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# Country Insurance

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*In this paper, we examine how country insurance schemes affect 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 more generously in the absence of a crisis are likely to be promoted.* [JEL F30, G22, H50]

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 IFIs and the moral hazard consequences, however, requires

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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 the 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 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 find only 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 1998 Russian default. This event is analyzed by Dell'Ariccia, Schnabel and Zettelmeyer (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 expense 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.

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

An additional aspect—increasingly emphasized in the recent literature on emerging market crises—that must be examined is the incidence of external shocks largely beyond the government's control. Some observers have stressed the exoge-

nous nature of sharp capital flow reversals (sudden stops) attributable, for example, to financial contagion, changes in global liquidity, or interest rate movements.[1] 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.[2] Indeed, in financially vulnerable emerging market economies, liquidity runs can be prompted by self-fulfilling pessimistic expectations, with little if any relation to a fundamental change in the economy.[3]

The presence of exogenous factors should certainly qualify the role played by moral hazard in triggering financial crises. More important, 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, *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 efforts are properly rewarded, reform incentives might be strengthened.*

This is 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 efforts, 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 toward 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 its 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

[1]The initial reference to sudden stops is Dornbusch, Goldfajn, and Valdes (1995). The concept has been recently developed by Calvo, Izquierdo, and Talvi (2003).

[2]This line was highlighted by De la Torre, Levy Yeyati, and Schmukler (2003) and Perry and Servén (2002) to account for the recent Argentine crisis.

[3]The self-fulfilling crisis view has been revived by Sachs, Tornell, and Velasco (1996) to explain the Mexican crisis. 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).

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 attenuate the costs of a crisis, at the expense of returns in good states, are partial substitutes for the country insurance policies discussed above. By contrast, country insurance could be particularly conducive to enhancing reforms that pay off relatively more in good 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 to reform efforts, 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, Guimarães, and Roubini (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 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 sometimes enhance the incentives for governments to take preventive actions, since the IMF's decisions are strategic complements to the adjustment effort of the country and the rollover 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.

## I. 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 policymaker inherits a fixed amount of debt and decides on the amount of reform effort he 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 policymaker's ability to reap immediate political returns (which may include political patronage or fund diversion). After the effort decision 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 reform efforts previously chosen.[4]

We assume that, unlike the returns from short-run policies, returns from reforms take time to materialize and depend on the evolution of the macroeconomic environment.[5] 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 has specific real effects (which translate into a political cost to the government) above and beyond those related to macroeconomic fundamentals, and that the implementation of reforms reduces the likelihood of a crisis episode.

Three cases are considered: a benchmark under which no insurance is provided (denoted by *NI*), and two alternative insurance contracts that stipulate the conditions under which an insurer provides the funds needed to repay lenders in the event of insolvency: blanket insurance (*BI*) that insures the borrower against insolvency in all states, and contingent insurance (*CI*) that provides the funds only in bad states of nature.[6] Note that an insurance contract could, in principle, be written as a function of a 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 efforts are not verifiable and thus cannot be used to condition the provision of insurance.

Depending on the case under consideration, the country may face three possible scenarios: solvency (which we henceforth denote as tranquil times); insolvency, in which default is avoided through the activation of the insurance policy (turbulent times); and insolvency followed by default (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 the adverse macroeconomic conditions that led to insolvency in the first place.

More formally, we assume that insolvency occurs with probability $\pi_j = 1 - s_j e$, where $e$ denotes the government's reform efforts, associated with a quadratic opportunity cost $c(e) = e^2$ that represents the foregone 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 setup, for a given level of effort, the probability of insolvency is higher in bad states; for a given state, insolvency is more likely when reform efforts have 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 ex ante probability of insolvency is given by $\pi = 1 - \gamma e$. From now on,

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

[5]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's objective function). The way in which the political returns of reforms differ according to a country's macroeconomic and financial context will depend on the nature of the reform. We revisit this issue in Section III.

[6]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 10.

we refer to $\gamma$ as the expected state of nature (alternatively, expected macroeconomic fundamentals) and to $\alpha$ as exogenous volatility, and we assume that $\gamma \geq \alpha$.

As noted before, we assume that reform efforts 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. To rule out trivial cases in which country insurance is either always or never optimal, we work under the assumption that

$$1 \geq \mu \geq \beta \geq \lambda. \tag{1}$$

In addition, we assume that the occurrence of a crisis entails an additional fixed cost to the government equal to *C,* such that

$$C \leq Min\left\{\frac{\lambda}{\gamma}; \frac{\beta+\lambda}{\gamma+\alpha}\right\}. \tag{2}$$

Assumptions (1) and (2) ensure that, in equilibrium, the ex-post probability of insolvency is nonnegative and less than one (that is, $\pi_j \in [0, 1)$). Finally, the assumption that, in the event of insolvency, reform payoffs are higher if the country is insured captures the effort-increasing incentive (the carrot) of the insurance policy. The rewards for reforms decline both with deteriorating fundamentals and with the unraveling of a debt crisis. Insurance cannot eliminate the former, but it helps avoid the latter.[7] This effect is counterbalanced by the standard moral hazard effect introduced by the insurance policy which, in our framework, is associated with the elimination of the fixed cost of a crisis, *C,* in those states in which the insurance is activated.[8] Figure 1 summarizes the dynamic structure of the model.

The problem of the government in the absence of insurance is given by

$$\underset{e}{Max}\, U_{NI} = \gamma\mu e^2 + (1-\gamma e)(\lambda e - C) - e^2, \tag{3}$$

which gives the optimal level of effort[9]

$$e^*_{NI} = \frac{\lambda + \gamma C}{2(1-\gamma(\mu-\lambda))}. \tag{4}$$

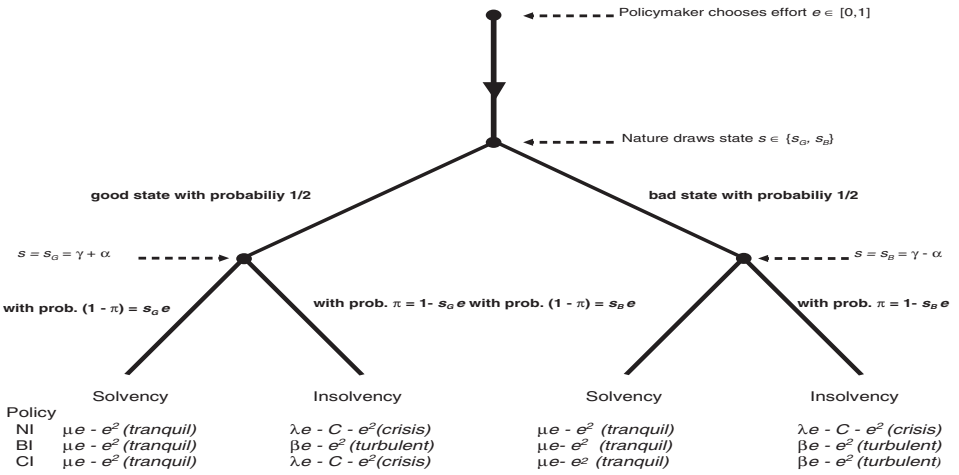
As expected, the optimal level of effort is a positive function of the cost of a crisis ($\frac{\partial e^*_{NI}}{\partial C} > 0$) and the expected quality of macroeconomic fundamentals ($\frac{\partial e^*_{NI}}{\partial \gamma} > 0$).

[7]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.

[8]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.

[9]A formal derivation of the results reported in the text is presented in the appendix.

Figure 1. Dynamic Structure of the Model




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 insolvency. 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

$$\underset{e}{Max}\, U_{BI} = \gamma\mu e^2 + (1-\gamma e)\beta e - e^2, \tag{5}$$

from which we have

$$e_{BI}^{*} = \frac{\beta}{2(1-\gamma(\mu-\beta))}. \tag{6}$$

Again, reform efforts increase 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*) under which insurance is provided exclusively in bad times ($s = s_B$). The government's problem can now be rewritten as

$$\underset{e}{Max}\, U_{CI} = \gamma\mu e^2 + \frac{1}{2}(1-(\gamma-\alpha)e)\beta e + \frac{1}{2}(1-(\gamma+\alpha)e)(\lambda e - C) - e^2, \tag{7}$$

from which we obtain

$$e^*_{CI} = \frac{\beta + \lambda + C(\alpha + \gamma)}{2(2(1-\mu\gamma) + \beta(\gamma - \alpha) + \lambda(\gamma + \alpha))}. \tag{8}$$

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 effect of the crisis is limited does the insurance effect dominate the moral hazard effect under a contingent insurance policy.

We are now in a position to compare reform efforts under the three different cases outlined above and see under which conditions country insurance schemes foster or hinder reform efforts.

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

To understand 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 efforts will be lower under an unconditional insurance policy. Conversely, a small stick would imply a minor moral hazard problem as a result of blanket insurance, tilting the carrot-stick balance in favor of the former.

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

tive compatible is well known in principal-agent models.[10] 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 blanket insurance as moral hazard becomes important ($C > C_1$), and leading to more reform than under the no-insurance case as long as moral hazard does not become an overwhelming concern ($C < C_3$).

A clearer understanding 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 benefit of a reform effort between the contingent-insurance and the no-insurance scenarios $\left(\frac{\partial U_{CI}}{\partial e} - \frac{\partial U_{NI}}{\partial e}\right)$ is given simply 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, in this extreme situation, reform has no effect on the probability of insolvency under adverse macroeconomic conditions.

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 efforts, we have

**Result 2:** *The higher the probability of a crisis for a given level of reform (the lower $\gamma$), the stronger the case for 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 the already high expected reform payoffs. By contrast, when these payoffs are downgraded by a highly unpredictable macroeconomic context, country insurance strengthens reform incentives, while moral hazard plays a lesser role. It is then not surprising that large exogenous volatility reinforces the case for conditional insurance. Under such a policy, the insurance is in place only when moral hazard effects are necessarily subdued, preserving the disciplining effect of crisis costs when moral hazard is more likely to be a concern.

[10] The classical reference is Holmstrom (1979). In our setup, the probability that insolvency is caused by the policymaker's lack of reform effort is proportional to the realization of the state $s_j$. This implies that reform effort satisfies Milgrom's (1981) monotone likelihood ratio property and ensures that the optimal insurance policy is, loosely speaking, monotonic in $s_j$.

## II. Insurance and Reforms

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

### Enhancing Versus Buffering Reforms

Following the existing literature, we use the term "reforms" to denote a diverse set of government policies that, by enhancing long-run productivity and fostering growth, increase a country's resilience in periods of financial distress. 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 their difference across states).[11] 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 maximizes its political dividend under a favorable macroeconomic context. Similarly, privatization of state-owned utilities may 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. Likewise, 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 helpful under adverse macroeconomic conditions but may be politically costly in periods of bonanza.

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 on whether they spread or compress the distribution of returns across states in the absence of insurance. In our model, this distinction can be simply captured by the difference in the parameters that determine reform payoffs under solvency and insolvency, $(\mu - \lambda)$: the greater the buffering nature of the reform, the smaller this difference.[12] To illustrate this point,

[11]Notice that we implicitly assume that the reform effort precedes the realization of the shock, so that the associated reform costs are incurred ex ante and are, therefore, state-independent. The situation in which these costs differ across states can be encompassed in our model simply by assuming that reform payoffs in each different state are net of the state-contingent component of reform costs.

[12]In addition, some buffering reforms (for example, 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 buffering 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 $\left(\text{since } \frac{\partial C_3}{\partial \lambda} < 0\right)$.

we can assume that $\lambda = \beta - (1 - k)\varepsilon$, $\mu = \beta + k\varepsilon$, and $0 < k < 1$, where a larger value of $\varepsilon$ would be associated with a larger enhancing effect. It is now easy to show

**Result 3:** *The scope for reform-inducing country insurance policies increases with the enhancing nature of reforms.*
**Proof:** See Appendix.

The explanation for this result is the following. Owing to their self-insuring nature, buffering reforms, by reducing the difference in returns across states, 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, enhancing reforms associated with a larger difference in payoffs across states are complemented by an insurance policy that preserves the value of effort in turbulent times. As a result, the presence of insurance would tend to stimulate the latter at the expense of the former.

## Is Country Insurance Feasible?

While desirable under certain conditions, effort-inducing insurance policies such as those described above are costly, raising 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.

To show that this would indeed be the case, we 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 insurance is available in the market at a fair price. Also assume that, at the moment it is deciding whether to buy the insurance, the country has to borrow from the international capital market (or 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 cost to the country (if anything, it results in an economic gain), policymakers would be willing to purchase a fairly priced (effort-inducing) insurance policy if it increased their own utility relative to the no-insurance case. More precisely, we can prove that:

**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 would be able to prevent the insurer, as sovereign risk mounted, from hedging its growing exposure by shortening the country's debt, feeding back into the

crisis dynamics.[13] 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.[14] While 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.[15] In this regard, our analysis adds to this view from a different dimension. By showing that a more active (and explicit) role for 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 case, an explicit insurance facility may dominate implicit ones by reducing the IFI's discretionary margin.[16]

## III. 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.

### Value Effect

In a multiperiod banking model, Cordella and Levy Yeyati (2003) show that by decreasing the probability of a crisis a state-contingent bailout policy may enhance

[13]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.

[14]Fisher (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.

[15]Note that, unless they are fully guaranteed by their nonborrowing shareholders, even IFIs may not be able to absorb unlimited risk without compromising their solvency. In practice, however, owing 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).

[16]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.

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. 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 multiperiod 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 noncrisis period, is forced to step down whenever a crisis occurs.[17] The government's problem could then be written as

$$\underset{e}{Max}\, V_k = \frac{U_k}{1-\delta q_k}, \tag{9}$$

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 equation (9) 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 depend 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 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 policy this value effect disappears, since $q_{BI} = 1$ for all levels of effort so that the probability of reelection is independent of the government's actions. It is easy to verify, then, that the new threshold cost of a crisis, $\hat{C}_1$, 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 it has no impact under a blanket insurance policy, 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

$$\delta > 1 - \frac{\alpha}{\gamma}. \tag{10}$$

[17]The assumption is for expositional simplicity. The argument is valid as long as the probability of reelection declines with a crisis.

Thus, if macroeconomic shocks are sufficiently dispersed (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.[18]

Note that the effort-enhancing channel discussed in Section II 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 policymakers' continuation value and their willingness to embrace reforms that further enhance their chances of remaining in power.

This dynamic value effect has 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 equation (10), the case for contingent insurance is stronger when $\delta$ is large, that is, when governments are relatively more forward looking. Accordingly, political and institutional factors that tend to undercut the incumbent's chances of remaining in office (such as lack of party discipline or, more generally, an unstable political environment) would weaken the incidence of the value effect.

Note that for any given value of crisis costs *C,* a contingent insurance contract would increase reform efforts by (and, as a result, would be willingly purchased by) high-$\delta$ governments as opposed to low-$\delta$ ones. Thus, for any given distribution of macroeconomic shocks, a contingent insurance contract could potentially be used as a screening device to separate committed from opportunistic governments.

## 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 tilde denotes this new scenario in which self-fulfilling crises are possible. Accordingly, a smaller $\theta$ increases the likelihood of a crisis for given macroeconomic fundamentals and reform efforts, weakening the effect of fundamentals and effort on the probability of avoiding a crisis.[19]

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 efforts. Then, if insurance was preferred in the absence of self-fulfilling crises, it will be even more

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

[19]We implicitly assume that $\theta$ is small enough so that the probability of a crisis is always between zero and one.

so in their presence; on the other hand, if no insurance was preferred, then the beneficial effect of insurance on the probability of 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 setup, effort will be higher under 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 due solely to liquidity runs beyond the policymaker's control, a country insurance scheme would protect reforms payoffs with no moral hazard consequences.

## IV. Conclusion

This paper presented a simple analytical framework to address the incentive effects associated with country insurance, and it 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.

We argued that this channel would tend to be particularly effective in crisis-prone volatile economies, and for enhancing reforms that pay off relatively more handsomely in good times. 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 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 costs. Indeed, this argument underscores the basic approach to the debt-crisis problem adopted by those who tend to see moral hazard as an overriding concern.[20]

One has to bear in mind, however, that the relevant crisis costs are those imposed on the decision makers (in our case, the governments) who 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 effect of the crisis, thereby reducing its political costs.[21]

[20]In line with this view, moral hazard hard-liners advocate strict limits on 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.

[21]This is particularly so when the punishment is perceived domestically as disproportionately large.

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 costs, while leading to deeper reform, would mean 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 costs 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, because these costs are mostly wasted resources, larger sticks, if feasible, would lead to more disciplined, but poorer, countries.[22]

Ultimately, the way in which this carrot and stick trade-off plays out in the real world depends, as is always the case, on a number of case-specific 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 into how international financial safety nets might help create positive incentive effects.

Among the latest financial crises, perhaps the two episodes that most 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. In the second, a generous safety net was provided in a timely way to help the country get through the turbulence of an election year. The aftermath of these episodes is illuminating. The Mexican bailout, heavily criticized at the time for its moral hazard consequences, led instead to a rapid sequence of reforms.[23] In addition, the government has experienced primary fiscal surpluses every year since then, which helped to almost halve the debt-to-GDP ratio,[24] while substituting local-currency domestic debt for foreign-currency external obligations (a recognized source of external vulnerability)—policies that certainly contributed to the country's achievement of an investment-grade rating. In Brazil, IMF assistance was followed by fiscal tightening and a partial de-dollarization of government liabilities to enhance debt sustainability as well as advances on the social security and tax reform fronts, implemented by the same policymakers who had triggered market jitters in the run-up to the election. Overall, rather than the surge of opportunistic populism that the moral hazard view envisaged, the two countries exhibited sensible policies in line with the insurance effect examined in this paper.

[22]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.

[23]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 develop the domestic capital market, an ongoing tax reform, and a selective privatization process.

[24]The ratio fell steadily from 40.8 percent at end-1995 to 24.7 percent at end-2003.

## APPENDIX

Differentiating the maximand in (3) with respect to *e,* we obtain

$$\frac{\partial U_{NI}}{\partial e} = -2e\left(1-(\mu-\lambda)\gamma\right)+\left(\gamma C+\lambda\right)=0, \tag{A-1}$$

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

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

Note that the ex post probability of a crisis in each state is such that $0 \le \pi_G < \pi_B < 1$, since assumption (1) implies that $e^{*}_{NI} > 0$ (which, in turn, ensures that $\pi_B < 1$) and $C \le \frac{\lambda}{\gamma}$, from assumption (2), implies that $0 \le \pi_G$.

Differentiating $e^{*}_{NI}$ with respect to *C,* γ, λ,

$$\frac{\partial e^{*}_{NI}}{\partial C} = \frac{\gamma}{2\left(1-(\mu-\lambda)\gamma\right)} > 0; \tag{A-2}$$

$$\frac{\partial e^{*}_{NI}}{\partial \gamma} = \frac{C+(\mu-\lambda)\lambda}{2\left(1-(\mu-\lambda)\gamma\right)^{2}} > 0; \tag{A-3}$$

$$\frac{\partial e^{*}_{NI}}{\partial \mu} = \frac{\left(\gamma C+\lambda\right)\gamma}{2\left(1-(\mu-\lambda)\gamma\right)^{2}} > 0; \tag{A-4}$$

$$\frac{\partial e^{*}_{NI}}{\partial \lambda} = \frac{1-\gamma\mu-C\gamma^{2}}{2\left(1-(\mu-\lambda)\gamma\right)^{2}} > 0 \Leftrightarrow C < \frac{1-\gamma\mu}{\gamma^{2}}. \tag{A-5}$$

Differentiating the maximand in (5) with respect to *e,*

$$\frac{\partial U_{BI}}{\partial e} = -2e\left(1-(\mu-\beta)\gamma\right)+\beta=0, \tag{A-6}$$

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

$$e^{*}_{BI} = \frac{\beta}{2\left(1-(u-\beta)\gamma\right)}.$$

As before, $0 \le \pi_G < \pi_B < 1$, since assumption (1) ensures that $e^{*}_{BI} > 0$ and the ex-post probability of a crisis are in this case always nonnegative.

Finally, differentiating $e^*_{BI}$ with respect to $\gamma$, $\mu$, and $\beta$,

$$\frac{\partial e^*_{BI}}{\partial \gamma} = \frac{\beta(\mu-\beta)}{2(1-(1-\beta)\gamma)^2} > 0; \tag{A-7}$$

$$\frac{\partial e^*_{BI}}{\partial \mu} = \frac{\beta\gamma}{2(1-(\mu-\beta)\gamma)^2} > 0; \tag{A-8}$$

$$\frac{\partial e^*_{BI}}{\partial \beta} = \frac{1-\mu\gamma}{2(1-(\mu-\beta)\gamma)^2} > 0. \tag{A-9}$$

Again, $0 \leq \pi_G < \pi_B < 1$, from assumption (1) (which ensures that $e^*_{NI} > 0$) and $C \leq \frac{\beta+\lambda}{\gamma+\alpha}$, from assumption (2) (which implies that $0 \leq \pi_G$).

Differentiating the maximand in (7) with respect to $e$, we obtain

$$\frac{\partial U_{CI}}{\partial e} = \frac{1}{2}\left(-2e\left(2(1-\mu\gamma)+\beta(\gamma-\alpha)+\lambda(\gamma+\alpha)\right)\right)+\left(\beta+\lambda+C(\gamma+\alpha)\right)=0, \tag{A-10}$$

from which it follows (second-order conditions 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 $C$, $\gamma$, $\beta$, $\lambda$,

$$\frac{\partial e^*_{CI}}{\partial C} = \frac{\alpha+\gamma}{2(2(1-\gamma)+\beta(\gamma-\alpha)+\lambda(\gamma+\alpha))} > 0; \tag{A-11}$$

$$\frac{\partial e^*_{CI}}{\partial \gamma} = \frac{2C(1+\alpha(1-\beta))+(2-\beta-\lambda)(\beta+\lambda)}{2(2(1-\gamma)+\beta(\gamma-\alpha)+\lambda(\gamma+\alpha))^2} > 0; \tag{A-12}$$

$$\frac{\partial e^*_{CI}}{\partial \mu} = \frac{\gamma(\beta+\lambda+C(\gamma+\alpha))}{2(2(1-\mu\gamma)+\beta(\gamma-\alpha)+\lambda(\gamma+\alpha))^2} > 0; \tag{A-13}$$

$$\frac{\partial e^*_{CI}}{\partial \beta} = \frac{2(1-\gamma\mu+\alpha\lambda)-C(\gamma^2-\alpha^2)}{2(2(1-\mu\gamma)+\beta(\gamma-\alpha)+\lambda(\gamma+\alpha))^2} > 0 \Leftrightarrow C < \frac{(1-\gamma\mu+\alpha\lambda)}{\gamma^2-\alpha^2}; \tag{A-14}$$

$$\frac{\partial e^*_{CI}}{\partial \lambda} = \frac{2(1-\gamma\mu+\alpha\beta)-C(\alpha+\gamma)^2}{2(2(1-\gamma)+\gamma(\gamma+\alpha)+\beta(\gamma-\alpha))^2} > 0 \Leftrightarrow C < \frac{(1-\mu\gamma-\alpha\beta)}{(\alpha+\gamma)^2}. \tag{A-15}$$

### Proof of Result 1

By a simple comparison of (4), (6), and (8), it is straightforward to verify that

$$e_{CI} > e_{BI} \Leftrightarrow C > C_1 \equiv \frac{(\beta-\lambda)(1-\mu\gamma-\alpha\beta)}{(\gamma+\alpha)(1-(\mu-\beta)\gamma)};$$

$$e_{NI} > e_{BI} \Leftrightarrow C > C_2 \equiv \frac{(\beta-\lambda)(1-\mu\gamma)}{\gamma(1-(E-\beta)\gamma)};$$

$$e_{NI} > e_{CI} \Leftrightarrow C > C_3 \equiv \frac{(\beta-\lambda)(1-\mu\gamma+\alpha\lambda)}{(\gamma-\alpha)(1-(\mu-\beta)\gamma)}.$$

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

To prove the proposition, it suffices to show that $\frac{\partial C_3}{\partial_\varepsilon} > 0.$ Substituting $\lambda = \beta - (1-k)\varepsilon$ and $\mu = \beta + k\varepsilon$ into $C_3$, define

$$X_3 \equiv (\gamma-\alpha)C_3 = \frac{k\varepsilon(1-\gamma(\beta+k\varepsilon)+\alpha(\beta-(1-k)\varepsilon))}{1-\gamma k\varepsilon},$$

from which

$$\frac{\partial X_3}{\partial\varepsilon} = \frac{k\left((1-\gamma k\varepsilon)^2-\beta\gamma\right)-\alpha(\beta(1-k)\varepsilon(2-k\gamma\varepsilon))}{(1-\gamma k\varepsilon)^2}.$$

Note that $\frac{\partial X_3}{\partial_\varepsilon} > 0$ if, and only if, $\varepsilon \in \left[\frac{\alpha+k(\gamma-a)-\Psi}{\gamma k(\alpha+k(\gamma-a))}; \frac{\alpha+k(\gamma-a)+\Psi}{\gamma k(\alpha+k(\gamma-\alpha))}\right]$, with $\Psi \equiv \sqrt{\alpha(1-k+\gamma k)^2\left(\beta\gamma^2 k+\alpha\left(1-k(1+\beta\gamma)\right)\right)}.$ From $\lim_{\varepsilon\to 0}\frac{\partial X_3}{\partial\varepsilon} > 0$, it follows that $\frac{\alpha+k(\gamma-\alpha)-\Psi}{\gamma k(\alpha+k(\gamma-\alpha))} < 0,$ which, in turn, implies that $\frac{\alpha+k(\gamma-\alpha)+\Psi}{\gamma k(\alpha+k(\gamma-\alpha))} > \frac{2(\alpha+k(\gamma-\alpha))}{\gamma k(\alpha+k(\gamma-\alpha))} = \frac{2}{\gamma k} > 1.$ Finally, (1) implies that $\varepsilon < 1$, which in turns implies that $\frac{\partial C_3}{\partial_\varepsilon} = \frac{1}{(\gamma-\alpha)}\frac{\partial X_3}{\partial\varepsilon} > 0.$

### 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

$$\frac{\partial q_{CI}}{\partial e} V_{CI} = \frac{(\gamma+\alpha)}{2} \frac{\gamma\mu e^2 + \frac{1}{2}(1-(\gamma-\alpha)e)\beta e + \frac{1}{2}(1-(\gamma+\alpha)e)(\lambda e - C) - e^2}{1-\frac{\delta}{2}(1+(\gamma+\alpha)e)};$$

$$\frac{\partial q_{NI}}{\partial e} V_{NI} = \gamma \frac{\gamma\mu e^2 + (1-\gamma e)(\lambda e - C) - e^2}{1-\delta\gamma e}.$$

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

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

Furthermore, since the two expressions in brackets are positive, a sufficient condition for the inequality to hold is that $(\gamma - \alpha - \delta\gamma) < 0$ or

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

### *Self-fulfilling crises*

Governments' problems under the three scenarios can be written as

$$\underset{e}{Max}\, \tilde{\mathcal{B}}_{NI} = (\gamma e - \theta)\mu e + (1-\gamma e - \theta)(\lambda e - C) - e^2;$$

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

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

from which we get

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

$$\tilde{e}_{BI}^{*} = \frac{\beta}{2(1-(\mu-\beta)\gamma)};$$

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

We then have

$$\tilde{e}_{CI}^{*} > \tilde{e}_{BI} \Leftrightarrow C > \tilde{C}_1 \equiv \frac{(\beta-\lambda)(1-\mu\gamma-\alpha\beta)}{(\gamma+\alpha)(1-(\mu-\beta)\gamma)} + \frac{\theta(\mu-\lambda)}{(\gamma+\alpha)};$$

$$\tilde{e}_{NI} > \tilde{e}_{BI} \Leftrightarrow C > \tilde{C}_2 \equiv \frac{(\beta-\lambda)(1-\mu\gamma)}{\gamma(1-(\mu-\beta)\gamma)} + \frac{\theta(\mu-\lambda)}{\gamma};$$

$$\tilde{e}_{NI} > \tilde{e}_{CI} \Leftrightarrow C > \tilde{C}_3 \equiv \frac{(\beta-\lambda)(1-\mu\gamma+\alpha\lambda)}{(\gamma-\alpha)(1-(\mu-\beta)\gamma)} + \frac{\theta(\mu-\lambda)(1+(\gamma-\alpha)\beta+\alpha\lambda-\gamma\mu)}{(\gamma-\alpha)(1-\gamma(\mu-\beta))};$$

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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