenous factors should certainly qualify the role played by moral hazard in triggering financial crises. More importantly, it influences the trade-off between costly long-term reforms and opportunistic short-term policies that is at the core of the debate on international safety nets. Specifically, *inasmuch as the political payoffs of reforms are severely reduced in the event of a financial collapse, the probability of facing an exogenous shock detracts from the incentives to embrace long-term reforms in the first place. Conversely, if policymakers are provided with some degree of insurance against exogenous factors so that the reform effort is properly rewarded, reform incentives might be strengthened.*

This is indeed the main message of this paper. With a focus on government moral hazard in a context in which crises depend both on the government’s actions and on exogenous factors, we identify the implications that country insurance has for the policymaker’s incentives to implement different types of reforms. Opting for a parsimonious framework allows us to encompass a number of channels (some, but not all of them, addressed by the existing literature) through which country insurance, by enhancing the returns on reform effort,

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<sup>1</sup>The initial reference to sudden stops is Dornbusch et al. [1995]. The concept has been recently developed by Calvo et al. [2003].

<sup>2</sup>This line was highlighted by De la Torre et al. [2003] and Perry and Servén [2002] to account for the recent Argentine crisis.

<sup>3</sup>The self-fulfilling crisis view has been revived by Sachs et al. [1996] to explain the Mexican crises. It gained advocates after the Asian crises (see among others Radelet and Sachs [1998] and Chang and Velasco [2001]), and was given new theoretical foundations by Morris and Shin [1998].

reinforces reform incentives, despite the presence of moral-hazard.

In particular, country insurance strengthens the incentives to invest in those reforms whose payoffs are negatively correlated with the probability of a crisis. Indeed, if the political returns on reforms that enhance productivity and economic growth in the long run can be eroded by episodes of financial distress driven by largely exogenous shocks, a high probability of facing these shocks would tilt the government's decision away from reform and towards short-term policies with immediate payoffs. Insurance, by reducing the incidence of these shocks, restores reform incentives. Not surprisingly, then, we find that insurance is more likely to stimulate reform in crisis-prone volatile economies.

On the other hand, a crisis entails political costs to the government, both direct (through the probability of being voted out of office) and indirect (through their deleterious consequences on the real economy). Then, as long as reforms play a role in preventing financial crises or mitigating their effects, insurance would relax the discipline induced by these costs. Ultimately, we find that this moral hazard effect may offset the beneficial impact of insurance if the political costs of a crisis are large enough.

When assessing the consequences of country insurance, our analysis also highlights the importance of the nature of the reforms under consideration, and, specifically, of the correlation between reform payoffs and the macroeconomic environment. In particular, "buffering" reforms that tend to reduce the real impact of adverse shocks and, as a result, pay off relatively more in the event of a crisis are likely to be discouraged by insurance, as the latter partially substitutes for the former. By contrast, country insurance could be particularly conducive to "enhancing" reforms that pay off more handsomely in tranquil times.

In the last part of the paper, we extend our analysis to address two additional channels recently discussed in the literature, through which country insurance may strengthen reform incentives: (i) an increase in the continuation value of policymakers (which, in turn, increases their incentives to avoid a crisis); and (ii) a reduction of the incidence of self-fulfilling crises unrelated with reform effort (which strengthens the link between the policymaker's decisions and the final outcome).

The first channel builds on Cordella and Levy Yeyati [2003], who, in a banking model, show that a central bank that commits to bailing out insolvent institutions in times of adverse macroeconomic conditions creates a risk-reducing "value effect" that lessens both the frequency of bankruptcies *and* overall bank risk. The second channel has been recently discussed by Corsetti et al. [2003] and Morris and Shin [2003]. The first paper develops a model in which international liquidity support can either generate debtor moral hazard or, by reducing liquidation costs in the event of a run, create the incentives for a government to implement costly reforms. The second paper shows that if currency crises are triggered by a coordination failure among creditors, international bailouts sometime enhance the incentives for governments to take preventive actions, as IMF's decisions are strategic complements with the adjustment effort of the country and the roll-over decisions of private creditors.

In this paper, we show that the introduction of a dynamic value effect reinforces the case for contingent country insurance, the more so the longer the effective planning horizon of the policymaker. Similarly, we find that the presence of self-fulfilling liquidity runs provides an additional rationale in favor of insurance, this time by reducing the incidence of exogenous events on the probability of facing crises that erode reform payoffs and undermine reform incentives.

The plan of the paper is as follows. The next section presents the model and derives the main analytical results. Section 3 discusses more in depth the implications of the nature of reforms, as well as the more practical question of implementability. Section 4 presents extensions that examine the role of the value effect and the presence of self-fulfilling crises. Finally, Section 5 extracts some policy implications and concludes.

## 2 The Model

To discuss the different effects that a country insurance policy may have on policymakers' incentives to undertake reforms, we consider the following stylized framework. At the beginning of the period, the government inherits a fixed amount of debt and decides on its policy stance. The policy choice is characterized by the amount of reform effort the government is willing to undertake. A reformist attitude (high effort) increases the probability of avoiding a crisis in the long run, but at the same time, reduces the government's ability to reap immediate political returns (which may include political patronage or fund diversion). After the policy choice is made, an exogenous state of nature (representing macroeconomic fundamentals) is revealed. In the absence of insurance, the probability of being unable to repay creditors at the end of the period (henceforth, a "crisis") is a function of macroeconomic fundamentals and the reform effort previously undertaken.<sup>4</sup>

We assume that, unlike the returns from short-run policies, returns from reform take time to materialize and depend on the evolution of the macroeconomic environment.<sup>5</sup> In addition, to capture the fact that the effective cost of a crisis influences reform incentives (alternatively, the moral hazard problem associated with insurance), we assume that a crisis event have specific real effects (which reflect in a political cost to the government) beyond and above those related with macroeconomic fundamentals, and that the implementation of reforms reduces the likelihood of a crisis episode.

Within this framework, we define the insurance contract as a policy that

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<sup>4</sup>The fact that we rule out partial repayment is just for the sake of simplicity and does not affect our main results.

<sup>5</sup>There are a number of ways in which reforms may increase the government's utility, including through a raise in productivity (if the country's income is an argument of the government's objective function) or through an improvement of the efficiency of tax collection (if the government's income, and its allocation, is an argument of the government objective function). The way in which the political returns of reforms differ according to the country's macroeconomic and financial context will depend on the nature of the reform. We will come back to this issue in Section 3.

stipulates the conditions under which an “insurer” provides the funds needed to repay lenders in the event of a crisis. We consider two extremely simple contracts: one that insures the borrower against insolvency whenever it occurs, and one that does it only in bad states of nature.<sup>6</sup> Note that an insurance contract can, in principle, be written as a function of realized reform effort. In practice, however, the measurement and verifiability of reform is bound to be contestable, to an extent that may prevent the enforcement of the contract. To capture this limitation, we assume that reform effort is not verifiable and thus cannot be used to condition the provision of insurance.

Under either insurance scheme, the country faces three possible scenarios: solvency, associated with benign macroeconomic fundamentals (which we henceforth denote as “tranquil” times); insolvency, associated with adverse macroeconomic fundamentals, where default is avoided through the activation of the insurance policy (which we denote as “turbulent” times), and insolvency followed by default (a “crisis”). The distinction between the last two scenarios reflects the fact that, while insurance may save the country the additional costs of a crisis, it does not fully eliminate the real consequences of a bad state of nature.

More formally, we assume that, in the absence of insurance, a crisis happens with probability  $\pi = 1 - s_j e$ , where  $e \in [0, 1]$  denotes the government’s reform effort, associated with a quadratic opportunity cost  $c(e) = e^2$  that represents the forgone returns from alternative short-run policies. The stochastic variable  $s_j$ ,  $j = B, G$ , denotes an observable exogenous state of nature, where the subscripts  $B$  and  $G$  refer to “good” and “bad” states, so that  $s_B < s_G < 1$ . In this simple set-up, for a given level of effort, the probability of a crisis is higher in bad states; for a given state, a crisis is more likely when reform effort has been low. For expositional simplicity, we further assume that  $\Pr(s_B) = \Pr(s_G) = \frac{1}{2}$ , and that  $s_B = \gamma - \alpha$ ;  $s_G = \gamma + \alpha$ . These two assumptions imply that the probability of a crisis is given by  $\pi = 1 - \gamma e$ . From now on, we refer to  $\gamma$  as the expected state of nature (or macroeconomic fundamentals) and to  $\alpha$  as exogenous volatility.

As noted before, we assume that reforms generate “returns” to the government. We let such returns be equal to  $\mu$  in tranquil times, to  $\beta$  in turbulent times, and to  $\lambda$  in crisis periods. In order to rule out the trivial cases in which country insurance is either always or never optimal, we work under the assumption that  $1 \geq \mu \geq \beta \geq \lambda$ . Finally, we assume that the occurrence of a crisis entails an additional fixed cost to the government equal to  $C$ .

The assumption that, in the event of insolvency, reform payoffs are higher if the country is insured captures the effort-increasing effect (the “carrot”) of the insurance policy. The rewards of reforms decline both with deteriorating fundamentals and with the unraveling of a debt crisis. Insurance cannot eliminate the former, but helps avoid the latter.<sup>7</sup> This effect is counterbalanced by the standard moral hazard effect introduced by the insurance policy which, in our

<sup>6</sup>In the context of our model, it is easy to show that all feasible contracts are strictly dominated by at least one of these two extreme alternatives. See also footnote 11.

<sup>7</sup>A natural way to interpret this assumption is to think of  $\beta - \lambda$  as the result of a lower cost of capital under unfavorable macroeconomic conditions when the country’s repayment capacity is preserved (at least partially) by the insurance policy.

framework, is associated with the elimination of the fixed cost of the crisis,  $C$ , in those states in which the insurance is activated.<sup>8</sup>

The problem of the government in the absence of insurance (denoted by the subscript  $NI$ ) is given by

$$Max_e U_{NI} = \gamma\mu e^2 + (1 - \gamma e)(\lambda e - C) - e^2, \quad (1)$$

from which we have that the optimal level of effort is given by<sup>9</sup>

$$e_{NI}^* = \frac{\lambda + \gamma C}{2(1 - \gamma(\mu - \lambda))}. \quad (2)$$

As expected, the optimal level of effort is a positive function of the cost of a crisis ( $\frac{\partial e_{NI}^*}{\partial C} > 0$ ) and the quality of macroeconomic fundamental ( $\frac{\partial e_{NI}^*}{\partial \gamma} > 0$ ). Effort also increases with the reform payoff in tranquil times ( $\frac{\partial e_{NI}^*}{\partial \mu} > 0$ ). The reform payoff during a crisis,  $\lambda$ , has, however, an ambiguous effect on policymakers' willingness to undertake reforms. A higher value of  $\lambda$ , by reducing the loss associated with defaults, raises the payoff of reforms. However, it also weakens the incentives to reduce the probability of a crisis. In the Appendix, we show that the first effect dominates the second when the cost of the crisis is low enough, a situation in which the disciplinary effect of a crisis is necessarily limited.

The introduction of a blanket insurance policy that guarantees creditors whenever the country becomes insolvent (a case denoted by the subscript  $BI$ ) modifies the problem to:

$$Max_e U_{BI} = \gamma\mu e^2 + (1 - \gamma e)\beta e - e^2, \quad (3)$$

from which we have that

$$e_{BI}^* = \frac{\beta}{2(1 - \gamma(\mu - \beta))}. \quad (4)$$

Again, reform effort increases with the quality of macroeconomic fundamentals ( $\frac{\partial e_{BI}^*}{\partial \gamma} > 0$ ) and with reform payoffs in tranquil ( $\frac{\partial e_{BI}^*}{\partial \mu} > 0$ ) and turbulent times ( $\frac{\partial e_{BI}^*}{\partial \beta} > 0$ ). As expected, under a blanket insurance policy, the disciplinary effect of the crisis is bound to play no role.

Finally, we study the effects of a contingent insurance policy (denoted by the subscript  $CI$ ), such that the creditors' guarantee is activated exclusively in bad times ( $s = s_B$ ). The government's problem can now be rewritten as:

$$Max_e U_{CI} = \gamma\mu e^2 + \frac{1}{2}(1 - (\gamma - \alpha)e)\beta e + \frac{1}{2}(1 - (\gamma + \alpha)e)(\lambda e - C) - e^2, \quad (5)$$

<sup>8</sup>In its simplicity, our model seems to rule out the possibility of moral hazard in the absence of insurance. However, moral hazard would still be present whenever the benefits and costs of reform for the government differ from those for its constituency. Trivially, as the cost of the crisis borne by the government declines (as  $C$  approaches zero), the policymaker will be increasingly tempted to reduce effort.

<sup>9</sup>A formal derivation of the results reported in the text is presented in the Appendix.

from which we obtain

$$e_{CI}^* = \frac{\beta + \lambda + C(\alpha + \gamma)}{4(1 - \mu\gamma) - 2\alpha(\beta - \lambda) + 2\gamma(\beta + \lambda)}. \quad (6)$$

As in the first case, the optimal level of reform effort is a positive function of the cost of a crisis ( $\frac{\partial e_{CI}^*}{\partial C} > 0$ ), the expected state of nature ( $\frac{\partial e_{CI}^*}{\partial \gamma} > 0$ ), and the reform payoff in tranquil times ( $\frac{\partial e_{CI}^*}{\partial \mu} > 0$ ). The reform payoffs in turbulent ( $\beta$ ) and in crisis times ( $\lambda$ ) have, however, an ambiguous effect on policymakers' willingness to undertake reforms. As in the no-insurance case, the reform payoff during a crisis,  $\lambda$ , has a positive effect on policymakers' willingness to undertake reforms only when the political costs of the crisis are low enough. The same is true for the reform payoffs in turbulent times: only when the disciplinary effects of the crisis are limited does the insurance effect dominate the moral hazard effect under a contingent insurance policy.

We are now in a position to compare the reform effort in the three different scenarios discussed above, and see under which conditions country insurance schemes foster or hinder reform effort.

**Result 1 :**

- (i) If crisis costs are very low ( $C < C_1 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma - \alpha\beta)}{(\gamma + \alpha)(1 - (\mu - \beta)\gamma)}$ ), the reform effort is highest under a blanket insurance, and lowest under the no insurance regime ( $e_{BI} > e_{CI} > e_{NI}$ );
- (ii) If crisis costs are low ( $C_1 < C < C_2 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma)}{\gamma(1 - (\mu - \beta)\gamma)}$ ), the reform effort is highest under conditional insurance and lowest under no insurance ( $e_{CI} > e_{NI} > e_{BI}$ );
- (iii) If crisis costs are high ( $C_2 < C < C_3 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma + \alpha\lambda)}{(\gamma - \alpha)(1 - (\mu - \beta)\gamma)}$ ), the reform effort is highest under conditional insurance, and lowest under blanket insurance ( $e_{CI} > e_{BI} > e_{NI}$ );
- (iv) If crisis costs are very high ( $C > C_3$ ), the reform effort is highest under no insurance, and lowest under a blanket insurance ( $e_{NI} > e_{CI} > e_{BI}$ ).

**Proof:** See Appendix.

To grasp the intuition of these results, it is best to start by comparing the no-insurance and blanket-insurance cases. First, notice that the main force at work is the interplay between the motivating carrot of insurance, captured by the difference between the reform payoff in turbulent and crisis times, and the dissuasive stick of crisis costs, which the insurance policy necessarily attenuates. It is not surprising, then, that if the stick is large enough, reform effort will be lower under an unconditional insurance policy. Conversely, a small stick would imply a minor moral hazard problem as a result of a blanket insurance, tilting the carrot-stick balance in favor of the former.

The moral hazard aspect detracts from the benefits of the blanket insurance when the cost of the crisis increases. This effect can be attenuated by conditioning the insurance policy to the realization of a bad shock. The reason this might



be “incentive compatible” is well known in principal agent models.<sup>10</sup> Indeed, state-contingent insurance increases the value of effort in those states in which a failure is most likely to be the consequence of external circumstances (a bad shock) and preserves the stick in those states in which a failure is most likely to be associated with insufficient reform. In terms of the previous trade-off, this contingent policy entails both a smaller carrot (since it is now available only in the event of a bad shock) and a weaker stick (effective only if the country becomes insolvent under good macroeconomic conditions). However, the first effect is proportionally smaller than the second one, improving upon a blanket insurance as moral hazard becomes important ( $C > C_1$ ), and leading to more reform than in the no-insurance case as long as moral hazard does not become an overwhelming concern ( $C < C_3$ ).

A clearer intuition of the conditioning mechanism can be obtained with the help of a limiting example in which a bad shock causes insolvency with certainty ( $\alpha = \gamma$ , so that  $s_B = 0$ ). Substituting these values in the first order conditions of the maximization problem, it follows immediately that the difference in the marginal utility of reform effort between the contingent-insurance and the no-insurance scenarios ( $\frac{\partial U_{CI}}{\partial e} - \frac{\partial U_{NI}}{\partial e}$ ) is simply given by  $\frac{(\beta-\lambda)}{2}$ . In this case, the only effect of the introduction of insurance is a higher return on reforms contingent on a bad shock. The moral hazard component, on the other hand, disappears because the incidence of reform on the probability of insolvency under adverse macroeconomic conditions is, in this extreme situation, inexistent.

The above example suggests that the effectiveness of country insurance contracts in fostering reforms depends not only on the reform payoffs under different scenarios, but also on the expected state of nature and its volatility. More precisely, if the case for country insurance is built on its ability to foster reform effort, we have that:

**Result 2 :**

- (i) *The higher the probability of a crisis for a given level of reform (the lower  $\gamma$ ), the stronger the case for insurance;*
- (ii) *The higher the exogenous volatility ( $\alpha$ ), the stronger the case for contingent insurance;*

**Proof:** See Appendix.

These results suggest that crisis-prone volatile economies would be natural candidates for country insurance. Indeed, in the presence of good and stable macroeconomic conditions, the moral hazard component of insurance is likely to undermine already high expected reform payoffs. By contrast, when expected returns on reforms are downgraded by a highly unpredictable macroeconomic

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<sup>10</sup>The classical reference is Hölmstrom [1988]. In our set-up, the probability that the crisis is caused by the policymaker’s lack of reform effort is proportional to the value of the macroeconomic conditions  $s_j$ . This implies that reform effort satisfies Milgrom’s [1988] monotone likelihood ratio property, and ensures that the “optimal” insurance policy is, loosely speaking, monotonic in  $s_j$ .

context, country insurance strengthens reform incentives, while moral hazard is bound to play a lesser role. Then, it is not surprising that high exogenous volatility reinforces the case for conditional insurance. Under such policy, the insurance is in place only in those states in which moral hazard effects are necessarily subdued, while in those states in which moral hazard should be a concern, the disciplining effect of crisis costs is preserved.

### 3 Insurance and Reforms

The simplified model presented above highlights the main trade-offs underscoring much of the discussion on international safety nets and, in particular, their effect on government moral hazard. In this section, we specialize the analysis to better illuminate its policy implications. More precisely, we first look at how the insurance-incentive nexus depends upon the nature of the reform under scrutiny. Then, we address the critical issue of the insurance contract's implementation costs.

#### 3.1 Enhancing versus buffering reforms

Following the existing literature, we use the term “reforms” to denote a diverse set of government policies that, while increasing the country's resilience in periods of financial distress, also enhance long-run productivity and foster growth. The implementation of such policies, however, often entails a short-term (political if not economic) cost. In our model, the effects of reforms are captured by their payoffs under the three different states (and the difference across states).<sup>11</sup> However, the relative payoffs under different scenarios (and, in turn, the impact of country insurance) are likely to differ substantially according to the specific nature of the reform under consideration.

For instance, deregulation (or government retrenchment) that tends to enhance productivity across the board requires a favorable macroeconomic context to provide its political yield. Privatization of state-owned utilities may also raise efficiency under all scenarios but, by increasing the rigidity of utilities prices, may entail substantial political costs during turbulent and crisis periods. By contrast, prudential reforms that increase capitalization and liquidity ratios of domestic banks may attenuate the impact of an adverse shock and the costs of a crisis, at the expense of wider intermediation margins in tranquil times. Similarly, tax reforms that improve fiscal accounts at the cost of a higher effective tax burden, by making government revenues less procyclical and broadening the scope for countercyclical fiscal policy, are particularly beneficial under adverse macroeconomic conditions, but may be politically costly during tranquil times.

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<sup>11</sup>Notice that we implicitly assume that reform effort precedes the realization of the shock, and that the associated reform costs are incurred ex-ante, and thus they are state-independent. This situation in which these costs differ across states can be encompassed in our model simply by assuming that reform payoffs in the different states of nature are netted out of the state contingent component of the reform cost.

Broadly speaking, then, reforms could be defined as “enhancing” or “buffering,” according to whether their payoffs are relatively higher or lower in tranquil times vis à vis crisis times. More generally, the distinction hinges upon whether they contribute to enhancing the upside or buffering the downside of the distribution of returns across states. In our model, this distinction can be simply captured by the difference in the parameters that determine reform payoffs ( $\mu - \lambda$ ): the more buffering the nature of the reform, the smaller this difference.<sup>12</sup> Based on this simple taxonomy, it is easy to show that the smaller ( $\mu - \lambda$ ), the more likely the reform effort under insurance exceeds that under the no-insurance case. In other words:

**Result 3** *The scope for reform-inducing country insurance policies narrows with the buffering nature of reforms.*

**Proof:** See Appendix

The intuition behind this result is straightforward. Due to their self-insurance nature, buffering reforms aim at attenuating the impact of adverse macroeconomic conditions. Thus, they are partial substitutes for the country insurance policies discussed above. As a result, the presence of the latter reduces the need for the former. Conversely, an insurance that preserves the value of effort in turbulent times is complementary to enhancing reforms. The presence of the latter, this time, stimulates the former.

### 3.2 Is country insurance feasible?

While desirable under certain conditions, effort-inducing insurance policies such as those described above are costly, bearing the question of whether a government would be willing to pay up-front a fair insurance fee to the insurer if the insurance policy were available.

In order to show that this would indeed be the case, let’s extend our framework along the following lines: Assume that policymakers’ utility (in the initial period) is a decreasing function of the interest rate they are charged; and that a fairly priced insurance is available in the market. Also assume that, at the moment of deciding whether to buy the insurance or not, the country has to refinance its stock of existing debt; and that risk-neutral creditors charge a spread over the risk free rate that compensates for the probability of default. Notice that, as long as insurance increases effort, it also reduces the probability of default. This in turns implies that the cost of refinancing the debt (net of the insurance premium) is necessarily lower when the country is insured than when it is not. Then, given that the policy does not involve an economic costs to the

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<sup>12</sup>In addition, some preventive reforms (e.g., higher bank liquidity requirements or social safety nets) may lead directly to a reduction of the deadweight loss of a crisis,  $C$ . This case can be readily represented as a change in  $\lambda$ , by replacing the fixed cost of the crisis  $C$  with a (slightly) more general  $C(e) = C - \theta e$ , where a preventive reform may be characterized by  $\theta > 0$ . In turn, the marginal return on reform in crisis times would now equal  $\bar{\lambda} = \lambda + \theta$ , reducing the scope for country insurance (since  $\frac{\partial C_3}{\partial \lambda} < 0$ ).

country (if anything, it results in an economic gain), a sufficient condition for policymakers to be willing to purchase a fairly priced (effort-inducing) insurance policy is that it increases their own utility relative to the no-insurance case. The following results builds upon this intuition:

**Result 4** *A government will always be willing to purchase a reform-inducing country insurance at a fair premium.*

**Proof:** See Appendix.

The previous theoretical argument, while appealing, ignores important practical considerations. First, the size of the stock of net financial liabilities in most emerging economies exceeds the financial capacity and diversification scope of any private agent or consortium of agents. Second, even if a consortium of insurers could credibly provide this contract for smaller economies, it is unlikely that the insured government can prevent the insurer, as sovereign risk mounts, from hedging its growing exposure by shortening the country's debt, feeding back into the crisis dynamics.<sup>13</sup> Finally, the inverse moral hazard problem (specifically, the lack of mechanisms to ensure the solvency of the insurer) should not be underestimated, particularly in an international context.

In light of the difficulties previously mentioned, many observers have suggested that IFIs should play the role of country insurers.<sup>14</sup> While the IFIs are unlikely to overcome the size problem, they are free from inverse moral hazard, and less constrained by the need to hedge their exposure. Thus, IFIs are in a privileged position to provide at least partial insurance schemes.<sup>15</sup> In this regard, our analysis adds to this view from a different dimension. By showing that a more active (and explicit) role of the IFIs as country insurers may not necessarily lead to a delay in the implementation of pending reforms, our findings strongly qualify the traditional moral hazard criticism of the role of IFIs as country insurers. A note of caution is in order in the case of contingent insurance, particularly since the international constituency of IFIs may weaken their capacity to condition their assistance once a crisis erupts. However, even in this

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<sup>13</sup>The same logic applies to currency risk: private insurers may accelerate a currency collapse by short-selling the local currency to hedge their exposure. Note the underlying coordination problem: although insurers are aware that by their hedging they increase the probability of a collapse, their individual negative impact is diluted in the aggregate while the benefits from hedging accrue entirely to them. Thus, this argument implicitly assumes that no bank will be willing or able to insure a country by itself. See Broda and Levy-Yeyati [2003] for a detailed discussion of the practical obstacles for private country insurance.

<sup>14</sup>Fischer [1999] argues that the IMF has in practice functioned as an international lender of last resort, and has called for changes in the international financial architecture to acknowledge this function and improve its effectiveness. See also Eichengreen [1999] for a survey.

<sup>15</sup>Note that, unless they are fully guaranteed by their non-borrowing shareholders, even IFIs may not be able to absorb unlimited risk without compromising their solvency. In practice, however, due both to those guarantees and to their superior enforcement technology, IFIs should be better equipped than private financial institutions to offer *limited* liquidity assistance facilities (much in the same way as a domestic lender of last resort).

case, an explicit insurance facility may dominate implicit ones by reducing the IFI's discretionary margin.<sup>16</sup>

## 4 Extensions

In this section, we extend our analysis to address two additional channels, recently discussed in the literature, whose interaction with country insurance schemes might significantly affect reform incentives. First, we sketch a dynamic version of our model to illustrate the way in which country insurance may influence the behavior of forward looking policymakers. Second, we allow for the possibility of self-fulfilling crises, to show how, in such circumstances, the positive effects of country insurance are magnified.

### 4.1 Value effect

In a multi-period banking model, Cordella and Levy Yeyati [2003] show that a state-contingent bailout policy, by decreasing the probability of a crisis, may enhance the expected continuation value of the borrower and, through this channel, the payoff of engaging in safer investment practices. A similar argument can be applied in the case of country insurance. In order to better understand the impact of insurance on the value at risk of the insured country (or, more precisely, of its government) we extend our static model to a multi-period setup with a similar timing of events. To capture the fact that access to this continuation value is uncertain, we assume that the government, which is reelected with a certain probability every non-crisis period, is forced to step down whenever a crisis occurs.<sup>17</sup> The government's problem could then be written as:

$$\underset{e}{Max} V_k = \frac{U_k}{1 - \delta q_k}, \quad (7)$$

where  $\delta$  represents the combination of the government's discount rate and the probability of reelection, and  $k = NI, BI, CI$ , with  $q_{NI} = \gamma e$ ;  $q_{BI} = 1$ ; and  $q_{CI} = \frac{1}{2}(1 + (\gamma + \alpha)e)$ . The first order condition of problem (7) can then be written as :

$$\frac{\partial V_k}{\partial e} = \frac{1}{1 - \delta q_k} \left( \frac{\partial U_k}{\partial e} + \delta \frac{\partial q_k}{\partial e} V_k \right) = 0.$$

The first thing to note is that, under standard regularity conditions, the incentives to reform depends positively on the second term between brackets. This, in turn, increases with the continuation value,  $V_k$ , and with the incidence of the government's own effort on its probability of surviving to access this

<sup>16</sup>Ultimately, as suggested by Cordella and Levy Yeyati [2003], inasmuch as political pressures foster indiscriminate bailouts at the expense of conditionality, an explicit acknowledgment appears to be preferable to the customary constructive ambiguity approach.

<sup>17</sup>The assumption is for expositional simplicity. The argument carries through as long as the probability of reelection declines with a crisis.

continuation value. In this context, country insurance introduces two countervailing effects. On the one hand, it weakens the link between effort and the probability of survival, lessening reform incentives. On the other, by increasing the probability of survival, it raises the continuation value, stimulating reform. We refer to the latter as the “value effect.”

Under a blanket insurance this value effect disappears, since  $q_{BI} = 1$  for all levels of effort so that the probability of re-election is independent of the government’s actions. It is easy to verify, then, that the new threshold cost of a crisis,  $\widehat{C}_1$ , such that a blanket insurance policy increases effort relative to the no-insurance case, would be smaller in this extended setup. This is because the introduction of a continuation value increases effort under the no-insurance case, but has no impact under a blanket insurance, thus weakening the case for the latter.

More interesting is the case of contingent insurance. Here, the differential impact of the introduction of a continuation value can be gauged simply by signing  $\frac{\partial q_{CI}}{\partial e} V_{CI} - \frac{\partial q_{NI}}{\partial e} V_{NI}$  which, for any given value of  $e$ , can be shown (see Appendix) to be positive if

$$\delta > 1 - \frac{\alpha}{\gamma}. \quad (8)$$

Thus, if macroeconomic shocks are sufficiently disperse (in particular, if bad shocks are sufficiently extreme), the value effect increases reform incentives under a contingent insurance policy proportionally more than it does in the absence of insurance.<sup>18</sup>

Note that the effort enhancing channel discussed in section 2 is complemented by this dynamic value effect. In the static case, insurance increases the political payoffs of reform when the country faces an adverse macroeconomic shock. In the dynamic case, by reducing the impact of exogenous shocks on political survival, insurance increases the policymakers’ continuation value and their willingness to embrace reforms that further enhance their chances of remaining in power.

This dynamic value effect yields several interesting implications. First, as in the static version, and for the same reasons, high macroeconomic volatility reinforces the case for contingent country insurance. Second, from condition (8), the case for contingent insurance is stronger when  $\delta$  is large, that is, when governments are relatively more forward looking. Accordingly, political/institutional factors that tend to undercut the incumbent’s chances of remaining in office (such as the lack of party discipline or, more generally, an instable political environment) would weaken the incidence of the value effect.

Note, in passing, that, for any given value of crisis costs  $C$ , a contingent insurance contract would increase reform effort for (and, as a result, would be willingly purchased by) high- $\delta$  governments as opposed to low- $\delta$  ones. Thus, for

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<sup>18</sup>Cordella and Levy Yeyati [2003] find that a bank bailout policy contingent on macroeconomic shocks being below certain threshold reduces banks’ risk appetite. One can invert their proposition by saying that the existence of risk-reducing cotingent bailouts requires a positive probability of sufficiently bad shocks. Note the similarity of the result discussed here in a different context.

any given distribution of macroeconomic shocks, a contingent insurance contract could potentially be used as a screening device to separate committed from opportunistic governments.

## 4.2 Self-fulfilling crises

Our simple model could be easily extended to allow for the possibility that a crisis may be triggered by self-fulfilling liquidity runs that are largely independent of government actions and can be prevented by the presence of an explicit insurance policy. More precisely, assume that, in the states of the world in which no insurance is provided, the probability of a crisis is given by  $\tilde{\pi} = 1 - (s_j e + \theta)$ , where the tildes denote this new scenario in which self-fulfilling crises are possible. Accordingly, a larger  $\theta$  increases the likelihood of a crisis for given macroeconomic fundamentals and reform effort, weakening the effect of fundamentals and effort on the probability of avoiding a crisis.<sup>19</sup>

Note that the presence of self-fulfilling crises adds to the impact of exogenous factors in the probability of a crisis. As a result, it introduces an additional channel through which insurance enhances the marginal returns on reform effort. Then, if insurance was preferred in the absence of self-fulfilling crises, it will be more so in their presence; on the other hand, if no insurance was preferred, then the beneficial effect of insurance on the probability of a self-fulfilling crises could tilt the balance in favor of insurance.

More generally, the thresholds below which the insurance effect dominates are shifted up. Formally, it is easy to verify (see Appendix) that, in this new set-up, effort will be higher under a blanket insurance than under no insurance ( $\tilde{e}_{BI} > \tilde{e}_{NI}$ ) whenever  $C < \tilde{C}_2 < C_2$ . Similarly,  $e_{CI} > e_{NI}$  whenever  $C < \tilde{C}_3 < C_3$ .

Accordingly, the case for country insurance (both conditional and unconditional) is reinforced once we allow for self-fulfilling crises. This is not surprising, given that the net benefits of insurance are directly related to the exogeneity of the factors underlying the crises. In the limiting case in which crises are solely due to liquidity runs beyond the policymaker's control, a country insurance scheme would protect reforms payoffs with no moral hazard consequences.

## 5 Concluding Remarks

This paper presented a simple analytical framework to address the incentive effects associated with country insurance, and identified an important channel through which insurance can foster reforms: By reducing the probability that deteriorating fundamentals evolve into full-blown crises, country insurance schemes may enhance the expected political payoffs of reforms, increasing reform incentives.

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<sup>19</sup>We implicitly assume that  $\theta$  is small enough so that the probability of a crisis is always between zero and one.

We argued that this channel would tend to be particularly effective in crisis-prone volatile economies, and for enhancing reforms which payoffs are positively correlated with the macroeconomic environment. By contrast, buffering reforms that tend to offset the impact of adverse shocks may be discouraged by insurance-type international safety nets. It follows that the effects of the latter on government moral hazard depend crucially on the nature of the specific policies under consideration, as well as on countries' political and institutional features.

Having shown that, under certain conditions, an incentive-compatible country insurance scheme is feasible, it remains to discuss how this scheme fares in terms of other alternatives. In particular, while we assumed so far that crisis costs were exogenously given, it follows from the previous analysis that an alternative way to guarantee that reforms are undertaken consists in raising such cost. Indeed, this argument underscores the basic approach to the debt crisis problem adopted by those that tend to see moral hazard as an overriding concern.<sup>20</sup>

One has to bear in mind, however, that the relevant crisis costs are those imposed on the decision makers (in our case, the governments) that are often only partially correlated with the economic situation. For instance, a populist government may gain substantial political rents in time of economic distress) blaming external factors (past governments, the international environment, "evil lenders" and even the IFIs) for the dismal income effect of the crisis, thereby reducing its political costs.<sup>21</sup> At any rate, even abstracting from a possible Samaritan's dilemma, it might not always be feasible for the international community to increase the pain of a defaulting government to any desired level.

Moreover, substantive crisis cost, while leading to deeper reform, would imply a loss for the government (and for the economy as a whole) should the crisis nonetheless occur. It follows that, for any level of reform effort attainable through the provision of country insurance, the stick of higher crisis cost is welfare-dominated by the carrot of insurance. This, of course, does not deny the positive effect a stick may have on the willingness to reform and the related probability of a crisis. Indeed, it follows from our analysis that there are cases in which effort levels associated with sufficiently large crisis costs cannot be reached through country insurance. However, inasmuch as these costs are mostly wasted resources, larger sticks, if feasible, would lead to more disciplined, but poorer countries.<sup>22</sup>

Ultimately, the way in which this carrot and stick trade-off plays out in the real world would depend, as it is always the case, on a number of case-specific

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<sup>20</sup>In line with this view, moral hazard hardliners advocate strict limits to international rescue packages and warn against changes in financial contracts, such as collective action clauses or international bankruptcy procedures that may mitigate the (disciplinary) cost of default.

<sup>21</sup>This is particularly so whenever the punishment is perceived domestically as disproportionately large.

<sup>22</sup>Hence, Mussa's [1999] claim that "the problems of moral hazard that are inevitably associated with [international financial support] are modest in comparison with the real hazards that such efforts seek to ameliorate. (p. 235)"



factors. Furthermore, while the empirical assessment of the moral hazard effect has proved to be elusive, the still untested insurance effect is likely to be as difficult to elucidate. However, a few recent experiences might provide preliminary insights on how international financial safety nets might help creating positive incentive effects.

Among recent financial crises, perhaps the two episodes that more closely illustrate the incentive effects of rescue packages are Mexico 1994 and Brazil 2002. In the first case, the country was offered a prompt bailout package that helped prevent default.<sup>23</sup> In the second, a generous safety net was timely provided to help the country get through the turbulences of an election year. The aftermath of these episodes are illuminating. The Mexican bailout, heavily criticized at the time for its moral hazard consequences, led instead to a rapid sequence of reforms.<sup>24</sup> In addition, the government obtained primary surpluses in every year since then, which helped to almost halve the debt to GDP ratio,<sup>25</sup> while substituting local currency domestic debt for foreign currency external obligations (a recognized source of external vulnerability). Overall, rather than the surge of opportunistic populism that the moral hazard view envisaged, Mexico exhibited sensible policies that ultimately led it to achieve an investment grade rating. In Brazil, in turn, the IMF-led package was followed by a fiscal tightening and a partial de-dollarization of government liabilities to enhance debt sustainability, and by advances on the social security and tax reform fronts, implemented by the same left-wing policymakers that had triggered market jitters in the run up to the election.

Among the many policy implications that can be derived from this analysis, perhaps the main one relates to the way in which it qualifies the traditional moral hazard concern associated with the role played by IFIs in the management and resolution of crises in developing countries. As the previous discussion suggests, *explicit* insurance-type standing facilities may strengthen the incentives to proceed with productivity enhancing reforms.

Partial contingent facilities in the spirit of those discussed here could be readily implemented building upon the (unsuccessful) experience of IMF contingent credit lines, making them automatically available to all member countries subject to the compliance with ex-ante conditions.<sup>26</sup> While reform effort, institutional quality, or the relative importance of adverse exogenous shocks are not readily verifiable and thus cannot be used to condition the access to this

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<sup>23</sup>Moreover, according to many observers, the open involvement of the US Treasury confirmed the preception that the growing economic and geopolitical links with the US blessed Mexico with an implicit safety net.

<sup>24</sup>These include a financial reform that raised prudential standards and opened the banking system to foreign ownership, a social security reform that launched a system of pension funds that helped developing the domestic capital market, a still ongoing tax reform, and a selective privatization process.

<sup>25</sup>The ratio fell steadily from 40.8% by end-1995 to 24.7% by end-2003.

<sup>26</sup>Incidentally, such a standing facility would be free from the signaling problem that led to the failure of existing CCLs, namely, the fact that the formal request of a CCL may be perceived by the market as an early signal of financial deterioration, conspiring against its preventive nature.

facility, alternative Maastricht-type criteria such as the debt-to-GDP ratio or the public deficit could be used as reasonable proxies to tilt incentives (as they did for EMU accession countries) towards long-run sustainable policies. In this way, IFIs would be simply following the lender of last resort model, providing interest rate insurance, subject to a set of pre-determined conditions, much in the same way as central banks do for domestic financial institutions.

## 6 Technical Appendix

Differentiating the maximand in (1) with respect to  $e$  we have that

$$\frac{\partial U_{NI}}{\partial e} = -2e(1 - (\mu - \lambda)\gamma) + (\gamma C + \lambda) = 0, \quad (9)$$

from which it follows that (second order conditions are always verified)

$$e_{NI}^* = \frac{\gamma C + \lambda}{2(1 - (\mu - \lambda)\gamma)}.$$

Differentiating  $e_{NI}^*$  with respect to  $C$ ,  $\gamma$ ,  $\lambda$ , we have that:

$$\frac{\partial e_{NI}^*}{\partial C} = \frac{\gamma}{2(1 - (\mu - \lambda)\gamma)} > 0; \quad (10)$$

$$\frac{\partial e_{NI}^*}{\partial \gamma} = \frac{C + (\mu - \lambda)\lambda}{2(1 - (\mu - \lambda)\gamma)^2} > 0; \quad (11)$$

$$\frac{\partial e_{NI}^*}{\partial \lambda} = \frac{2\gamma(\lambda + C\gamma)}{2(1 - (\mu - \lambda)\gamma)^2} > 0; \quad (12)$$

$$\frac{\partial e_{NI}^*}{\partial \lambda} = \frac{1 - \gamma\mu - C\gamma^2}{2(1 - (\mu - \lambda)\gamma)^2} > 0 \Leftrightarrow C < \frac{1 - \gamma\mu}{\gamma^2}. \quad (13)$$

Differentiating the maximand in (3) with respect to  $e$  we have that

$$\frac{\partial U_{BI}}{\partial e} = -2e(1 - (\mu - \beta)\gamma) + \beta = 0, \quad (14)$$

from which it follows that (SOCs are always verified)

$$e_{BI}^* = \frac{\beta}{2(1 - (\mu - \beta)\gamma)}.$$

Differentiating  $e_{BI}^*$  with respect to  $\gamma$ ,  $\beta$ , we have that:

$$\frac{\partial e_{BI}^*}{\partial \gamma} = \frac{\beta(\mu - \beta)}{2(1 - (\mu - \beta)\gamma)^2} > 0; \quad (15)$$

$$\frac{\partial e_{BI}^*}{\partial \mu} = \frac{\beta\gamma}{2(1 - (\mu - \beta)\gamma)^2} > 0; \quad (16)$$

$$\frac{\partial e_{BI}^*}{\partial \beta} = \frac{1 - \mu\gamma}{2(1 - (\mu - \beta)\gamma)^2} > 0. \quad (17)$$

Differentiating the maximand in (5) with respect to  $e$ , we have that

$$\frac{\partial U_{CI}}{\partial e} = \frac{1}{2}(-2e(2(1 - \mu\gamma) + \beta(\gamma - \alpha) + \lambda(\gamma + \alpha)) + (\beta + \lambda + C(\gamma + \alpha))) = 0, \quad (18)$$

from which it follows (SOCs are always verified) that

$$e_{CI}^* = \frac{\beta + \lambda + C(\alpha + \gamma)}{2(2(1 - \mu\gamma) + \beta(\gamma - \alpha) + \lambda(\gamma + \alpha))}.$$

Differentiating  $e_{CI}^*$  with respect to  $C$ ,  $\gamma$ ,  $\beta$ ,  $\lambda$ , we have that:

$$\frac{\partial e_{CI}^*}{\partial C} = \frac{\alpha + \gamma}{2(2(1 - \gamma) + \beta(\gamma - \alpha) + \lambda(\gamma + \alpha))} > 0; \quad (19)$$

$$\frac{\partial e_{CI}^*}{\partial \gamma} = \frac{2C(1 + \alpha(1 - \beta)) + (2 - \beta - \lambda)(\beta + \lambda)}{2(2(1 - \gamma) + \beta(\gamma - \alpha) + \lambda(\gamma + \alpha))^2} > 0; \quad (20)$$

$$\frac{\partial e_{CI}^*}{\partial \mu} = \frac{\gamma(\beta + \lambda + C(\gamma + \alpha))}{2(2(1 - \mu\gamma) + \beta(\gamma - \alpha) + \lambda(\gamma + \alpha))^2} > 0; \quad (21)$$

$$\frac{\partial e_{CI}^*}{\partial \beta} = \frac{2(1 - \gamma\mu + \alpha\lambda) - C(\gamma^2 - \alpha^2)}{2(2(1 - \mu\gamma) + \beta(\gamma - \alpha) + \lambda(\gamma + \alpha))^2} > 0 \Leftrightarrow C < \frac{(1 - \gamma\mu + \alpha\lambda)}{\gamma^2 - \alpha^2}; \quad (22)$$

$$\frac{\partial e_{CI}^*}{\partial \lambda} = \frac{2(1 - \gamma\mu - \alpha\beta) - C(\alpha + \gamma)^2}{2(2(1 - \gamma) + \gamma(\gamma + \alpha) + \beta(\gamma - \alpha))^2} > 0 \Leftrightarrow C < \frac{(1 - \mu\gamma - \alpha\beta)}{(\alpha + \gamma)^2}. \quad (23)$$

### Proof of Result 1

By a simple comparison of (2), (4), and (6), it is straightforward to verify that

$$\begin{aligned} e_{CI} > e_{BI} &\Leftrightarrow C > C_1 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma - \alpha\beta)}{(\gamma + \alpha)(1 - (\mu - \beta)\gamma)}; \\ e_{NI} > e_{BI} &\Leftrightarrow C > C_2 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma)}{\gamma(1 - (\mu - \beta)\gamma)}; \\ e_{NI} > e_{CI} &\Leftrightarrow C > C_3 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma + \alpha\lambda)}{(\gamma - \alpha)(1 - (\mu - \beta)\gamma)}. \end{aligned}$$

The fact that  $C_3 > C_2 > C_1 > 0$ , completes the proof. ■

### Proof of Result 2

Using Result 1,

(i) It follows from:  $\frac{\partial C_3}{\partial \gamma} = -\frac{(\beta - \lambda)(1 + \alpha\lambda - \mu\gamma)(1 - \alpha\beta + 2\beta\gamma - \mu\gamma)}{(\alpha - \gamma)^2(1 + \beta\gamma - \mu\gamma)^2} < 0$ ;

(ii) It follows from:  $\frac{\partial C_1}{\partial \alpha} = -\frac{\beta - \lambda}{(\alpha + \gamma)^2} < 0$ , and  $\frac{\partial C_3}{\partial \alpha} = -\frac{(\beta - \lambda)(1 + \gamma\lambda - \mu\gamma)}{(\alpha - \gamma)^2(1 + \beta\gamma - \mu\gamma)} > 0$ .

■

### Proof of Result 3

Setting  $\mu = \lambda + \varepsilon$ , we have that  $\frac{\partial C_3}{\partial \varepsilon} = -\frac{\gamma(\beta - \lambda)(\beta\gamma - \alpha\lambda)}{(\gamma - \alpha)(1 - \gamma(\lambda\varepsilon - \beta))^2} < 0$ . ■,

#### Proof of Result 4

It is enough to show that  $U_{BI}(e_{BI}) > U_{NI}(e_{NI})$  for  $e_{BI} > e_{NI}$ , and  $U_{CI}(e) > U_{NI}(e)$  for  $e_{CI} > e_{NI}$ . This follows from the fact that  $U_{BI}(e_{NI}) < U_{NI}(e_{NI})$  and  $\left. \frac{\partial U_{BI}(e)}{\partial e} \right|_{e < e_{BI}} > 0$  imply that  $U_{BI}(e_{BI}) < U_{NI}(e_{NI})$  for  $e_{BI} > e_{NI}$ .  $U_{CI}(e_{CI}) < U_{NI}(e_{NI})$  for  $e_{CI} > e_{NI}$  follows from a similar argument. ■

#### Value effect

We want to show that, for any  $e$ ,

$$\frac{\partial q_{CI}(e)}{\partial e} V_{CI}(e) > \frac{\partial q_{NI}(e)}{\partial e} V_{NI}(e),$$

with

$$\begin{aligned} \frac{\partial q_{CI}}{\partial e} V_{CI} &= \frac{(\gamma + \alpha) \gamma \mu e^2 + \frac{1}{2}(1 - (\gamma - \alpha)e)\beta e + \frac{1}{2}(1 - (\gamma + \alpha)e)(\lambda e - C) - e^2}{2 \left(1 - \frac{\delta}{2} \mathbf{1}(\gamma + \alpha)e\right)}; \\ \frac{\partial q_{NI}}{\partial e} V_{NI} &= \gamma \frac{\gamma \mu e^2 + (1 - \gamma e)(\lambda e - C) - e^2}{1 - \delta \gamma e}. \end{aligned}$$

We then have that  $\frac{\partial q_{CI}}{\partial e} V_{CI} > \frac{\partial q_{NI}}{\partial e} V_{NI}$ , if, and only if,

$$\begin{aligned} & \frac{1}{2}(\gamma + \alpha)(1 - \delta \gamma e) \left[ -\frac{1}{2}(1 - \gamma e)(\lambda e - C) + \frac{1}{2}\alpha e(\lambda e - C) + \frac{1}{2}[1 - (\gamma - \alpha)e]\beta e \right] \\ & > \frac{1}{2}(\gamma - \alpha - \delta \gamma) [\gamma \mu e^2 + (1 - \gamma e)(\lambda e - C) - e^2]. \end{aligned}$$

Furthermore,  $[1 - (\gamma - \alpha)e] > [1 - (\gamma + \alpha)e]$  and  $\beta > \lambda$  imply that:

$$\left[ \frac{1}{2}[1 - (\gamma - \alpha)e]\beta e - \frac{1}{2}[1 - (\gamma + \alpha)e](\lambda e - C) \right] > 0$$

so that a sufficient condition for the inequality to hold is that  $(\gamma - \alpha - \delta \gamma) < 0$  or

$$\delta > 1 - \frac{\alpha}{\gamma}.$$

#### Self-fulfilling crises

Government's problems under the three scenarios can be written as:

$$Max_e \tilde{U}_{NI} = (\gamma e - \theta)\mu e + (1 - \gamma e - \theta)(\lambda e - C) - e^2;$$

$$Max_e \tilde{U}_{BI} = \gamma \mu e^2 + (1 - \gamma e)\beta e - e^2;$$

$$Max_e \tilde{U}_{CI} = (\gamma e + \frac{\theta}{2})\mu e + \frac{1}{2}(1 - (\gamma - \alpha)e)\beta e + \frac{1}{2}(1 - (\gamma + \alpha)e + \theta)(\lambda e - C) - e^2;$$

From which, we have that

$$\begin{aligned}\tilde{e}_{NI}^* &= \frac{\gamma C + \lambda - \theta(\mu - \lambda)}{2(1 - (\mu - \lambda)\gamma)}; \\ \tilde{e}_{BI}^* &= \frac{\beta}{2(1 - (\mu - \beta)\gamma)}; \\ \tilde{e}_{CI}^* &= \frac{\beta + \lambda + C(\alpha + \gamma) - \theta(\mu - \lambda)}{2(2(1 - \mu\gamma) + \beta(\gamma - \alpha) + \lambda(\gamma + \alpha))}.\end{aligned}$$

We then have that

$$\begin{aligned}\tilde{e}_{CI} > \tilde{e}_{BI} &\Leftrightarrow C > \tilde{C}_1 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma - \alpha\beta)}{(\gamma + \alpha)(1 - (\mu - \beta)\gamma)} + \frac{\theta(\mu - \lambda)}{(\gamma + \alpha)}; \\ \tilde{e}_{NI} > \tilde{e}_{BI} &\Leftrightarrow C > \tilde{C}_2 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma)}{\gamma(1 - (\mu - \beta)\gamma)} + \frac{\theta(\mu - \lambda)}{\gamma}; \\ \tilde{e}_{NI} > \tilde{e}_{CI} &\Leftrightarrow C > \tilde{C}_3 \equiv \frac{(\beta - \lambda)(1 - \mu\gamma + \alpha\lambda)}{(\gamma - \alpha)(1 - (\mu - \beta)\gamma)} + \\ &\quad + \frac{\theta(\mu - \lambda)(1 + (\gamma - \alpha)\beta + \alpha\lambda - \gamma\mu)}{(\gamma - \alpha)(1 - \gamma(\mu - \beta))},\end{aligned}$$

from which it follows immediately that  $\tilde{C}_1 > C_1$ ,  $\tilde{C}_2 > C_2$  and  $\tilde{C}_3 > C_3$ .

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