IMF Conditionality

Giulio Federico[*]
Nuffield College, Oxford
OX1 1NF, U.K.
giulio.federico@nuffield.oxford.ac.uk

First Draft: February 2001
This Draft: September 2001

Abstract

This paper presents a principal-agent model of IMF conditional lending, in the aftermath of a "capital-account" liquidity crisis. We show that traditional ex-post conditionality can be effective in safeguarding the Fund's resources, allowing for the provision of efficient emergency lending and reducing inefficient ex-ante credit rationing if the capital outflow which triggers the crisis is not excessive.

We apply the baseline model to analyse the issues of debtor moral hazard and private sector involvement (PSI), which have characterised the recent debate on reforming the International Financial Architecture. We show that debtor moral hazard is only a concern if the IMF cannot commit to make the post-crisis participation constraint of the debtor country binding, and that it can only be resolved via ex-ante conditionality (or pre-qualification). Attempts to reduce debtor moral hazard may however compromise the Fund's ability to safeguard its resources ex-post.

We also show that PSI in the solution of balance of payments crisis is a central determinant of the effectiveness of both crisis prevention and resolution efforts on the part of the IMF. PSI may be an enabling condition for efficient crisis resolution, and may therefore be imposed even by a "PSI-averse" IMF. Moreover, there are conditions under which it is optimal for the IMF to ex-ante precommit to a tough, and ex-post sub-optimal, PSI policy, in order to mitigate investor moral hazard.

JEL Classification: F33, F34.

Keywords: IMF; conditionality; balance of payments crisis.

The purposes of the IMF are:

[...] (v) To give confidence to members by making the general resources of the Fund temporarily available to them under adequate safeguards, thus providing them with opportunity to correct maladjustments in their balance of payments without resorting to measures destructive of national or international prosperity.

IMF Articles of Agreement, Article I

[*]I thank Chris Adam and David Vines for helpful comments and conversations on an earlier draft. I am also grateful for the remarks of James Boughton, Marcus Miller and of participants to a workshop of the Centre for the Study of African Economies (Oxford) and to the Royal Economics Society Easter School 2001.

1 Introduction

Conditionality is the practice by which the International Monetary Fund (IMF, or Fund) makes its financial assistance to member countries contingent on the implementation of specific economic policies. According to Article I(v) of its Articles of Agreement (quoted above) one of the purposes of the IMF is to intervene in support of member countries which are in a position of external disequilibrium (i.e. do not have sufficient foreign exchange to purchase imports or to service their external debt). When it does so the IMF typically negotiates a program of adjustment with the recipient country as a pre-condition for the initial disbursement of resources, and it makes the release of its funds contingent on the implementation of these programs. This practice is known as *conditionality*.[1]

This paper models IMF conditionality from a contractual perspective, employing a principal-agent framework. This is designed to capture both the stylised macroeconomic features of situations of balance of payment disequilibrium which warrant intervention by the IMF, and the nature and potential effectiveness of these interventions. In doing so the paper seeks to bring together the various rationales for conditionality which have been put forward since the inception of this practice in the 1950s, and to analyse their mutual consistency and interaction. This analysis is of direct relevance to the current debate on reforming the *International Financial Architecture* (IFA), which has been triggered by the large international financial crises of the mid- to late 1990s (i.e. most notably the Mexican and East Asian crises), and which has generated a renewed interest by researchers and policy-makers on possible reforms of IMF crisis lending and of its conditionality practices.

The main results presented in this paper are as follows. First, two of the basic functions which can be identified with IMF conditionality contracts (the protection of Fund resources and the provision of commitment technology to the recipient country) are mutually compatible, if the balance of payments disequilibrium (or capital outflow) which triggers IMF intervention is not too large. Second, IMF bail-outs can lead to debtor moral hazard if the IMF's commitment power is limited. Conditionality can be used to reduce the incidence of this type moral hazard only if it is applied before the crisis (following "pre-qualification" procedures), and in exchange for larger post-crisis IMF loans. This may however compromise the ability of the Fund to safeguard its resources after the crisis, which may in turn lead to an institutional bias on the part of the IMF in favour of traditional ex-post conditionality. Third, if the crisis is large, ex-post *Private Sector Involvement* (PSI) in the form of debt-relief is a pre-condition for effective conditionality. Depending on the IMF's attitude towards PSI and on the severity of investor moral hazard, the IMF may find it optimal to pre-commit before a crisis to maximise PSI if a crisis occurs. This may in turn introduce inefficient credit constraints ex-ante.

This paper proceeds as follows: the rest of this introduction consists of a brief review of existing literature on conditionality, and of the approach taken in this paper; Section 2 presents the baseline model of IMF conditionality, and Sections 3 to 5 employ and extend the basic framework to analyse three issues respectively: conditionality as commitment technology, debtor moral hazard, and PSI; Section 6 concludes.

[1] Appendix A.1 provides some information on the practice of IMF conditional lending, describing the nature and historical use of IMF financial facilities which are subject to conditionality.

1.1 Existing Work on IMF Conditionality

Much has been written about IMF conditionality. This has been mostly about the *content* of conditionality, i.e. the type of policy changes demanded by the IMF as part of its financial assistance programs, and the effectiveness of the IMF's approach to stabilisation and adjustment (see e.g. Williamson (1983) and Shadler *et al.* (1995)). However work on the rationale and design of conditionality contracts (which is the subject of this paper) has been relatively scarce, especially at a formal level.

Papers which deal with (or comment on) the contractual aspects of conditionality can be broadly divided into three categories, which partially reflect three distinct stages in the evolution of the international monetary system, and which therefore place emphasis on different potential rationales for IMF intervention: the Bretton Woods era (or *conditionality as a safeguard*); the debt crisis of the 1980s (or *conditionality as commitment technology*); and the capital-account crises of the mid- to late 1990s (or *conditionality as moral-hazard containment*).

1.1.1 Conditionality as a Safeguard

The traditional and core view of IMF conditionality, as implicitly stated in the Articles of Agreement of the Fund and applied during the Bretton Woods era, is that by linking its financial support to policy changes, the IMF safeguards its resources, and guarantees their revolving nature.[2] This is because conditionality can help to ensure that adjustment to a balance of payment disequilibrium will take place and that the temporary relief offered by the Fund's intervention will not lead to delays in the implementation of necessary adjustment policies. This in turn implies that the recipient country will be in a position to repay the Fund in due course (see e.g. Guitian (1981); IMF (2000b)). Conditionality therefore can be seen as acting as a substitute for the collateral which is typically employed in domestic loan contracts to discipline the behaviour of the borrower.

The ability to safeguard its lending via conditionality is often seen as a unique privilege of the Fund relative to private suppliers of liquidity,[3] which enables it to intervene at times of crisis and prevent actions which are otherwise optimal for the debtor country, but which may have a negative externality on other IMF members.[4] *Conditionality as a safeguard* may therefore go hand in hand with *conditional lending as a bribe*, which is used by the Fund to induce recipient countries to adopt policies which have a public good component.[5]

[2] The IMF's resources are made up of its members' quotas. The Fund therefore functions like a credit cooperative, making its resources available to members on a temporary and revolving manner. See Appendix A.1 for more detail on the IMF's lending practices.

[3] This argument has been made by a number of authors (e.g. Sachs (1989b) and Rodrik (1996)), who argue that the IMF has an advantage relative to private creditors in imposing and enforcing conditionality for several reasons: political neutrality (which makes the commitment not to extract an excessive share of the benefits of reform credible); informational advantage (e.g. lower costs in monitoring the implementation of conditionality); higher leverage relative to private creditors due to cross-conditionality practices (by which other donors and creditors link their financial support to the implementation of IMF programs).

[4] This is what Article I(v) refers to as "measures destructive of national or international prosperity", and which, depending on specific circumstances, may imply sharp ("competitive") depreciation of the exchange rate, significant output falls (e.g. recessions) or default on external debt.

[5] Masson and Mussa (1995) make an argument along these lines.

1.1.2 Conditionality as Commitment Technology

A second rationale for conditionality emerged in the wake of the debt-crisis of the 1980s,[6] following the realisation that high levels of sovereign debt may lead to inefficient outcomes due to *debt-overhang*.[7] This refers to the fact that a sovereign with a high level of external debt may face sub-optimal incentives to invest and achieve higher future incomes because of the large proportion of future output gains which need to be transferred to external creditors. This can in turn reduce debt repayment, leading to a Debt Laffer curve. Two solutions to exit such debt traps have been identified in the literature: fresh liquidity (or debt rescheduling) and/or debt relief (see e.g. Diwan and Rodrik (1992)). Efficient solutions to debt-overhang may however not take place if debtors cannot precommit to policies which increase future output in exchange for favourable recontracting of their debt obligations (e.g. commit to invest rather than consume additional lending). Conditionality can represent the mechanism which allows debtors to commit to efficient policies by tying a favourable restructuring of the external debt to the adoption of these policies, and therefore allowing for an efficient exit from a debt-overhang situation.[8] In the absence of conditionality and debt restructuring an inefficient outcome may persist (for high levels of external debt) and/or ex-ante credit-rationing may take place (Fafchamps (1996)).

1.1.3 Conditionality as Moral Hazard Mitigation

A third and more recent interpretation of conditionality is associated with the recent debate on the how to reform the International Financial Architecture (IFA)[9] and on the potential need for an international Lender of Last Resort in a world with large and volatile international capital flows, which may leave countries exposed to "runs" and liquidity crises even if their fundamentals are sound (in a fashion similar to the classic Diamond and Dybvig (1983) banking model).[10] Some commentators have argued that, given the scale of the financial flows involved, IMF bail-outs in these circumstances may lead to a problem of moral hazard, and excessive ex-ante risk-taking by both creditors and debtors (see for instance the IFIAC (or Meltzer)

[6] This was precipitated by the default of Mexico in the summer of 1982, and led to the IMF playing a key role in debt rescheduling and (eventually) relief efforts, with conditionality at the center of its interventions (see Guitian (1995)).

[7] This concept was articulated by a number of authors, in particular Sachs (1989a) and Krugman (1988).

[8] Alternatively, conditionality can be seen in this context as a mechanism which guarantees to the debtor that creditors will not extract an excessive share of their future output by delegating the debt-relief (or rescheduling) management to an impartial organisation like the IMF (Claessens and Diwan (1990); Fafchamps (1996)); or as a mechanism which screens high productivity countries from low productivity ones, and allows creditors to target debt-relief on the former (Marchesi and Thomas (1999)).

More generally in these contexts conditionality can be seen as an "external agency of restraint" (Collier (1997)) which allows policy makers to adopt policies which would otherwise be time-inconsistent.

[9] Eichengreen (2000) dates the start of this on-going debate to a speech made by Rubin (the then U.S. Secretary of the Treasury) in February 1998. Much of the recent discussion on IFA (e.g. Eichengreen (1999), Eichengreen (2000), Jeanne (2000) and Goldstein (2000)) centers around the issue of investor and debtor moral hazard reduction, emphasising the need for reforms of IMF lending (including its conditionality) and for more Private Sector Involvement in crisis resolution.

[10] Much has been written on this issue in the wake of the Mexican crisis of 1995, and of the East Asian crisis of 1997/1998. Relevant work includes Radelet and Sachs (1998) and Chang and Velasco (1999) (who argue in a favour of a "country-run" interpretation of the crises), Dooley (2000) and Corsetti *et al.* (2000) (who favour a "moral-hazard" interpretation for the crises) and Fischer (1999) and Giannini (1999) (who discuss the issue of international lending of last resort).

Report (2000)). Given the risk and potential implications of moral hazard, it has been argued that conditionality should (and can) be seen as a mechanism to limit debtor moral hazard and introduce *co-insurance*, by imposing an additional cost onto countries which face a capital-account crisis and which are bailed-out by the Fund (Guitian (1995); Fischer (1999)).[11] In this context conditionality could therefore be seen as a substitute for the "penal rates" at which the domestic Lender of Last Resort should lend according to the standard Bagheotian doctrine.

1.2 Structure and Approach of the Paper

As the survey of the literature presented above shows IMF conditionality is a multifaceted instrument, which is frequently assigned different roles by commentators (and, arguably, by the Fund itself). The purpose of this paper is to provide a stylised model which can encompass these roles, and shed light on their robustness and mutual compatibility.

The framework we develop to analyse IMF conditionality is based around a simple principal-agent model with the following building blocks: (i) external disequilibrium is due to capital inflows, which can trigger a "sun-spot" crisis (i.e. partially unrelated to fundamentals) by suddenly withdrawing from the debtor country;[12] (ii) the model follows some of the literature on sovereign debt, starting from a recognition that debt contracts between sovereigns cannot be enforced, and that willingness to pay rather than ability to pay determines the amount of debt-repayment (see e.g. Eaton and Fernandez (1995)); (iii) the model assumes that the IMF is the only potential supplier of conditional liquidity in the immediate aftermath of a crisis (see the arguments mentioned in Section 1.1 for why this might be so); (iv) hidden action or information aspects of conditionality contracts are not modelled, for simplicity;[13] and (v) there is no nominal exchange rate, so that a crisis manifests itself as a sudden reversal of foreign capital flows (possibly followed by debtor default), rather than as a sharp currency depreciation.

In the next section of the paper we employ these building blocks to construct an agency model of conditionality, where a principal (the IMF) offers a conditional liquidity contract to an agent (the debtor) following a crisis event. As in standard principal-agent models, the principal designs the contract to trade-off the maximisation of reform effort with the minimisation of bail-out transfers. We show that this contract can avoid the occurrence of a inefficient liquidity crunch and of debt overhang if the capital outflow which triggers the crisis is not excessive. The use of conditionality also allows the IMF to lend under "adequate safeguards" (i.e. recover its bail-out

[11] According to this line of argument, the cost due to conditionality presumably derives from the conflict of priorities between the IMF and the recipient government, which implies that under conditionality the recipient adopts policies which it would have not adopted otherwise.

[12] In other words the balance of payments crisis we consider as the trigger for IMF intervention is not a Krugman-style *current-account crisis* (as in Krugman (1979)), which is typically driven by over-expansionary policies and/or negative external shocks, but a *capital-account crisis*, of the kind seen in Mexico and East Asia in the 1990s. We focus on capital-account crises to make our analysis directly relevant to the current debate on IMF reforms, but the set-up we put forward is adaptable to more traditional current-account crises (i.e. the fundamental constraints on Fund intervention are the same).

[13] This is the case also in the "moral hazard" extensions of the model that we present in Sections 4 and 5, where we follow the recent literature on the International Financial Architecture and use the term "moral hazard" rather loosely, to refer to a situation where an agent does not spontaneously adopt an efficient level of "effort" from the point of view of a principal (as opposed to the standard hidden-action situation where first best effort is not attainable because of a combination of asymmetric information, noise and agent risk-aversion).

It would be relatively straightforward to introduce hidden action and information considerations in the model we present below, but doing so would not add particularly significant insights about the nature of IMF conditionality.

at the end of the crisis period), by tying the provision of the bail-out to the implementation of income-increasing reforms.

Sections 3 to 5 then proceed to draw out some of the implications of the baseline model. Section 3 shows how the presence of the IMF and of its provision of conditional liquidity can act as a source of commitment technology for the debtor both ex-post (once a crisis has occurred) and ex-ante (when foreign capital flows into the country). Whilst ex-post the IMF has incentives to extract all of the value of this commitment technology with its conditionality contract (given its incentives to minimise transfers to the agent and maximise adjustment efforts), ex-ante the debtor may benefit from the external restraint provided by the Fund, due to the reduction in inefficient credit rationing.

Section 4 and 5 address the currently topical issue of whether apparently efficient IMF bail-outs can induce *moral hazard*. We show in Section 4 that debtor moral hazard (i.e. excessive risk-taking on the part of the debtor) can arise only if the Fund's ability to commit to make the agent's participation constraint bind ex-post is limited. If this is the case, the IMF ex-post contract will be characterised by some slippage in the implementation of reforms,[14] which will in turn induce the debtor to reduce ex-ante crisis prevention efforts. To solve debtor moral hazard the Fund needs to complement its ex-post bail-out with ex-ante conditionality, i.e. the commitment to higher ex-post bail-outs in exchange for more pre-crisis effort on the part of the debtor. Section 4 shows that if the incidence of the Fund's ex-post discretion is limited, ex-ante conditionality is able to restore first-best ex-ante efforts.

Section 5 examines the role for so-called Private Sector Involvement (PSI) in balance of payments crises. It shows that PSI can be an essential component of IMF-led crisis resolution packages, enabling efficient IMF bail-outs to take place. Even a PSI-averse IMF, i.e. one which seeks to maximise debt repayment, will therefore demand some PSI if the capital outflow is large. A PSI-tolerant IMF (i.e. one which trades-off reform inducement with bail-out and PSI minimisation) has incentives to increase the degree of PSI, but it would still leave some rents to investors relative to a no-IMF benchmark (as long as in the absence of Fund intervention investors cannot co-ordinate on an efficient debt-relief offer). This insurance effect for investors can generate an investor moral hazard problem, if the probability of crisis is sufficiently sensitive to ex-ante capital inflows and if the crisis is sufficiently disruptive (from a global perspective). If this is the case, the Fund will face incentives to pre-commit to a tougher, and ex-post sub-optimal, PSI policy, in order to deter excessive capital inflows.

Section 6 concludes by summarising the main results obtained in this paper, and highlighting the variety of trade-offs which can be identified between the different possible functions and implications of IMF conditionality.

2 The Baseline Model

2.1 Set-up

Consider the following three-player and two-period model. The players are a group of foreign investors, a recipient (or debtor) country and the IMF. The two periods are an investment period ($t = 1$) and a potential crisis period ($t = 2$).

[14] This slippage can be interpreted as implying that there is ex-post program "ownership" by the debtor.

At $t = 1$ the investors lend an amount k to the recipient country, which is assumed exogenous in this baseline model, and which we endogenise in the next section of the paper. We assume that k is consumed by the debtor country, and there is no reserve accumulation or investment.[15] At $t = 2$ a 'crisis' may occur, with probability γ, which leads to a creditor 'panic', inducing investors to collectively demand k back from the debtor country at the beginning of the period. The probability of crisis is also assumed to be exogenous in this baseline model, and is endogenised in the extensions we present in Sections 4 and 5. However, both in the baseline model and in the endogenous-crisis extensions we assume that probability of the crisis occurring is not *directly* related to the investors' prospects for debt-repayment, and that the crisis takes place for reasons which are outside the model (e.g. investor panic; contagion; or a sudden interest-rate reversal working against the debtor country).

The recipient country faces a choice of adjustment effort (e_t) at both $t = 1$ and $t = 2$. More effort leads to more output $y(e_t)$ (i.e. $y'(e_t) > 0$), but at a cost $c(e_t)$. The standard assumption of convexity of the cost function is made (i.e. both $c'(e_t)$ and $c''(e_t)$ are positive). In this context effort can be thought of as an efficient supply-side measure (e.g. price liberalisation, or a reduction in tariffs) which increases domestic output but also implies a political economy cost for the policy makers in the recipient country.[16]

If a crisis occurs at the beginning of $t = 2$, the country can choose whether to repay k (which is demanded back by the creditor) or default. If it repays, it suffers a $(1 + \lambda)k$ fall in welfare, where λ (which lies between 0 and 1) measures the deadweight loss associated with *sudden* capital outflows. This can be interpreted as a loss due to early project liquidation (as in many banking models), or as a cost brought about by a sudden foreign exchange scarcity or a sharp fall in absorption.[17] We assume that the λ-loss applies to capital outflows which take place at the beginning of the $t = 2$ period (i.e. when investors demand their capital back), but not to those at the end of the period. If the debtor defaults on k it suffers a direct sanction $p(y(e_2))$ which is increasing in its domestic production level.[18,19]

If the crisis does not occur, k is not demanded back by the investor, and the debt is serviced by the debtor at $t = 2$ (and thereafter) at the international interest rate. For simplicity the international interest rate is fixed at 0, so that debt-servicing does not imply any transfer of resources from debtor to creditor.[20]

[15] This is analytically equivalent, in our set-up, to an assumption that foreign capital is invested by the recipient country at $t = 1$, and that its returns are fully wiped out in the event of a crisis (e.g. because of early project termination).

[16] Alternatively, $y(e_t)$ can be thought of as the production of tradeables (rather than overall income) and e_t as the relative price of tradeables to non-tradeables. Under this interpretation the function $c(e_t)$ would capture the policy-makers' preference with respect to tradeables and non-tradeables, for a given production possibility frontier for these two goods. Appendix A.3.1 outlines a model which defines effort e_t along these lines.

[17] This effect could be modelled explicitly, by introducing a concave utility function, or by allowing for price stickiness (which does not allow the debtor country to produce more tradeables when hit by a crisis to compensate for the sudden scarcity of foreign exchange). The set-up presented here can be therefore thought of as the reduced form of a more complex model, which preserves the essential features of such a model (i.e. a sudden outflow of foreign capital is costly) but is more tractable. Appendix A.3.1 outlines a model with price-stickiness which provides micro-foundations for the presence of a liquidity cost λ.

[18] This follows the standard assumption of "gun-boat technology" in the sovereign risk literature (see e.g. Eaton and Fernandez (1995)).

[19] The penalty rate p is inclusive of the deadweight loss λ. The penalty received by the creditor therefore equals $\frac{p}{1+\lambda}y(e)$, given that it is net of the liquidity cost λ.

[20] The incentives for the creditor to invest k with an interest rate of 0 are made explicit in the extension with

The IMF has resources at its disposal, and can intervene to bail-out the debtor country if a crisis occurs at $t = 2$.[21] IMF intervention consists of a conditional loan b, which is disbursed at the start of $t = 2$ (i.e. when the λ-loss applies) if three requirements are fulfilled by the recipient country: it implements a given (Fund-determined) second-period effort level e_2; it repays k to the investors at the beginning of the period $t = 2$; and it repays b to the IMF at the end of the period. The latter two conditions imply that the IMF requires that the debtor country does not default on its external debt as a pre-condition for its lending, and that the Fund *needs* to lend under "adequate safeguards", making sure it is repaid at the end of $t = 2$ (we expand on both of these points below). By the end of the period $t = 2$ the deadweight loss λ on capital outflows does not apply, so that the cost to the debtor of repaying the amount b equals $-b$. This implies that an IMF bail-out leads to a net utility transfer of λb to the debtor.

The utility functions of the recipient country and of the IMF are as follows:

- Recipient utility (U_t^R, for $t = \{1, 2\}$):

$$U_1^R = y(e_1) - c(e_1) + k$$

$$U_2^R = \begin{cases} y(e_2) - c(e_2) & \text{if there is not a crisis} \\ y(e_2) - c(e_2) - p(y(e_2)) & \text{if there is a crisis and default} \\ y(e_2) - c(e_2) - (1+\lambda)k + \underbrace{\lambda \min(b,k)}_{\text{if the IMF intervenes}} & \text{if there is a crisis and no default} \end{cases}$$

- IMF utility:

$$U^{IMF} = y(e_2) - b$$

The IMF's utility function is underpinned by the assumption that the Fund is concerned about the production level of the recipient country (which may, for instance, contribute to global stability and/or international trade), and that it also seeks to minimise the use of its resources (to maintain their revolving nature).[22] Note that we are assuming that the Fund is not directly concerned with the consumption level in the recipient country, and does not directly seek to minimise the dead-weight loss induced by a crisis. However, as we show below, the presence of a crisis allows the IMF to intervene (i.e. a crisis gives leverage to the Fund) and mitigate the incidence of the deadweight loss λk, even though none of the efficiency gains brought about by the IMF's actions are passed on to the recipient country. In section 4 we relax the latter assumption, and allow for some rents from Fund intervention to be appropriated by the recipient.

---

endogenous capital which we consider in the next section of the paper, and relate to capital depreciation in the investor country.

[21] We do not allow the IMF to intervene before the crisis. This assumption is relaxed in the debtor moral hazard extension of the model (Section 4).

We also do not model why the IMF has access to financial resources. We simply assume the existence of a quota-funded IMF as an instrument of international monetary co-operation, which acts a source of emergency reserves (which is an efficient risk-pooling activity for member states if the shocks which trigger external crises are idiosyncratic) and as a promoter of international economic linkages (see the IMF's utility function in the main text).

[22] Note that this assumes that the IMF does not care about first period output. This assumption is made for simplicity and is innocuous, given that we are ruling out IMF intervention before a crisis in the baseline model.

The following assumptions on functional forms are made in what follows, for the sake of tractability: $y(e_t) = e_t$; $p(e_t) = pe_t$, with $p \in (0, 1)$; and $c(e_t) = \frac{1}{2}e_t^2$.

Figure 1 summarises the timing of the game. As the figure shows, we assume that the realisation of the crisis is known before the actual outflow of k or the levying of the penalty $p(e_2)$, which allows the recipient country to set e_2 according to whether it wants to default on its debt or not. The figure also illustrates the fact that the IMF's bail-out takes place just after e_2 is set, which allows the Fund to enforce a pre-announced conditional liquidity contract (see Section 2.3 for further discussion of this point).

As it is shown in the rest of this section this set-up can convey the basic rationale for IMF intervention: by providing valuable balance of payment support and granting debtor countries "time to adjust" (i.e. allowing them to avoid the λ-cost associated with a sudden capital outflow), the Fund can induce income-increasing reforms, avoid unnecessary demand-side adjustment (i.e. an excessive fall in consumption) and, depending on the level of debt, avoid inefficient debt-overhang. The scope for efficient intervention by the IMF hinges on the interaction between conditionality and the size of the capital outflow, as the results presented below illustrate.

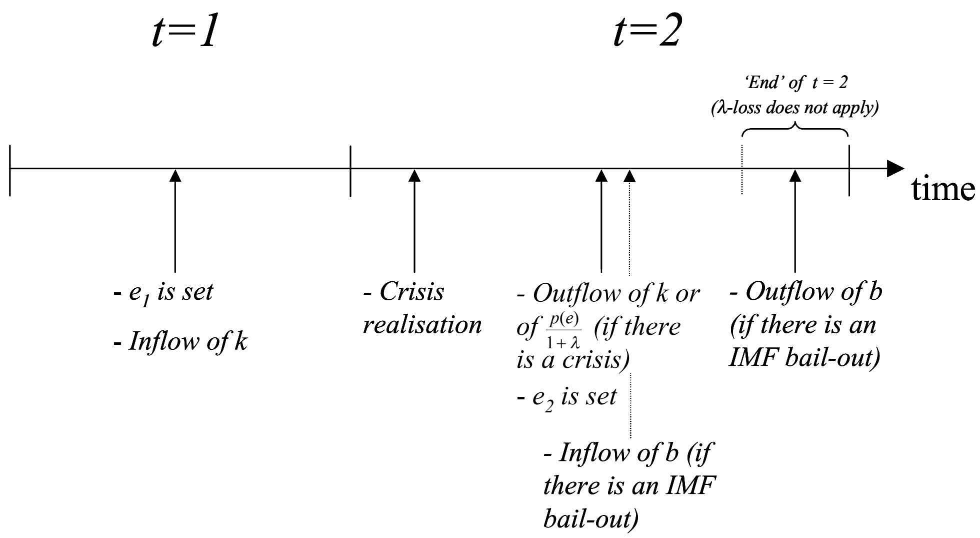


Figure 1: The timing of the game.

2.2 The Equilibrium without the IMF

At $t = 1$ the recipient maximises its utility relative to e, and therefore sets $e_1^* = 1$ (from the following FOC: $\frac{\partial U_1^R}{\partial e_1} = 1 - e_1 = 0$), which is independent of the level of capital inflow k given the assumption of quasi-linearity in the utility function.[23]

At $t = 2$ if the crisis does not occur the same level is chosen for e_2. If a crisis occurs the debtor faces a choice between defaulting and paying the debt. This yields the following optimal

[23] Throughout the paper we write variables with a superscript $*$ to denote optimal levels in the absence of IMF conditionality, and with superscript c to indicate optimal levels chosen by the IMF.

level for e_2:

$$e_2^* = \begin{cases} 1 & \text{for } k \leq k^D \text{ (\textit{repayment equilibrium})} \\ 1-p & \text{for } k > k^D \text{ (\textit{default (or debt-overhang) equilibrium})} \end{cases} \quad (1)$$

where $k^D \equiv \frac{p(1-\frac{p}{2})}{1+\lambda}$, with $\frac{\partial k^D}{\partial p} > 0$ (i.e. the likelihood of default falls with the size of the default penalty).

Equation (1) implies that if the level of external debt is high enough the recipient finds it optimal to default on its external debt and reduce national output (or withdraw from external trade), and suffer the penalty $p(e)$. This corresponds to a situation of *debt overhang* (as in Sachs (1989a)), where high levels of external debt induce a country to reduce adjustment effort and therefore production. For low levels of k, the recipient finds it optimal to repay the debt, and run a current account surplus equal to $(1+\lambda)k$ at the start of $t=2$, by reducing consumption.

The equilibrium utility level obtained by the recipient at $t=2$ is as follows:

$$U_2^{R,*} = \begin{cases} \frac{1}{2} - (1+\lambda)k & \text{for } k < k^D \\ \frac{(1-p)^2}{2} & \text{for } k \geq k^D \end{cases}$$

2.3 The Equilibrium with the IMF

As set out above, the IMF can intervene if a crisis occurs at $t=2$. The IMF's incentive to supply emergency funds derives from its ability to offset the deadweight loss λk with its bail-out and, therefore, obtain some leverage on the recipient country to induce it to adopt an optimal level of adjustment.[24]

IMF intervention consists of *conditionality*, i.e. the offer of a bail-out b in exchange for a given second period effort level e_2. We assume here that the IMF can enforce the optimal contract $\{b^c, e_2^c\}$ in a time-consistent fashion, i.e. it can guarantee that the agent will exercise effort e_2^c in exchange for the (net) transfer λb^c (as long as the agent's individual rationality constraint is satisfied). In our set-up this is analytically equivalent to assuming that the choice of e_2 by the agent can be observed by the Fund and is not reversible, and that the Fund has access to full commitment technology (and hence has all the bargaining power). If this is the case, the principal can enforce optimal conditionality by relying, for instance, on a linear contract which specifies b as a function of e_2, and which therefore 'delegates' the choice of e_2 to the agent. By meeting the relevant incentive compatibility constraint, such a contract would ensure that e_2^c is set by the agent, and b^c is transferred by the principal.

In practice however reform implementation is a gradual and reversible process, and only a share of the IMF's bail-outs is paid out at the outset of a reform program, and additional tranches of b are released depending on the level of progress in reforming policies. That is, the IMF solves the incentive-provision problem which would be caused by front-loading the bail-out in the absence of the agent's commitment to a given level of e_2 by staggering its lending (see Appendix A.1). This gives rise to a trade-off between the early disbursement of bail-out funds (which is more effective in preventing excessive demand-side adjustment and, therefore, in

[24] Note that the adjustment that we are allowing for here is both an explicit supply-side adjustment (i.e. a change in e, or "expenditure-switching") and an implicit demand-side one (i.e. a reduction in absorption, or "expenditure-changing") which is given by the change in consumption (= income - debt repayment) relative to a no-crisis outcome.

meeting the agent's participation constraint) and the provision of incentives to change policies. We abstract from this trade-off in our modelling, by effectively 'compressing' the timing of the liquidity-reform contract and assuming that reforms demanded by the IMF can be fully implemented before liquidity is provided.[25]

Our modelling of conditionality does however allow for the imperfect enforcement of the optimal IMF contract due to limited commitment power on the part of the Fund. This is arguably a more relevant reason, from a policy perspective, for why optimal IMF conditionality contracts may not be fully enforceable. We introduce this feature in Section 4 of the paper, in the context of our discussion of debtor moral hazard.

The IMF is subject to three constraints in its intervention. One is a standard individual rationality constraint (IRC) for the recipient country, which in this case implies that the cost to the recipient country of implementing the level of effort demanded by the IMF rather than e_2^* *and* the cost of having to repay k fully for all values of k (i.e. even for $k \geq k^D$) needs to be outweighed by the benefit of receiving the IMF bail-out at the outset of the crisis. We express this constraint as $U_2^R(e_2, b, -k) \geq U_2^{R,*}$ where $U_2^R(e_2, b, -k)$ indicates the recipient's utility when it exercises second-period effort e_2, receives b at the beginning of $t = 2$ (and repays it at the end of the period), and pays back k at the beginning of $t = 2$.

The second constraint reflects the legal framework under which the IMF operates (as reflected in its Articles of Agreement), and in particular the need for the Fund to lend "under adequate safeguards". This means that the IMF needs to guarantee that the recipient country faces appropriate incentives to repay at the end of period 2 the funds lent as part of the bail-out. This constraint is satisfied if we impose the following restriction on IMF contracts $\{e_2, b\}$: $\frac{p}{1+\lambda} e_2 \geq b$. This assumes that the Fund has access to the same penalty technology as private creditors, and accounts for the fact that the penalty faced by the recipient for not paying the Fund needs to be scaled down by $1 + \lambda$, given that it is levied at the end of period 2. We define this restriction as the "Adequate Safeguards Constraint" (ASC).

The third constraint is a "no net transfers constraint", which implies that the size of the bail-out cannot exceed the initial capital outflow suffered by the debtor country (i.e. $b \leq k$). This is a technical constraint which is employed to reflect the fact that any b in excess of k does not benefit the recipient (given that it does not provide any liquidity relief), and therefore cannot be optimal for the IMF (since it cannot be used to induce additional effort).

Optimal IMF intervention therefore consists of a conditional bail-out package $\{e_2, b\}$ which solves the following program:

$$\begin{aligned}
\max_{e_2, b} U^{IMF} &= e_2 - b \\
s.t. &: U_2^R(e_2, b, -k) \geq U_2^{R,*} \text{ (IR constraint) (IRC)} \\
&: b \leq \frac{p}{1+\lambda} e_2 \text{ (\textit{adequate safeguards} constraint) (ASC)} \\
&: b \leq k \text{ (\textit{no net transfers} constraint)}
\end{aligned}$$

Figure 2 describes the IMF 's conditionality program, plotting the Fund's indifference curve in (b, e_2) space and the three constraints under which it optimises (i.e. the IRC, the ASC and

[25] Our modelling approach is also analytically equivalent to assuming that b^c is released in tranches (e.g. according to an optimal linear contract) as e_2 is increased up to e_2^c, over a time horizon during which the additional 'liquidity' value of the bail-out (i.e. λb) applies in full.

the $b = k$ schedule). The figure illustrates the fact that making IRC binding is always optimal for the Fund (i.e. first-best conditional effort is at the tangency of the IMF's indifference curve and the IRC) and that a binding $b \leq k$ constraint and/or a binding ASC lower the intensity of conditionality relative to the first-best and can ultimately provoke the collapse of the contract. This is shown formally in Proposition 1, which describes the properties of the solution to the IMF's conditionality program, and is also illustrated in Figure 3 below.

Proposition 1 *The intensity of IMF conditionality is a function of the level of capital outflows which precipitate the balance of payments crisis.*

For high values of k (i.e. $k > k^H \equiv (1+\lambda)k^D$) no conditionality can be imposed by the IMF (i.e. the IR and "no net transfers" constraints cannot be jointly satisfied).

For lower values of k (i.e. $k \leq k^H$), three cases for the optimal conditionality contract can be identified, depending on whether the "no net transfers" constraint and the "adequate safeguards" constraint bind:

(i) neither the "no net transfer" nor the "adequate safeguards" constraints bind if $k^D \geq \frac{\lambda}{2}$ and for $k \in \left[\frac{\lambda}{2}, k^M\right]$, where $k^M \equiv k^H - \frac{\lambda^2}{2}$. If this is the case the IMF is able to induce first-best conditionality, characterised by:

$$\begin{aligned} e_2^c &= 1+\lambda \equiv e_2^{FB} \\ b^c &= \begin{cases} \frac{\lambda}{2} & \text{for } k \in [\frac{\lambda}{2}, k^D) \\ \frac{\lambda}{2} + \frac{1+\lambda}{\lambda}(k-k^D) & \text{for } k \in [k^D, k^M] \end{cases} \end{aligned}$$

For other values of k or if $k^D < \frac{\lambda}{2}$ (which implies $k^D > k^M$), the IMF can only impose second-best conditionality (i.e. $e_2^c < 1+\lambda$). If this is the case we have:

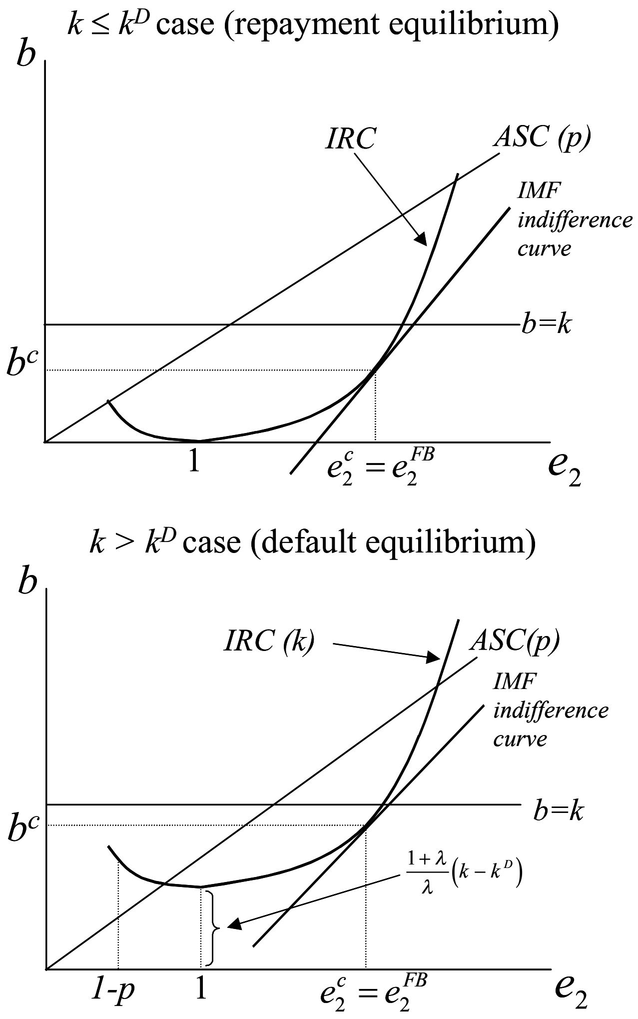
(ii) For p high enough (i.e. $p \geq \bar{p} \equiv \frac{2\lambda}{1+\lambda}$) the "adequate safeguards" constraint is always slack, $b^c = k$ and the IMF imposes the following level of conditional effort:

$$e_2^c = \begin{cases} 1+\sqrt{2\lambda k} & \text{for } k < \min(k^D, \frac{\lambda}{2}) \\ 1+\sqrt{2\left(k^H - k\right)} & \text{for } k \in [\max(k^D, k^M), k^H] \end{cases}$$

(iii) For $p < \bar{p}$ the "adequate safeguards" constraint binds if $k \geq \max(k^D, k^M)$ for high enough k. This implies that there exists a $\hat{k}^H(p) \in (\max(k^D, k^M), k^H)$ such that for $k > \hat{k}^H(p)$ conditionality collapses. For $k \in (\max(k^D, k^M), \hat{k}^H(p)]$ we have one of two cases, depending on the value of p: if $p \in [\hat{p}, \bar{p})$ (where $\hat{p} \equiv \frac{2\lambda(1+\lambda)}{1+2\lambda(1+\lambda)} < \bar{p}$), we have that e_2^c and b^c are given by the values in case (ii) above, in the relevant range for k; if $p < \hat{p}$, both e_2^c and b^c are lower than the corresponding levels in case (ii) at $k = \hat{k}^H(p)$, and converge to those levels for lower values of k.

Proof. In Appendix A.2.1.

Proposition 1 shows the IMF is able to "bribe" the country experiencing a balance of payments crisis to exert more adjustment effort and, where relevant, not default on its foreign debt, as long as the level of external debt is not too high. The "bribe" consists of the provision of foreign exchange to the debtor country at a time of crisis. The ability to provide such a bribe partially derives to the IMF from the fact that it can impose conditionality to safeguard its bail-out, and prevent default on its own lending. We elaborate on this point in the next section of the paper, where we discuss the role of the contract as ex-post commitment technology for the debtor country and as an enabling condition for efficient debt rescheduling.



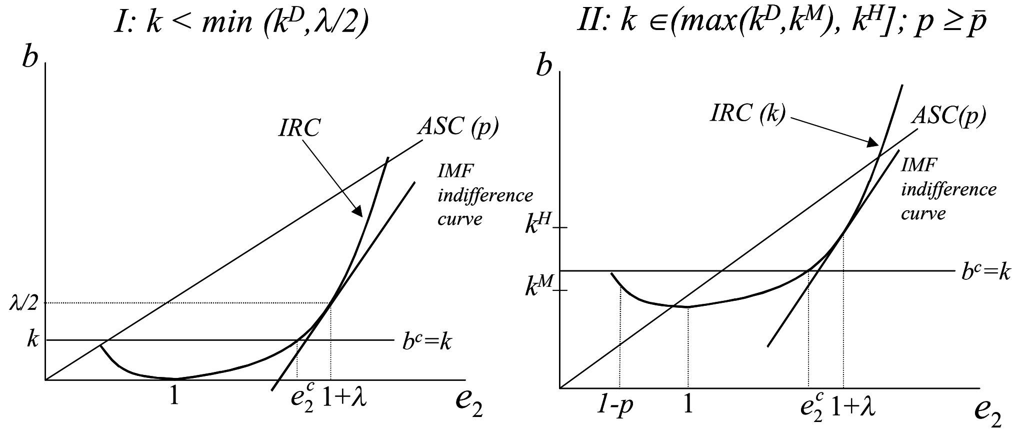
IMF utility increases as one moves South-East (i.e. towards a higher effort level and a lower bail-out), and its indifference curve has a slope of 1.

The IRC is a convex function of e_2, given that the cost of e_2 is quadratic, and always binds at the optimum, since the IMF has incentives to minimise *b*. The unconstrained optimum (first-best effort) is therefore at the tangency of the IMF's indifference curve and the IRC.

Higher levels of *b* are necessary to satisfy the IRC if $k > k^D$, given that if this is the case the recipient finds it optimal to default on the external debt in the absence of IMF intervention, and needs to be compensated for not doing so. This is why, in this case, the IRC lies above the *x*-axis and its position is a function of *k*.

The additional two constraints faced by the IMF are also shown on this graph: the ASC, which is flatter (and therefore harder to satisfy) the lower is the penalty for default *p*; and the $b \leq k$ constraint. Both of these constraints are shown as slack in the figure (i.e. the optimal contract lies below both of them), implying that effort is at its first-best level.

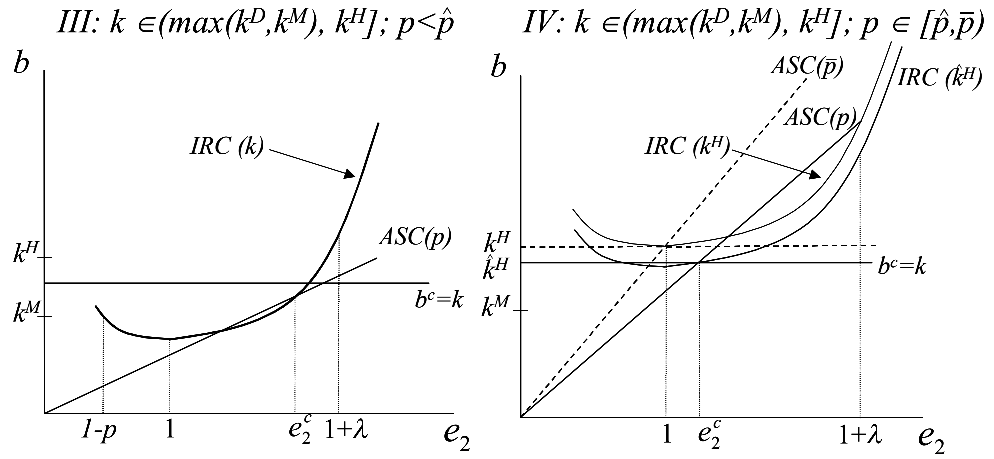
Figure 2: The IMF's baseline conditionality program (first-best case).



Panels I and II illustrate case (ii) of the Proposition, where the $b = k$ constraint is always binding.

Panel I shows the case of excessively low k, which decreases the leverage of the Fund, and forces it to accept an effort level which is below the first-best one.

Panel II illustrates the case of high k (but not high enough to lead to a collapse of conditionality) and high p, where the Fund needs to settle for second-best effort given its inability to compensate the recipient for both not-defaulting on debt and choosing first-best effort.



Panels III and IV depict case (iii) of the Proposition, which describes the optimal IMF contract for high values of k ($k > max(k^D,k^M)$) and relatively low values of p ($p < \bar{p}$).

Panel III shows the weakening of conditionality relative to case (ii) if the penalty rate p is particularly low (namely $p<\hat{p}$). If this is the case the IMF needs to weaken conditionality further relative to the case (ii), *and* conditionality collapses 'earlier' (i.e. for lower threshold values of k).

Panel IV shows the corresponding case for $p \in(\hat{p},\bar{p})$. If this is the case, as long as conditionality can be imposed, the effort level is equal to case (ii). However conditionality collapses 'earlier' than under case (ii), namely for $k > \hat{k}^H = k^{3C}$ (see the Proof of the Proposition). The panel shows the equilibrium where $k = k^{3C}$.

Figure 3: Second-best IMF conditionality (cases (ii) and (iii) of Proposition 1).

Conditionality is at its first best (i.e. $e^c = 1+\lambda$; $b^c < k$) if the crisis is of an intermediate size and if the penalty p is sufficiently high relative to λ so that $k^D \geq \frac{\lambda}{2}$ is satisfied (see Figure 4 and Figure 5). The first-best effort level reflects the one-to-one trade-off faced by the IMF between extra effort by the recipient and additional bail-out funds, which induces it to optimally increase e_2 relative to the recipient's optimum ($e_2^* = 1$) in accordance with the marginal effectiveness of its bail-out in increasing the recipient's utility (which is given by λ). The first-best conditionality contract can be decentralised with a linear "tranching" contract of the form $b = \mu_0 + \mu_1 e_2$, where the IMF optimally sets $\mu_1^c = 1$ and it uses the level of μ_0^c to satisfy the IRC.

If the crisis is either too small or too large, or if the $k^D < \frac{\lambda}{2}$ is not satisfied, second-best conditionality needs to be accepted by the Fund. The second-best cases (i.e. cases (ii) and (iii) of Proposition 1) are illustrated in Figure 3 and in Figure 4. Under second-best conditionality the intensity of the "tranching" contract is lower than under the first-best ($\mu_1^c < 1$).

Conditionality is weakened relative to the first-best if capital outflow is too small (e.g. $k < \frac{\lambda}{2}$) because if this is the case the benefits deriving to the recipient from the IMF bail-out are relatively low, thereby reducing the leverage of the Fund in imposing extra reform effort. In this case, $b^c = k$, so that the Fund is effectively "financing the run" with its resources.

Conditionality is also not at its first best if the crisis is "too large" (e.g. $k > k^M$) since if this is the case the IMF needs to reduce the intensity of the contract to compensate the recipient for not defaulting on a higher level of debt. For particularly high levels of capital outflows (i.e. $k > k^H$) the IMF cannot impose any conditionality, and therefore does not intervene. Allowing for some debt relief mitigates this conclusion, and always enables conditionality to take place, as it is shown in Section 5.

In the high-k second-best cases, the levels of the parameters λ and p interact to determine the intensity of conditionality and the extent to which the IMF is "financing the run". In particular, if the default penalty is relatively low, the ASC will bind for high k and conditionality will collapse for values of k below k^H (see Figure 5).

As Figure 5 shows, the Fund prefers high values of p relative to λ (as in Area I of the graph), to be able to exercise first-best conditionality and not be constrained by the ASC. This is because high levels of λ increase the debt-repayment costs due to the IMF conditionality package for the debtor, which makes it harder for the Fund to meet the agent's participation constraint in the cases where the optimal bail-out is not fully covering the initial capital outflow (i.e. where $b^c < k$). High levels of p on the other hand make it easier for the IMF to meet the agent's participation constraint, and to protect its lending at the end of $t = 2$.

Throughout the rest of the paper, and in particular in Sections 3 and 5, we restrict the values of the parameters p and λ to be in Area I of Figure 5 (i.e. so that both $p \geq \bar{p}$ and $k^D \geq \frac{\lambda}{2}$ are satisfied). This allows us to focus on one specific form of ex-post IMF conditionality, enhancing the tractability of the extensions of the baseline model we consider in the following sections of the paper. This restriction does not alter the substance of the results obtained in what follows.

The following three sections of the paper employ the baseline model to assess the role of the IMF in both crisis resolution and prevention, and evaluate the various functions performed by IMF conditionality. In the next section of the paper we spell out the role of the baseline conditional liquidity contract as a source of valuable commitment technology for the debtor country. In Sections 4 and 5 we extend the baseline model to be able to examine the issue of moral hazard, and to allow for the possibility of PSI (in the form of debt relief) in the crisis resolution package designed by the IMF.

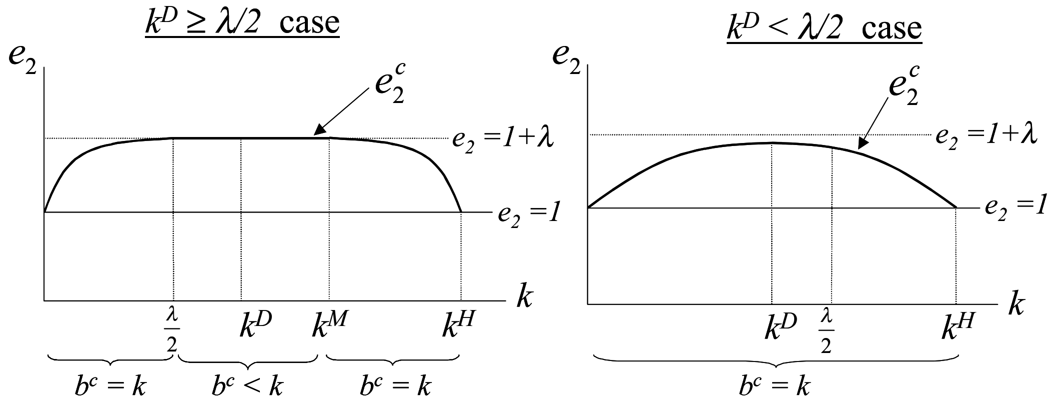


Figure 4: The intensity of IMF conditionality as a function of capital outflows k (for $p \geq \bar{p}$).

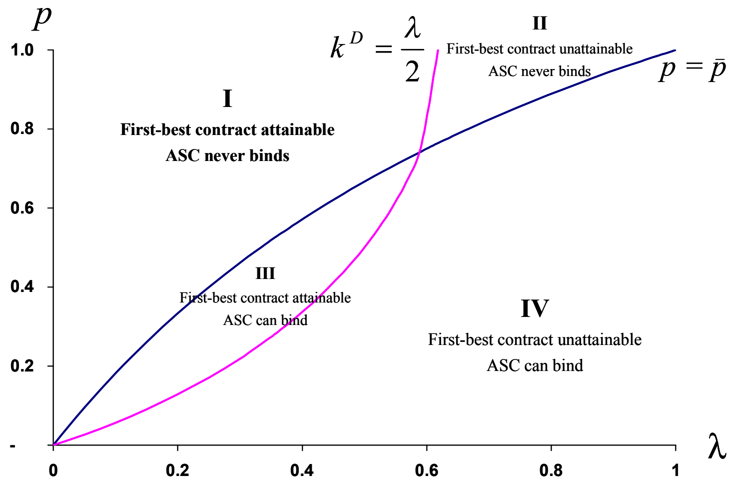


Figure 5: The nature of IMF conditionality as a function of the parameters p and λ.

3 IMF Conditionality as Commitment Technology

In this section of the paper we focus on the role of the IMF as an external agency of restraint which is capable of constraining the policies of the debtor country and remove sub-optimal discretionary equilibria. We highlight two roles of IMF conditionality as commitment technology: an ex-post one, which affects the efficiency of crisis resolution; and an ex-ante role, which has an impact on capital inflows before a crisis takes place. Both of these roles are direct by-products of the baseline IMF conditionality presented in the previous section, and their presence does not rely on the Fund explicitly seeking to act as an agency of restraint.

We firstly introduce the idea of IMF conditionality as a source of ex-post commitment technology. This role of IMF conditionality is implicit in the modelling we have presented so far, and the main purpose of the next sub-section is to isolate and clarify some of the features of the baseline IMF contract, and to illustrate their relationship with the issue of debtor ex-post commitment.

The second commitment role of conditionality highlighted in this section requires us to extend the modelling presented so far, by endogenising capital inflows at $t = 1$. This enables us to examine issues of credit-rationing, and to introduce a framework which we also use in Section 5 of the paper, to analyse the issue of PSI (in the form of debt-relief) and investor moral hazard.

Both of the roles of IMF conditionality we discuss in this section have been noted, and to some extent formalised, in the literature on sovereign debt and conditionality.[26] The main objective of this section of the paper is therefore to incorporate these results in the context of the stylised agency framework introduced here, and to show that our baseline model is capable of capturing them. In the following two applications of the baseline model (in Sections 4 and 5) we extend the model in original directions, addressing issues which are currently being discussed in the context of the debate on reforming the IFA.

3.1 Ex-post Commitment, Ownership and Safeguards

The model of conditionality presented in the previous section interprets IMF conditional bail-outs as contracts for liquidity, in the context of a balance of payments crisis. In our baseline model the IMF is assumed to have a comparative advantage relative to private investors with respect to both the imposition of conditionality (i.e. the ability to monitor and contract upon e_2) and in the provision of emergency liquidity (i.e. in the form of the bail-out b). In this sub-section we show that the first property of the contract (i.e. conditionality) can be interpreted as a source of post-crisis commitment technology which can benefit the debtor relative to a no-IMF state of the world, as long as the Fund refrains from extracting all the rents from its intervention.

It is possible to isolate the role of conditionality by initially considering an IMF bail-out without conditionality, i.e. the provision of unconditional liquidity following a crisis. A default-averse IMF which is subject to an "adequate safeguards" constraint is able to avoid default and debt-overhang by providing an unconditional bail-out b which is less or equal to k, as long as $k \in (k^D, \hat{k}^D]$, where $\hat{k}^D \equiv \frac{p}{1+\lambda}\left(1 - \frac{p}{2(1+\lambda)}\right) \in (k^D, k^H)$. $\hat{k}^D$ is the value of external debt which

[26] Sachs (1989b) notes the importance of IMF conditionality as a source of commitment in debt restructuring negotiations, and Claessens and Diwan (1990), Diwan and Rodrik (1992) and Fafchamps (1996) formalise this insight. Fafchamps (1996) also comments on the potential role of IMF conditionality in mitigating inefficient credit rationing ex-ante.

makes the debtor indifferent between repayment and default at *the end* of $t = 2$ (i.e. when the liquidity cost of sudden capital outflows λ does not apply). It therefore corresponds to the maximum amount that the IMF can lend unconditionally at the start of $t = 2$, and still be certain to be repaid at the end of $t = 2$.

As long as $b \leq k \leq \hat{k}^D$, the IMF is able to intervene under adequate safeguards, without the need to impose conditionality. The fact that $\hat{k}^D > k^D$ implies that, by acting as a pure liquidity provider, the IMF can increase the range of values of debt k for which inefficient default does not occur in equilibrium.[27] This increases debt repayment and makes the debtor country better off, relative to the no-IMF outcome (see Figure 6, which plots debtor utility in the no-IMF case and in the full debt-rescheduling, i.e. $b = k$, case).

The liquidity-only intervention also increases IMF utility (i.e. $U^{IMF} = e_2 - b$) relative to a no bail-out alternative, given that debtor reform effort equals 1, rather than $1 - p$, and the funds provided by the IMF are always below p (given that $\hat{k}^D < p$). The IMF faces therefore incentives to provide an unconditional bail-out, as long as debt default is the equilibrium outcome otherwise.

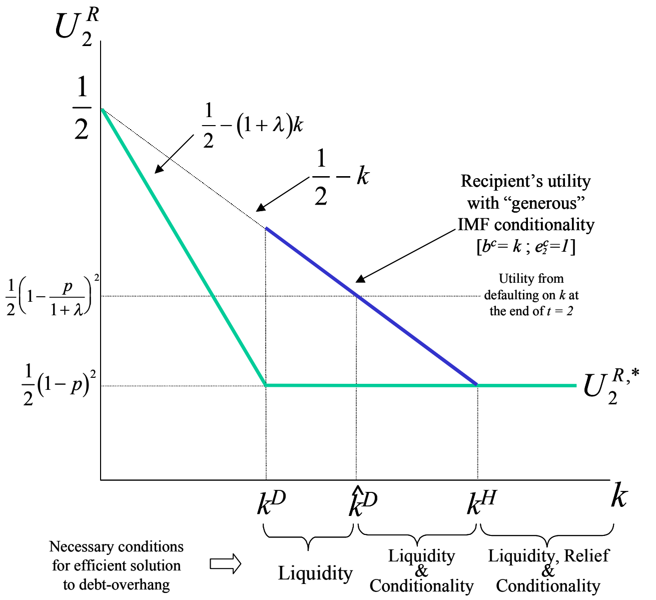


Figure 6: Debtor's utility as a function of external debt k and of the IMF's bail-out policy.

Liquidity without conditionality therefore can improve the efficiency of the interaction between private investors, the debtor and the IMF (i.e. all three parties are better off).[28] The

[27] This effect is due to the fact that the marginal benefit to the debtor of a reduction in the liquidity 'tax' λ is larger if the country is repaying its debt as opposed to defaulting, given that in the latter case the country reduces its exposure to the tax by distorting its production. Therefore, if the effective λ−penalty faced by the debtor is reduced (which is the case for $b > 0$) a higher value of the debt k is required to equalise debtor utility in the debt-repayment and default equilibrium respectively.

[28] If investors are sufficiently patient *within* the $t = 2$ period, they may be willing to provide the unconditional liquidity themselves, rendering IMF intervention unnecessary for $k < \hat{k}^D$. Our assumption of "investor panic" once a crisis hits is effectively equivalent to a high-impatience assumpion, which rules out this form of PSI, and forces the IMF to act as a sole provider of both emergency lending and conditionality. Allowing for private contributions

absence of conditionality does not however allow the Fund to maximise the efficiency of crisis resolution and it does not provide it with enough flexibility to maximise its own utility.

The first effect is clear from the fact that $\hat{k}^D < k^H$: there is a range of debt (namely $k \in (\hat{k}^D, k^H]$ for which liquidity plus conditionality can avoid default and sub-optimal effort, whilst unconditional liquidity cannot. In this range of k the debtor would like to be able to pre-commit, after a crisis has occurred, to repaying the entirety of the debt and set $e_2 = 1$, in exchange for a bail-out equal to k (which is equivalent to a debt stand-still until the end of $t = 2$). However, if conditionality is not imposed (e.g. because e_2 cannot be observed by the Fund), the debtor has incentives to renege on the promise of full debt repayment at the end of $t = 2$, and minimise the cost of default by setting $e_2 = 1 - \frac{p}{1+\lambda}$ (and obtain utility $U_2^R = \frac{1}{2}\left(1 - \frac{p}{1+\lambda}\right)^2$ - as shown in Figure 6). Anticipating this, the Fund would not release the unconditional $b = k$ bail-out, if $k \in (\hat{k}^D, k^H]$.

By making the bail-out conditional on reform effort, the IMF can solve this ex-post debtor commitment problem, and allow for efficient debt-rescheduling to take place. By doing so the Fund is also able to lend under adequate safeguards, and prevent debtor default on the bail-out. This implies that in this range of k ($k \in (\hat{k}^D, k^H]$), the conditional bail-out contract displays a circular logic: the provision of emergency liquidity allows the Fund to impose conditionality (i.e. additional reform effort), which in turn protects IMF resources and enables the bail-out to take place.

From the debtor's perspective, the most attractive conditional liquidity package which solves its commitment problem is one which sets $b^c = k$ and $e_2^c = 1$, i.e. it reschedules all of the debt repayment, and it allows for optimal domestic production (from the debtor's point of view). As long as $k < k^H$, the debtor would be better off than under the no-IMF outcome (see Figure 6), and it would therefore benefit from the commitment technology provided by IMF conditionality (i.e. there is "ownership" of the program).[29] The IMF would also be better off relative to the no-conditionality outcome: it would earn $1-b$, which is greater than its utility in the no bail-out case (i.e. $U^{IMF} = 1 - p$), given that the maximum value for the bail-out, k^H, is lower than p.

There is however a second role of conditionality, in the form of debtor rent-extraction, which is present in the baseline contract described by Proposition 1. If the IMF is not concerned about leaving any rents to the debtor country in a crisis-situation, then it will use the ability to contract upon e_2 both to maximise the range of k for which default can be avoided under adequate safeguards (i.e. provide commitment technology to the debtor), *and* to extract rents from its intervention (i.e. by increasing e_2 and -when possible- decreasing b, relative to the "ownership" package described above).[30] If this is the case, the debtor is effectively indifferent between IMF intervention or default, and "ownership" of the program is therefore limited.[31]

to the provision of bail-out funds (which, for example, might be necessary if the IMF is resource-constrained) may give rise to issues of IMF moral hazard. That is, the IMF might not face sufficiently strong incentives to monitor and enforce its conditionality adequately if it is not the sole (or main) provider of the bail-out (see Rodrik (1996) for an argument along these lines).

[29]We explore the debtor moral hazard implications of a "generous" IMF, which leaves rents to the debtor country, in the next section of the paper.

[30]As Proposition 1 shows, the IMF finds it optimal to depart from a policy of full debt rescheduling ($b^c = k$) for $k \in (k^D, k^M)$, as long as the $k^D > \frac{\lambda}{2}$ condition holds. Note that $\hat{k}^D > k^M$ so that in the range of k where conditioning on e_2 is required to enable the Fund to lend under adequate safeguards, the IMF captures the rents from its intervention by increasing e_2 above 1 (rather than by reducing b below k).

[31]On the other hand, the investors' participation constraint is slack in the baseline conditionality model, im-

The ability to condition on e_2 therefore allows the Fund both to provide valuable commitment to debtor and to extract the value of this commitment via demanding higher reform efforts.

For $k > k^H$ conditionality collapses, given that the IMF cannot provide enough incentives to the recipient not to default on its external debt. If this is the case, there is a need for debt relief to avoid default and enhance the efficiency of crisis resolution (we elaborate on this point in Section 5). Three ranges for the values of external debt can be therefore identified in terms of required components of a debt-overhang resolution package: for $k \in (k^D, \hat{k}^D)$ unconditional liquidity is required; for $k \in [\hat{k}^D, k^H]$ conditional liquidity is necessary; and for $k > k^H$ both conditional liquidity and relief are required.[32] These ranges are illustrated in Figure 6.

3.2 Ex-Ante Commitment Technology

3.2.1 The Equilibrium with Endogenous Capital without the IMF

A way to model the ex-ante (i.e. pre-crisis) effects of IMF conditionality is to endogenise period 1 investment k. This allows for an analysis of the efficiency properties of the investment equilibria with and without IMF intervention, focusing on the issue of credit-rationing.

To endogenise period 1 capital inflows k we specify a function which describes the return to investors of holding their capital at home, rather than investing it abroad (i.e. in the debtor country). We assume that the total capital stock in the investor country equals S, that k indicates the amount of capital invested abroad, and that aggregate domestic returns are given by a quadratic function of the following form:

$$f(S-k) = (1+S-\alpha)(S-k) - \frac{(S-k)^2}{2}$$

This domestic return function displays diminishing marginal returns, which induce investors to transfer some of their capital abroad. α is a parameter which measures the relative attractiveness of holding capital abroad, and which we restrict to lie between 0 and S.[33]

The returns from holding capital abroad are given by the rate of interest (which we assume to be fixed at 0) and by the probability of a crisis, followed by a default. If no crisis occurs, or if default is not the post-crisis equilibrium (which is the case for $k \leq k^D$ in the absence of IMF intervention), the marginal product of capital held abroad equals 1, and optimal investment behaviour is given by $k^* = \alpha$ (i.e. the investor keeps capital at home until f' equals 1, and invests the rest abroad).[34]

If a crisis can occur (i.e. the probability of crisis γ is positive) and default is the post-crisis outcome ($k > k^D$) the marginal product of k is given by $1-\gamma$, and therefore the optimal investment level is given by $k^* = \alpha - \gamma$ (which equalises marginal returns from holding capital abroad or at home).

plying that they benefit from IMF bail-outs. As we show in Section 5, the IMF has incentives to make both the debtor's and the investors' IRCs bind only if investor moral hazard is significant.

[32] This effect is also highlighted by Claessens and Diwan (1990) and Diwan and Rodrik (1992).

[33] In what follows we assume that S is high enough (namely $S > k^D + \frac{1}{1+\lambda}$), to ensure that all the cases we characterise in this section can occur in equilibrium.

[34] $f'(S-k) = 1$ yields $1 + S - k^* = 1 + S - \alpha$, which implies $k^* = \alpha$.

Equilibrium capital flows to the debtor country are therefore as follows:

$$k^* = \begin{cases} \alpha & \text{for } \alpha < k^D \\ k^D & \text{for } \alpha \in [k^D, \gamma + k^D] \\ \alpha - \gamma & \text{for } \alpha > \gamma + k^D \end{cases} \tag{2}$$

so that, in equilibrium, defaults occurs only for $\alpha > \gamma + k^D$.

This equilibrium, which is sub-game perfect, displays credit rationing (as in Fafchamps (1996)) in the sense that the level of investment is below the no-default level α for $\alpha \geq k^D$. This reduction in credit is due to the presence of sovereign risk, which does not allow the debt contract to be fully enforceable and creates the possibility of strategic default by the debtor.

Proposition 2 below describes the efficiency properties of the credit-rationing equilibrium.

Proposition 2 *In the absence of IMF intervention credit rationing occurs in the sub-game perfect equilibrium of the game if $\alpha \geq k^D$. This is ex-ante Pareto inefficient if the following two conditions hold:*

(i) $\gamma < \frac{1}{1+\lambda}$

(ii) $\alpha \in \left(k^D, k^D + \frac{1}{1+\lambda}\right)$

For $\alpha \geq k^D + \frac{1}{1+\lambda}$ credit rationing is an equilibrium outcome but it is not ex-ante inefficient.

Proof. For the equilibrium with credit rationing to be ex-ante inefficient we require the expected two-period utility of the debtor to be lower than in a counter-factual situation where it can precommit to always repay the creditor in a situation of crisis, and therefore receives the unconstrained amount $k^* = \alpha$.

Comparing expected utilities we obtain the following condition for inefficiency:

$$\frac{\alpha - k^*}{\alpha - k^D} > \gamma(1 + \lambda) \tag{3}$$

where k^* is given by equation (2). For $\alpha \in (k^D, k^D + \gamma)$ we have that $k^* = k^D$ so that an inefficiency results if and only if $\gamma < \frac{1}{(1+\lambda)}$. For $\alpha > k^D + \gamma$, we have that $k^* = \alpha - \gamma$, which implies that expression (3) holds if and only if $\alpha < k^D + \frac{1}{1+\lambda}$, which also requires the condition $\gamma < \frac{1}{1+\lambda}$ to hold. ■

Proposition 2 shows that the sub-game perfect equilibrium (SPE) of the creditor-debtor game is inefficient if two conditions (one on the probability of a crisis taking place and one on the relative productivity of international capital investment) hold. If these conditions are satisfied, the debtor's expected utility would be higher if it were able to credibly precommit not to default on its external debt if a crisis occurs.[35] This is because the loss from the lower level of foreign capital inflows due to credit-rationing outweighs the benefit of being able to default on this debt if a crisis takes place.

It is convenient to interpret the benefit of discretion to the debtor (i.e. the benefits which arise from the ability to default) as the expected value of a put option. Under this interpretation, the two conditions identified by Proposition 2 determine when the value of the put is lower than

[35] In the absence of commitment technology (e.g. such as IMF conditionality) this is not possible, given that default is ex-post optimal for high enough levels of capital ($k > k^D$).

the benefit from commitment (i.e. the additional inflow of capital in period 1), implying that the SPE of the investors-debtor game is inefficient. This is the case if the probability of crisis γ (i.e. the probability of being able to exercise the option) is relatively low;[36] and if α, the profitability for investors of lending to the debtor country, is sufficiently high so as to generate costly credit rationing (i.e. $\alpha > k^D$), but also not high enough as to increase the expected value of the option beyond the value of commitment (i.e. $\alpha < k^D + \frac{1}{1+\lambda}$). This second effect arises because as α increases so do capital inflows at $t = 1$, which in turn increases the value of the option of being able to default on debt if a crisis occurs. That is, the debtor payoff in the debt-repayment equilibrium, which decreases with k^*, can be interpreted as the "stock price" which determines the value of the put. Higher capital inflows therefore lower the "stock price" and raise the value of the option.[37]

Figure 7 illustrates the nature of the equilibrium with endogenous capital without the IMF, and the range of α for which this is inefficient.

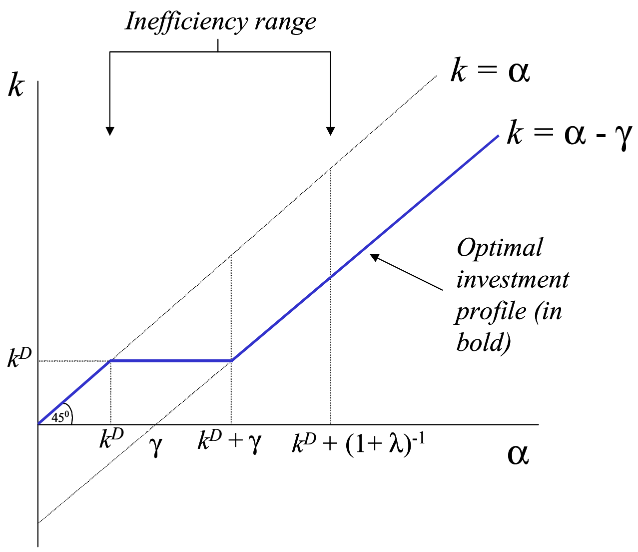


Figure 7: The investment equilibrium without the IMF (for $\gamma < \frac{1}{1+\lambda}$).

3.2.2 The Equilibrium with Endogenous Capital with the IMF

As shown in Section 2 the presence of the IMF avoids default for all levels of capital below $k^H \equiv (1 + \lambda)k^D$, as long as $p > \bar{p}$. This has the direct effect of reducing credit rationing by

[36] The condition for γ is equivalent to the condition for the optimality of imposing capital controls: if $\gamma(1+\lambda) > 1$, the debtor country would like to minimise the inflows of capital at $t = 1$, and therefore any credit rationing is efficient, from its perspective.

[37] This effect can also be seen by reference to Figure 6, which displays the (fixed) benefit of defaulting once a crisis has occurred (i.e. the strike price of the put) and the utility obtained under the debt-repayment outcome (i.e. the underlying stock price). This shows that the value of the default put and the stock price are inversely related.

stimulating capital flows ex-ante, which are now given by:

$$k^{*,IMF} = \begin{cases} \alpha & \text{for } \alpha < k^H \\ k^H & \text{for } \alpha \in [k^H, \gamma + k^H] \\ \alpha - \gamma & \text{for } \alpha > \gamma + k^H \end{cases}$$

The enhanced level of capital flows in turn reduces the range of values for which a Pareto inefficient outcome realises (potentially eliminating it), as shown in Figure 8, and described by the following Lemma.

Lemma 1 *In a situation where the debtor-creditor relationship is characterised by Pareto inefficiency (see Proposition 2), IMF conditionality has the following impact:*

- *it eliminates the inefficiency for* $\gamma \in \left[\frac{1-\lambda p(1-\frac{p}{2})}{1+\lambda}, \frac{1}{1+\lambda}\right)$
- *if* $\gamma < \frac{1-\lambda p(1-\frac{p}{2})}{1+\lambda}$, *IMF conditionality reduces the range of* α *for which the ex-ante equilibrium is inefficient to* $\alpha \in \left((1+\eta)k^H, k^D + \frac{1}{1+\lambda}\right)$, *where* $\eta \equiv \frac{\gamma\lambda}{1-\gamma(1+\lambda)} > 0$.

Proof. The presence of the IMF eliminates credit rationing for $\alpha \leq k^H$. For $\alpha \in \left[k^H, k^H + \gamma\right]$, IMF intervention enhances capital flows, affecting the efficiency comparison between commitment and discretion relative to the no IMF case. For this range of α the expected utility comparison between commitment and discretion (equation (3)) now yields the following inequality as a condition for inefficient credit rationing:

$$\alpha > \left(1 + \frac{\gamma\lambda}{1-\gamma(1+\lambda)}\right) k^H \equiv (1+\eta)k^H$$

where $\eta \equiv \frac{\gamma\lambda}{1-\gamma(1+\lambda)} > 0$ (given that $\gamma < \frac{1}{1+\lambda}$, from Proposition 2). This condition is consistent with $\alpha < k^H + \gamma$ iff $\gamma < \frac{1-\lambda p(1-\frac{p}{2})}{1+\lambda} < \frac{1}{1+\lambda}$.

For $\alpha > k^H + \gamma$, the efficiency comparison is the same in the IMF and no IMF cases. Inefficient credit rationing therefore characterises the IMF case if $\alpha < k^D + \frac{1}{1+\lambda}$. This is consistent with $\alpha > k^H + \gamma$ also if $\gamma < \frac{1-\lambda p(1-\frac{p}{2})}{1+\lambda}$. Therefore if the latter condition holds IMF intervention cannot prevent inefficient credit-rationing for $\alpha \in ((1+\eta)k^H, k^D + \frac{1}{1+\lambda})$. ■

The IMF, by intervening with a conditional bail-out and maximising its objective function can therefore provide commitment technology to the recipient, reducing the incidence of ex-ante inefficient credit-rationing by providing the debtor with a credible "promise" to repay its external debt. Some inefficiency may however remain since credit rationing persists also with the presence of the IMF, implying that the value of the commitment never to default (which the IMF cannot supply) may still exceed the expected value of the "discretion put".

As Lemma 1 shows the IMF eliminates the inefficiency if γ is not excessively low or if α does not lie within a given intermediate range (which is narrower than the corresponding range in the no-IMF scenario). If γ is particularly low, the expected value of the ability to default is relatively small, implying that there is a range of α for which the value of commitment exceeds the expected value of the default put option, also in the presence of the IMF. As in the no-IMF case, this occurs if α is sufficiently high so as to generate costly credit rationing, but not high enough so as to increase the expected value of put beyond the value of commitment.[38]

The efficiency properties of the IMF-equilibrium are summarised in Figure 8.

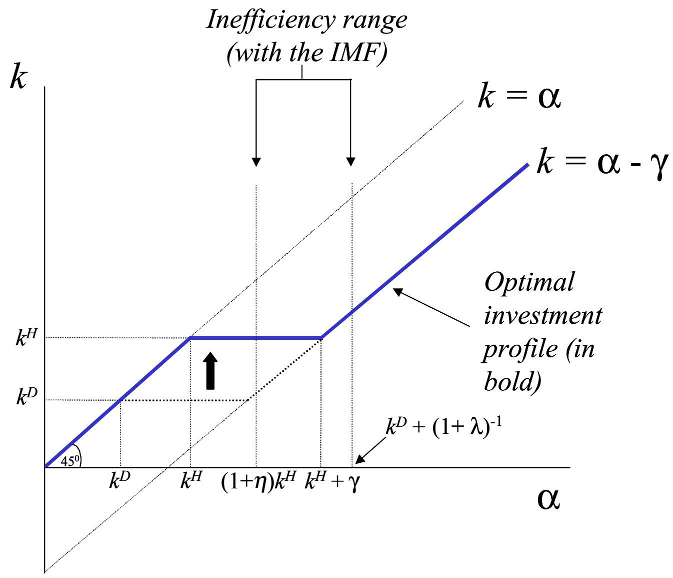


Figure 8: The investment equilibrium with the IMF (for $\gamma < \frac{1-\lambda p(1-\frac{p}{2})}{1+\lambda}$).

This sub-section has shown the IMF conditionality can enhance the efficiency of debtor-investor interaction, by limiting the negative impact of sovereign risk on capital inflows and mitigating the consequences of the debtor's lack of commitment power. In contrast to the case of the provision of ex-post restraint by the Fund analysed in Section 3.1, the IMF does not extract all the benefits from its provision of ex-ante commitment technology to the debtor. In this sense, program "ownership" is restored from the debtor's point of view, even though the debtor's ex-post participation constraint binds.

As our modelling has highlighted, the Fund is able to act as an effective agency of restraint by guaranteeing higher debt-repayment to foreign investors, thus reducing the impact of ex-ante credit-rationing. The benefits of higher capital inflows brought about by the presence of the IMF may however have costs associated with them. If investor moral hazard (i.e. the risk of excessive lending) is a concern, given its impact on the probability of a crisis occurring, the Fund may wish to reduce its role as a guarantor of foreign investment when a crisis hits and mitigate capital inflows via a relatively "tough" position on PSI in a situation of crisis. We take up this issue in Section 5 of the paper.

[38] Note that at the value of α where credit rationing sets in (i.e. $\alpha = k^H$) the expected benefits of discretion exceed those of commitment, given that the latter are small (i.e. credit rationing is limited) whilst the former reflect the value of being able to default on relatively high amounts of debt ($k \geq k^H$), and are therefore relatively large. Commitment is therefore valuable only if debt is strictly higher than k^H (namely, $k > (1+\eta)\,k^H$).

4 Debtor Moral Hazard

The issue of "moral hazard" is frequently discussed in the context of the IMF and of its crisis interventions. Some commentators argue that the IMF, by providing insurance to both debtors and investors in a crisis situation, can induce moral hazard, i.e. insufficient crisis-prevention efforts on the part of the debtor ("debtor moral hazard") and excessive ex-ante investment on the part of the creditors ("investor moral hazard") (see, e.g. Goldstein (2000) and IFIAC (2000)). In this section we extend the baseline model introduced in Section 2 in order to address the issue of debtor moral hazard, and we devote the next section of the paper to the analysis of PSI and investor moral hazard.

4.1 Extended Set-up

In the standard insurance principal-agent model moral hazard refers to a situation where a risk-averse agent who purchases insurance from a principal against some negative realisation and who can exercise some costly and unobservable effort to reduce the probability of the "bad" event taking place, does not spontaneously apply the first-best level of effort. The solution to the moral hazard problem (in the context of insurance) is to make the agent's payoff depend on the realisation of the negative event, to elicit at least second-best effort (i.e. co-insurance takes place in equilibrium).

The baseline model of crisis and conditionality used in this paper needs to be augmented in a number of directions to produce a moral hazard framework. In this extension we add some properties of a moral hazard situation, but not all of them. In doing so we offer a model which captures some of the basic features of the recent moral hazard debate on the role of the IMF (e.g. IMF bail-outs can lead to a sub-optimally high probability of crises), but where first-best effort can be restored in equilibrium with an appropriate conditionality contract, so that, strictly speaking, there is not a moral hazard problem.

The two features we add to the baseline model are as follows. Firstly, we assume that the probability of crisis is endogenous, and a function of the agent's (i.e. the debtor country's) first period effort.[39] In particular we assume that $\gamma(e_1) = \bar{\gamma} - \delta_e e_1$, where $\delta_e \geq 0$ and $\bar{\gamma} \leq 1$.[40] The agent therefore has some control over the probability of the negative event (i.e. the crisis) taking place via its economic policies, and a moral hazard situation may occur if it provides sub-optimal crisis-prevention effort.

The second feature we add is that there is a level of unconditional funds (βk, where $\beta \in (0, 1)$) which the IMF always transfers to the debtor country in a situation of crisis. This may be due to "global stability" considerations, which effectively force the IMF to intervene even in the absence of conditionality; or to an assumption that the Fund is constrained not to extract all

[39] In the following section of the paper we introduce investor moral hazard considerations using a similar reduced-form approach, and assuming that γ is a function of k (capital inflows at $t = 1$) rather than of e_1. In both this and the next extension we abstract from the *direct* effect of the presence of the IMF on the probability of crisis (as opposed to indirect effects, via e_1 and k). This direct effect can be expected to be negative (i.e. the presence of emergency IMF lending enhances the probability that investors will not suffer capital losses in the event of a crisis, therefore reducing the investors' incentives to run - see e.g. Lane and Phillips (2000)). On the other hand if an IMF bail-out partially finances a run (see Zettelmeyer (2000)) it may actually increase the probability of a crisis.

[40] Additional parameter restrictions, which are made explicit below, are necessary to ensure that $\gamma \geq 0$ in equilibrium.

of the rents of its intervention from the debtor, for "political-economy" reasons (e.g. some ex-post program "ownership" needs to be granted to the debtor).[41] Assuming that βk is released unconditionally is equivalent (in terms of its implications for the recipient's utility) to assuming that the optimal IMF contract is not fully implemented by the recipient so that there is some unpunished 'slippage' (i.e. $1 \leq e_2 < e_2^c$). The unconditional release of βk can therefore be thought of as the outcome of IMF discretion in enforcing the baseline conditionality contract (i.e. a lack of full commitment/bargaining power).

This second assumption is also necessary for a debtor moral hazard model to be developed: without it (i.e. as in the baseline model) the IMF makes the individual rationality constraint of the agent bind when it intervenes (i.e. it supplies the lowest feasible level of bail-out funds), thereby not providing any "relief" to the debtor country from the occurrence of crisis and therefore not reducing the incentives for the agent to avoid the crisis ex-ante. In addition, given the binding IRC assumption, the IMF cannot use ex-post (or traditional) conditionality to incentivise ex-ante efforts to prevent the crisis, since it cannot lower the debtor country's payoff relative to its outside option (i.e. repaying the debt without bail-out or defaulting).[42] If on the other hand, as we assume in this section, the IMF leaves the debtor country's participation constraint slack following a crisis, the debtor country will face reduced incentives to avoid the crisis ex-ante, implying that the Fund's intervention causes some debtor moral hazard.

We also make the two following simplifying assumptions in this extension, in order to focus the analysis on the issue of debtor moral hazard: the penalty rate p is "high enough", so that default is not an option for the debtor country if a crisis occurs;[43] and the debtor country knows the level of external debt k before setting its first-period effort level e_1, implying that it can set it as a function of the expected cost a crisis.

4.2 Ex-ante Conditionality

In the absence of IMF conditionality, the debtor country sets e_1 to maximise its expected utility, and always sets $e_2 = 1$ (given the assumption of high p). The optimal level of e_1 (defined as e_1^*) is therefore as follows:

$$e_1^* \in \arg\max_{e_1} e_1(1 - \frac{e_1}{2}) + k + (1 - \gamma(e_1))\frac{1}{2} + \gamma(e_1)(\frac{1}{2} - (1+\lambda)k + \lambda\beta k)$$

where βk is the level of unconditional bail-out provided by the IMF in the event of a crisis. This yields:

$$e_1^*(k, \beta) = 1 + \delta_e(1 + \lambda(1-\beta))k \tag{4}$$

which is decreasing in β and increasing in k. For $\beta > 0$ "moral hazard" therefore sets-in, lowering the level of first period effort below its first-best level $e_1^{FB}(k) \equiv 1 + \delta_e(1+\lambda)k$ (which corresponds to the case of $\beta = 0$).

[41] Appendix A.3.2 explicitly derives the presence of βk unconditional transfers from an assumption of IMF "altruism". Alternatively, βk could be derived as the outcome of a bargain between the IMF and the recipient country, which allows both parties to do better than their outside option, and which therefore would leave some rents to the recipient.

[42] That is, IMF conditionality cannot act as co-insurance, as implicitly suggested by Fischer (1999).

[43] This is equivalent to assuming that $k \leq k^D$. It implies that the debtor always repays βk to the Fund at the end of $t = 2$, so that the net impact of the IMF's unconditional loan on the debtor's utility equals $\lambda\beta k$.

How can the IMF mitigate this moral hazard effect? One direct way would be to commit not to release βk unconditionally after a crisis, and instead commit to offer a conditionality contract of the form modelled in the baseline framework of this paper, which makes the IRC binding (and which would therefore induce first-best first-period effort). Ex-post this is however not credible, given the assumption of limited IMF commitment power introduced in this section, and would not be a sub-game perfect outcome. *Ex-post* conditionality therefore cannot avoid moral hazard.

Another instrument to mitigate moral hazard which does not rely on the IMF's ability to commit to be "tough" ex-post, is *ex-ante* conditionality, that is conditionality on the first-period effort level. This would consist of an offer by the IMF of a *higher* bail-out in the event of a crisis (i.e. $b > \beta k$) in exchange for a level of first period effort e_1 which is above e_1^*.[44] This contract is similar to an insurance contract, where the premium paid by the recipient is in the form of higher crisis-prevention efforts.[45] It is also closely related to the "pre-qualification" (or "selectivity") proposals put forward by a number of commentators recently (e.g. Goldstein (2000), the IFIAC (Meltzer) Report (2000) and, in the related context of conditional aid, Collier *et al.* (1997)), and partially adopted by the Fund with the introduction of a new facility (the Contingent Credit Line (CCL)) in 1999.[46]

The optimal ex-ante conditionality contract $\{e_1^c, b^c\}$ is derived from the following program:[47]

$$\begin{aligned} \max_{e_1,b} E(U^{IMF}) &= \gamma(e_1)(1-b) + (1-\gamma(e_1)) \\ s.t. &: E(U^R(e_1,b)) \geq E\left(U^R(e_1^*,\beta k)\right) \text{ (IRC}\,(\beta)\,) \\ &: b \in [\beta k, k] \end{aligned}$$

where $E(U^i)$ indicates expected two-period utility (for $i \in \{IMF, R\}$), so that $E\left(U^R(e_1^*,\beta k)\right)$ is the reservation two-period expected utility of the recipient, obtained by setting $e_1 = e_1^*$ and receiving βk if a crisis takes place. As in the baseline model, we assume that the Fund does not directly benefit from first period reform efforts.[48] Given this assumption, the IMF's objective with ex-ante conditionality therefore boils down to the minimisation of its expected bail-out $\gamma(e_1)b$, i.e. the IMF offers an ex-ante contract in order to safeguard its resources ex-post.

Figure 9 illustrates the IMF's ex-ante program, showing its formal similarity with baseline ex-post conditionality (see Figure 2). Also in this case we can plot the agent's IRC in (b, e) space, showing here first–period effort, and illustrate how higher (expected) bail-out funds can purchase higher effort. In Figure 9 we show a situation where the $b \leq k$ constraint does not

[44] This requires us to assume that the IMF is able to commit not to abuse the trust of the debtor country ex-post (i.e. if a crisis takes place), which is a more reasonable assumption to make than the one of "commitment to be tough" (i.e. never releasing βk unconditionally), given the institutional nature of the Fund.

[45] Given risk-neutrality, the agent is not benefiting from insurance *per se*, but rather from the additional net transfer received from the IMF in period 2, which is traded-off with extra effort in period 1. Note that of course the IMF could make this transfer in period 1, thus directly purchasing a higher e_1. We do not allow for this because it would violate the Fund's Articles of Agreement, whilst ex-ante conditionality is consistent with them (i.e. the transfer from the IMF to the recipient occurs only in the event of balance of payments disequilibrium and is in the form of a loan).

[46] See Appendix A.1 for a description of the CCL.

[47] The "adequate safeguards" constraint does not apply given our assumption of a sufficiently high p. Note that this assumption also implies that we can set e_2 equal to 1.

[48] Allowing for this would be straightforward but would not allow us to focus exclusively on the debtor moral hazard prevention role of conditionality, which is the aim of this extension.

bind, so that first-period effort can be restored to the first-best via ex-ante conditionality, as stated by Proposition 3 below.

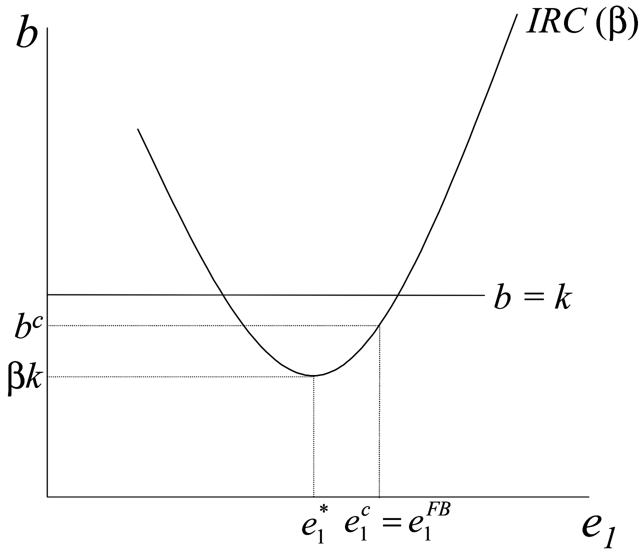


Figure 9: The ex-ante conditionality program.

Proposition 3 describes the properties of the optimal ex-ante conditionality contract.

Proposition 3

(i) For k low enough (i.e. $k \leq k^T(\beta) \equiv \frac{2(1-\beta)(\bar{\gamma}-\delta_e)}{\delta_e^2(\beta^2\lambda+2(1+\lambda)(1-\beta))}$*), we have that* $b^c \leq k, \gamma(e_1^c) \geq 0$ *and the IMF can apply first-best ex-ante conditionality, which is as follows:*

$$
\begin{aligned}
e_1^c &= e_1^{FB}(k) \equiv 1 + \delta_e(1+\lambda)k \\
b^c &= \left(1 + \frac{\lambda\delta_e^2\beta k}{2\gamma(e_1^c)}\right)\beta k
\end{aligned}
$$

(ii) If $k \in (k^T(\beta), k^U(\beta)]$*, then ex-ante conditionality can only elicit second-best effort by the agent and the* $b \leq k$ *constraint binds. Therefore:*

$$
\begin{aligned}
e_1^c &= e_1^{SB}(\beta,k) \in [e_1^*(\beta,k), e_1^{FB}(k)) \\
b^c &= k
\end{aligned}
$$

$k^U(\beta)$ *is given the condition* $\gamma(e_1^*(\beta,k)) = 0$*, which yields* $k^U(\beta) = \frac{\bar{\gamma}-\delta_e}{\delta_e^2(1+\lambda(1-\beta))} \geq k^T(\beta)$*. At* $k = k^U(\beta)$*, we have* $e_1^c = e_1^*(\beta,k)$*. Values of k higher than* $k^U(\beta)$ *are ruled out because of the non-negativity constraint on* $\gamma(e_1)$*.*

Proof. See Appendix A.2.2. ■

Figure 10 illustrates the results given in Proposition 3. The left hand panel plots the two threshold schedules of k described in the Proposition: $k^T(\beta)$, below which first-best ex-ante conditionality can be imposed; and $k^U(\beta)$, which gives the upper bound on acceptable values of k (to satisfy the non-negativity constraint on γ), and is also the locus of values of k such that no ex-ante conditionality is imposed by the Fund (i.e. $e_1^c = e_1^*$). The right hand panel plots the corresponding values of first-best effort, with and without ex-ante conditionality, for a given value of β (i.e. $\beta = \beta_0$). Conditional effort departs from the first-best for $k > k^T(\beta)$, and it converges to the no-conditionality level at $k = k^U(\beta)$.

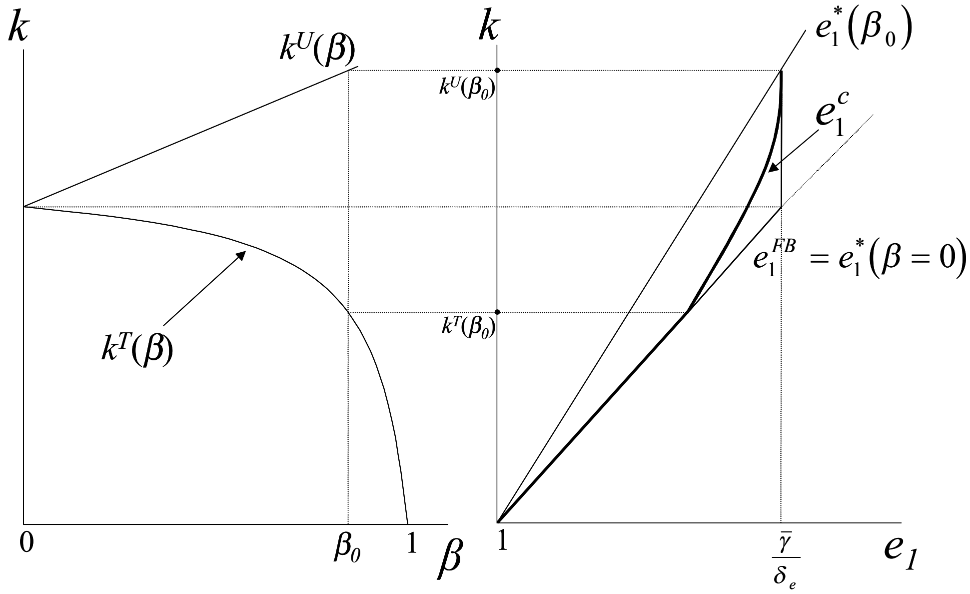


Figure 10: The ex-ante conditionality contract.

Proposition 3 shows that if k, the capital inflow at $t = 1$, is sufficiently low relative to the degree of unconditional IMF ex-post support (measured by β), ex-ante conditionality can restore first-best effort in the pre-crisis period by means of the promise of a higher bail-out in the event of a crisis. However, if k is relatively high, the $b \leq k$ constraint binds, and the IMF needs to settle for second-best ex-ante conditionality. This is because high level of capital inflows in the first period imply a greater wedge between e_1^* and e_1^{FB}. Given the increasing marginal cost of effort for the debtor, this implies that $b^c(k)$ under first-best ex-ante conditionality is strictly convex in k, so that there is a level a threshold level of k (defined here as $k^T(\beta)$) beyond which $b \leq k$ binds and the IMF can only impose second-best conditionality. This threshold level of k is decreasing in β, which measures how 'close' the IMF already is to the $b \leq k$ constraint in the second period, and it tends to 0 as β tends to 1 (see Figure 10).

An implication of this result is that "important" (or high-β) countries (i.e. those which receive more unconditional support from the IMF in the event of a crisis) are subject to less intense ex-ante conditionality ceteris paribus, and that their ex-ante policy may still be characterised by moral hazard in spite of the IMF ex-ante intervention. IMF discretion (which is measured by β) therefore acts as a budget constraint on the Fund's debtor moral hazard prevention activities, making first-best pre-crisis effort unattainable, for large enough levels of external debt.

Second-best conditionality converges to the no-conditionality outcome as k increases further beyond $k^T(\beta)$. This is due to the fact that high levels of capital inflows increase the agent's first-best period effort also in the absence of conditionality, lowering the probability of a crisis taking place. If k is high enough, the agent finds it optimal to drive this probability to 0 even without conditionality (i.e. setting $e_1 = \frac{\gamma}{\delta_e}$), implying that the IMF's unconditional bail-out βk never materialises and that the Fund has therefore no incentives to apply ex-ante conditionality. For this level of k (i.e. $k = k^H(\beta)$) the first and second-best levels of first-period effort effectively converge, given that they are both constrained by the $\gamma(e_1) \geq 0$ condition (see Figure 10).

Proposition 3 also reveals that the IMF does not face incentives to use ex-ante conditionality to increase the agent's level of effort in period 1 beyond the first-best level (i.e. the level which is optimal for the agent if $\beta = 0$). This is because the purpose of ex-ante conditionality as we have modelled in this extension is to minimise the expected use of IMF resources at $t = 2$.[49] Expected bail-out minimisation implies the maximisation of expected recipient utility *net of the IMF bail-out* (given the presence of the binding IRC(β)), which by definition is achieved by setting $e_1 = e_1^{FB}$. The IMF therefore only departs from imposing ex-ante first-best effort if it faces a binding budget constraint, due to the $b \leq k$ restriction.

4.3 Discussion

This section of the paper has examined under what conditions the presence of the IMF can induce "moral hazard" on the part of the debtor country. We have shown that this takes place if the IMF cannot commit not to intervene in the event of a crisis in the absence of agreement on an ex-post conditionality package (or, alternatively, if it inflates bail-outs or allows for program-slippage under ex-post conditionality, thus not making the agent's constraint bind). If this is the case, ex-ante conditionality can be used to eliminate (or at least reduce) debtor moral hazard.

Our modelling of ex-ante conditionality (or "pre-qualification") is in contrast to some of the current discussion of this issue in the context of the IFA debate, where this is seen as incompatible with Fund lending to non-prequalified countries and a justification for Fund inaction when a crisis hits these countries (e.g. as in the "pre-qualify and stand-by" approach advocated by IFIAC (2000)). In our model *ex-ante conditionality is motivated by the inability of the Fund to credibly stand-by in the event of large crises.* In this sense it is more consistent with current Fund practice, where ex-ante facilities (such as the CCL) co-exist with traditional ex-post lending.

The discussion of ex-ante conditionality presented in this section also points to a potentially important trade-off between traditional ex-post conditionality and ex-ante contracts. The Fund will face a trade-off between these two, at the margin, given the presence of a common budget constraint, which is due to the fact that overall IMF lending b cannot exceed capital outflows k. An increase in ex-ante conditionality (i.e. the promise of additional unconditional funds if a crisis occurs) lowers the availability of funds for ex-post conditionality, which is needed to induce higher reform efforts and, where relevant, avoid outright default, during a crisis.

This financial trade-off may imply a choice for the Fund between crisis prevention and the minimisation of the expected recourse to its funds on the one hand, and the safeguarding of its lending via conditionality on ex-post effort on the other. If the Fund is constrained to maximise the extent to which its loans are repaid by debtor countries (e.g. because of its Articles of Agreement), it will face a bias in favour of ex-post conditionality. This in turn could lead to a

[49] Additional motives for the Fund to impose ex-ante conditionality would be present if the Fund was directly concerned with reform effort at $t = 1$, or if the IMF faced an opportunity cost from a crisis outcome which exceeded the cost of releasing unconditional bail-out funds. The latter can be introduced by assuming that the Fund earns a reservation utility if a crisis does not take place. This is the approach we follow in the next section of the paper, to analyse the issue of investor moral hazard.

sub-optimally high probability of crises taking place, and an excessive recourse to Fund bail-outs.

5 Private Sector Involvement (PSI) and Investor Moral Hazard

One of the more controversial issues in the current debate on how to reform the international financial architecture is the one of investor 'moral hazard' and of the appropriate degree of *Private Sector Involvement* (PSI)[50] in crisis-resolution (see, e.g., Goldstein (2000), Eichengreen (2000) and Lane and Phillips (2000)). Many commentators (including the IMF) recognise that investor behaviour and incentives have a significant bearing on both crisis prevention and crisis resolution, and that the moral hazard induced by IMF intervention is a two-sided issue (i.e. involving investors as much as debtors).

Papers which discuss the issue of PSI in the context of the IFA (such as the ones cited above) are largely informal, and focus either on the mechanisms by which PSI can be implemented (e.g. IMF-sanctioned payments standstills and Collective Action Clauses (CACs) in bond contracts), or on the empirical question of whether investor moral hazard is a serious concern (see Lane and Phillips (2000)). In this section of the paper we formalise some of the insights on the rationale of PSI which are discussed in the IFA debate, and emphasize the role of PSI within the overall bail-out/conditionality package designed by the IMF in the aftermath of a balance of payments crisis. Modelling the issue of PSI within the general agency model presented in this paper enables us to identify the kind of trade-offs faced by the IMF in devising a PSI-policy, and to analyse the role of the link between PSI and investor moral hazard in affecting the Fund's position towards PSI.

To introduce the possibility of PSI in crisis resolution we augment the baseline conditionality model presented in Section 2 by allowing for debt relief.[51] That is, we allow investors to forgive some of the debt which the country owes to them following a crisis realisation. This might be done directly, if investors are able to co-ordinate their actions, or via the IMF, in the context of an IMF bail-out package. In what follows we firstly analyse the no-IMF benchmark level of PSI; we then examine the IMF's ex-post optimal PSI-policy, i.e. the extent of PSI which the IMF favours following a crisis occurrence; and, thirdly, we allow for investor moral hazard, and model under what circumstances the IMF might want to depart from its ex-post optimal PSI policy to mitigate investor moral hazard ex-ante.

Throughout this section we denote debt repayment as k^r, whilst k, as above, denotes the exogenous level of capital inflows at $t = 1$, and therefore the maximum debt repayment investors can demand if a crisis takes place.[52] We also introduce a new variable ψ, which measures the extent of PSI which occurs after a crisis. Debt-repayment is therefore negatively related to ψ (i.e. $\frac{\partial k^r(\psi)}{\partial \psi} < 0$) and, as we show below, it is convenient to express it using the following functional form: $k^r = (1 - \psi)\, k^D$.

[50] This is sometimes referred to as 'burden-sharing' or private sector 'bail-in'.

[51] We therefore use the terms debt relief and PSI interchangeably in what follows. Another form of PSI, which we do not formally consider here but which is partially discusssed in Section 3.1, is debt rescheduling.

[52] In Section 5.3 we endogenise k, following the approach introduced in Section 3.2, and we denote capital inflows at $t = 1$ as k^*.

5.1 PSI without the IMF

Without IMF bail-outs investors collectively have incentives to forgive all debt beyond k^D. This is because in the absence of debt-relief and for $k > k^D$, default takes place, and debt-overhang sets in. If this is the case, repayment by the debtor takes the form of the "gun-boat" penalty $\frac{p}{1+\lambda}e_2^*$, so that $k^r = \frac{p}{1+\lambda}(1-p) \equiv (1-\bar{\psi})k^D$, where $\bar{\psi} \equiv \frac{p}{2-p} > 0$. $\bar{\psi}$ denotes the maximum level of PSI investor can suffer from in the event of a crisis. If, on the other hand, the investors forgive all debt above k^D, they can induce both $e_2 = 1$ and the full repayment of k^D, so that $k^r = k^D > (1-\bar{\psi})k^D$. If this is the case, $\psi = 0$.[53]

Relief of all debt beyond k^D is therefore a Pareto efficient outcome, given that it removes the tax on effort present with debt-overhang (i.e. it induces efficient domestic production) and it raises debt-repayment (as in the classic model by Sachs (1989a)[54]). It however may not occur if there are multiple creditors who fail to co-ordinate and grant relief collectively. Depending on whether investors can co-ordinate effectively, the no-IMF benchmark level of the PSI variable is therefore either 0 or $\bar{\psi}$.

In the rest of this section of the paper, where we consider the IMF's optimal PSI policy, we assume that investors cannot co-ordinate their debt-relief offer, so that $\psi = \bar{\psi}$ in the absence of the IMF.

5.2 PSI with the IMF

We next consider the possibility of debt-relief in the context of IMF conditionality. In our set-up the IMF can effectively decide how much debt relief to grant to the debtor country, by making its bail-out conditional on both the effort exercised in the second period and the amount of capital repaid to the creditor (which may be below k). The optimal IMF contract therefore specifies three variables: e_2^c, b^c and ψ^c.

In offering this three-variable contract the IMF needs to satisfy both the debtor and the investors' participation constraint. The latter can be represented by the following condition: $\psi \leq \bar{\psi}$ (Investors' IRC), given our assumption that the investors are not able to collectively negotiate the efficient level of debt relief (i.e. set $\psi = 0$ after a crisis). We assume that if both IRCs are met, the contract is accepted by both parties and, in particular, the investors refrain from demanding any further debt-repayment and/or applying the gun-boat penalty pe_2.

We consider in what follows three cases for the IMF's PSI-policy. The first two relate to two possible attitudes of the Fund's toward PSI (*PSI-aversion* and *PSI-tolerance*), and allow us to identify two benchmark cases for the Fund's PSI policy. The third case, which we examine in the next sub-section, allows for investor moral hazard, and explores its implications on the Fund's optimal ex-ante PSI policy.

In both this and the next-subsection we restrict our attention to the cases where initial investment k is above k^D, which implies that the IMF has some flexibility in the determination of its PSI-policy (i.e. for $k \leq k^D$, the investor recovers the entirety of its initial investment, even in the absence of the IMF, so that there is no PSI).

[53] This does not imply that PSI is minimised, given that in the case of IMF intervention negative values of ψ are also possible, as it is shown below.

[54] The insight that it is preferable to set a fixed level of external debt rather than a variable income-dependent (and therefore distortionary) one is forcefully argued by Keynes (1919).

5.2.1 PSI-aversion

The first possibility we consider is that the IMF is *PSI-averse*, and that its preferences are lexicographic in debt relief (i.e. in the amount of un-paid debt): the IMF first minimises PSI, and then maximises its utility function, as specified in Section 2 (i.e. $U^{IMF} = e_2 - b$).[55]

These preferences imply that relief is only optimal for $k > k^H$, and that debt-repayment k^r therefore equals $\min((1-\underline{\psi})k^D, k)$, so that $\psi^c = \underline{\psi} \equiv -\lambda$. This is because, when $k > k^H$, limiting debt-repayment to k^H allows for some conditionality to be imposed (in particular, $e_2^c = 1$ and $b^c = k^H$, from Proposition 1(ii)), which gives the Fund utility of $1 - k^H$. This is higher than $1 - p$, the level obtained in the no-relief (and therefore no-conditionality) outcome. In addition, for $k > k^H$, the combination of conditionality and debt-relief implies a lower level of un-paid debt than the alternative (i.e. $k - (1 - \underline{\psi})k^D$ rather than $k - (1 - \bar{\psi})k^D$).

A PSI-averse IMF therefore maximises re-payment to the creditors, and allows for debt-relief only to the extent to which this enables it to be in a position to exercise some conditionality. This has the effect of reducing the extent to which PSI takes place after crises, relative to a situation with no IMF lending: PSI occurs only for high levels of debt ($k > k^H$), and debt-repayment is always higher than in the no-IMF benchmark (as long as $k > k^D$). A relief-averse IMF therefore does not make the investors' IRC bind ($\psi^c < \bar{\psi}$). Given that the debtor country is effectively indifferent relative to the IMF's bail-out (its IRC binds), this implies that most of the efficiency gains from the IMF's provision of emergency lending are appropriated by the foreign investors.

5.2.2 PSI-tolerance

An alternative possibility for the attitude of the IMF vis-à-vis debt relief is what we term here *PSI-tolerance*. A PSI-tolerant IMF trades-off PSI minimisation with its other two objectives of promoting reform effort and minimising its bail-outs, after a crisis has occurred. It therefore maximises the following function:

$$U^{IMF} = e_2 - b - (k - k^r(\psi))$$

If this is the case IMF finds it optimal to set $\psi^c = 0$, i.e. set $k^r = k^D$, like in the no-IMF debt-relief equilibrium described above, when investors were able to co-ordinate their actions after a crisis.

This result can be seen by considering the Fund's utility as a function of ψ, in the range $k^r(\psi) \in [k^r(\bar{\psi}), k^r(\underline{\psi})]$ (which ensures that the investors' IRC is met). It is possible to express U^{IMF} solely as a function of ψ, by replacing e_2 and b with their optimal levels as a function of

[55] It is possible to interpret a PSI-averse IMF as one which is 'captured' by foreign investors, and whose main concern is therefore the recovery of their capital. PSI-aversion is the natural (and more moderate) extension of the assumption on IMF behaviour used in Section 2, whereby full debt repayment (i.e. no relief) is a pre-condition for IMF intervention following a crisis.

debt repayment $k^r(\psi)$.[56] $U^{IMF}(\psi)$ is therefore as follows (after some simplification):

$$U^{IMF}(\psi) = \begin{cases} e_2^c(k^r(\psi)) - k & \text{for } k^r(\psi) \in (k^M, k^r(\underline{\psi}) \equiv k^H] \\ 1 + \frac{\lambda}{2} - (k - k^D) + \frac{k^D}{\lambda}\psi & \text{for } k^r(\psi) \in (k^D, k^M] \\ 1 + \frac{\lambda}{2} - k + (1-\psi)k^D & \text{for } k^r(\psi) \in (\frac{\lambda}{2}, k^D] \\ e_2^c(k^r(\psi)) - k & \text{for } k^r(\psi) \in [k^r(\bar{\psi}), \frac{\lambda}{2}] \end{cases} \tag{5}$$

which assumes that $k > k^H$ and $k^r(\bar{\psi}) < \frac{\lambda}{2}$.[57]

This implies that the IMF's marginal utility relative to the level of PSI ψ is:

$$\frac{\partial U^{IMF}}{\partial \psi} = \begin{cases} \frac{k^D}{\sqrt{2(k^H - k^r(\psi))}} & \text{for } k^r(\psi) \in (k^M, k^r(\underline{\psi}) \equiv k^H] \\ \frac{k^D}{\lambda} & \text{for } k^r(\psi) \in (k^D, k^M] \\ -k^D & \text{for } k^r(\psi) \in (\frac{\lambda}{2}, k^D] \\ -\frac{\lambda k^D}{\sqrt{2\lambda k^r}} & \text{for } k^r(\psi) \in [k^r(\bar{\psi}), \frac{\lambda}{2}] \end{cases} \tag{6}$$

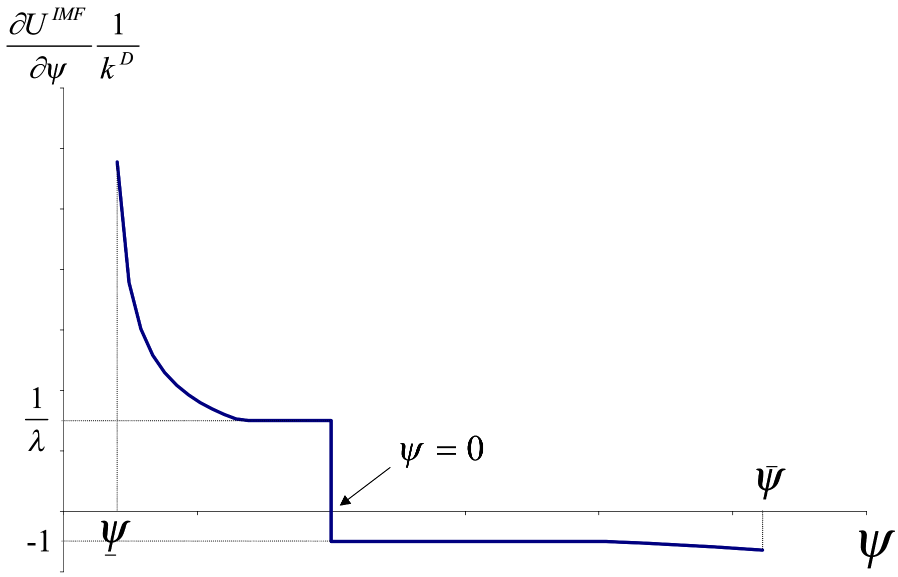


Figure 11: The IMF's marginal benefit from PSI.

This shows that the IMF's marginal utility of PSI is positive for $k^r(\psi) \in (k^D, k^H]$, i.e. for $\psi \in [\underline{\psi}, 0)$, and it is negative for $\psi > 0$ (see Figure 11). A PSI-tolerant IMF therefore finds it optimal to set $\psi^c = 0$. This is so because for $k^r(\psi) \in (k^M, k^H]$ any increase in debt-relief implies a one-to-one reduction in the level of the bail-out (given that $b^c = k^r(\psi)$ in that range), and it also has a positive impact on adjustment effort (which is decreasing in $k^r(\psi)$ in that range), therefore leading to a positive net marginal impact of PSI for the Fund. In the range

[56] These are given by the solutions for e_2^c and b^c in Proposition 1, substituting $k^r(\psi)$ for k (i.e. relaxing the assumption implicit in Proposition 1 that all foreign debt is repaid).

[57] If the first condition does not hold, the $k^r \leq k$ constraint will bind for $k^r \leq k^H$, limiting the range of $k^r(\psi)$ which the IMF can consider.

If the second condition does not hold, there are only three ranges of $k^r(\psi)$ which need to be considered for the purposes of computing $U^{IMF}(\psi)$, given that the investors' IRC rules out the fourth.

$k^r \in (k^D, k^M]$ on the other hand, reform effort is unaffected by the amount of debt-relief (given that it is at first-best anyway) but bail-outs are reduced by more than one-to-one in response to any given debt relief (i.e. $\frac{\partial b^c}{\partial k^r(\psi)} = \frac{1+\lambda}{\lambda}$, from the debtor's IRC), again implying a positive marginal impact of PSI. Any PSI beyond $\psi = 0$ however has a negative marginal utility, given that its negative impact on the intensity of reform effort and on the level of debt-repayment.

The optimal PSI policy for a relief-tolerant IMF is therefore to set $\psi^c = 0$, which allows it to implement first-best conditionality, i.e. $e_2^c = 1 + \lambda$ and $b^c = \frac{\lambda}{2}$. This also allows the Fund to fully relax the "adequate safeguards constraint" (ASC), ensuring that the recipient of the bail-out never has an incentive to default on the IMF, even for low values of p.

This combined conditionality-PSI contract leaves no rents to the investors if their outside option is one of co-ordinated debt-relief (i.e. their IRC binds if this is the case). If, on the other hand, investors are unable to co-ordinate their debt relief effort, IMF intervention effectively reduces PSI, and leads to a positive gain for investors, which is exactly equal to the benefits from being able to co-ordinate.

5.3 PSI and Investor Moral Hazard

The results presented so far in this section show how the nature of ex-post conditionality and the IMF's attitude towards debt-repayment affect the Fund's PSI policy. In particular they clarify the role of PSI within the overall conditionality package offered by the IMF following a crisis, showing that PSI is a tool the IMF can use to enhance its leverage in a post-crisis situation.

Another consideration which is likely to play a significant role in shaping the IMF's PSI policy, and which is currently attracting considerable attention in the IFA debate, is the one of investor moral hazard. Like in the case of debtor moral hazard (see Section 4), this can be interpreted as referring to a situation where pre-crisis investor behaviour leads to a sub-optimal probability of a crisis taking place. This section explores the implications of the presence of moral hazard on the part of foreign investors on the IMF's optimal PSI and conditionality policy. We assume in this section that the IMF is relief-tolerant, and that its ex-post optimal PSI policy is therefore to set $\psi^c = 0$. We also assume that the IMF is able to pre-commit ex-ante (i.e. before a crisis) to any PSI policy, even if this is ex-post sub-optimal. The purpose of this extension is to model the impact of PSI on investor moral hazard, and understand whether and under what circumstances the IMF might want to ex-ante deviate from its ex-post optimal PSI policy.

5.3.1 Extended Set-up

For an investor moral hazard situation to arise we need to make two additions to our basic set-up, in a similar fashion to the debtor moral hazard extension modelled in Section 4. Firstly, the probability of crisis occurring γ needs to be a function of capital inflows before a crisis. Secondly, the IMF needs to find a crisis event costly, so that it is concerned with mitigating investor moral hazard.

Endogenous crisis and capital inflows We endogenise investment (i.e. foreign capital inflows in period 1) as in the analysis of credit rationing presented in Section 3.2. The only difference we introduce here is that the probability of crisis is a function of investment behaviour, according to the following linear function:

$$\gamma(k) = \bar{\gamma} + \delta_k k$$

where $\bar{\gamma} > 0$ and $\delta_k > 0$.[58] This is intended to capture, in reduced form, the fact that the higher the level of foreign debt of a given country, the more likely it is that it will be subject to a sudden and unexpected balance of payments crisis.[59]

Given the domestic production function introduced in Section 3.2, and our earlier assumption that PSI is maximised (i.e. $\psi = \bar{\psi}$) if a crisis occurs without IMF intervention, optimal foreign capital inflows at $t = 1$, $k^*(\psi)$, and debt repayment if a crisis takes place, $k^r(\psi)$, are given by the following functions (in the absence of IMF bail-outs):

$$k^*(\bar{\psi}) = \begin{cases} \alpha & \text{for } \alpha < k^D \\ k^D & \text{for } \alpha \in [k^D, \hat{\alpha}(\bar{\psi})] \\ \hat{k}(\bar{\psi}) & \text{for } \alpha > \hat{\alpha}(\bar{\psi}) \end{cases} \Rightarrow k^r(\bar{\psi}) = \begin{cases} k^* & \text{for } \alpha \leq \hat{\alpha}(\bar{\psi}) \\ (1-\bar{\psi})k^D & \text{for } \alpha > \hat{\alpha}(\bar{\psi}) \end{cases} \tag{7}$$

where $\hat{\alpha}(\psi) = \bar{\gamma} + (1 + \delta_k(1+\psi))k^D$ and $\hat{k}(\psi) = \frac{\alpha - \bar{\gamma} + \delta_k(1-\psi)k^D}{1+2\delta_k}$ (see Figure 12 for an illustration of $k^*(\bar{\psi})$).

Relative to the optimal investment schedule with a fixed probability of crisis (see equation (2)), capital flows are now less sensitive to the productivity of foreign investment if default is the ex-post outcome in the event of a crisis (i.e. $\frac{\partial k^*}{\partial \alpha} < 1$ for $\alpha > \hat{\alpha}(\bar{\psi})$); and the threshold level of productivity of foreign investment above which investors are willing to accept a capital loss in the event of a crisis (defined as $\hat{\alpha}(\bar{\psi})$ here) is higher. Investors therefore internalise some of the moral hazard due to their behaviour, and lend capital to the debtor country more prudently.

In the presence of IMF bail-outs both the optimal investment function ($k^*(\psi)$) and the repaid investment function ($k^r(\psi)$) can be generalised as a function of the IMF's choice of the PSI variable ψ if a crisis takes place, as long as $\psi \in (0, \bar{\psi})$.[60] This is the case given our assumption that the IMF is be able to commit, before a crisis, to any (ex-post) PSI policy, which allows it to therefore affect ex-ante investment and the probability of a crisis taking place.

In particular, $\hat{\alpha}(\psi)$ is a positive function of PSI (i.e. the lower PSI, the less likely is it that investment will be constrained at k^D); and $\hat{k}(\psi)$ is negative function of PSI (i.e. the lower PSI, the higher the level of capital flows for a given value of α).

Figure 12 summarises the optimal investment schedule at $t = 1$, as a function of the productivity of foreign investment α and the level of PSI if a crisis takes place.

[58] In equilibrium the following condition needs to hold to ensure that $\gamma(k) \leq 1$ for $\alpha \in [0, 1]$:

$$\bar{\gamma} \leq 1 - \frac{\delta_k k^D}{1 + 2\delta_k}$$

[59] Like in the case of debtor moral hazard, we do not seek to model the process of crisis-determination in detail here. We introduce it as a simple reduced form relationship, to enable us to provide a stylised model of investor moral hazard.

[60] Negative values of ψ imply that investors recover more than k^D in the event of a crisis (as it is the case with a relief-averse IMF). If this is the case, investment is rationed relative to the no-crisis benchmark for values of α greater than k^D. We do not consider the case of IMF relief-aversion in this extension, and we can therefore restrict ψ to be non-negative.

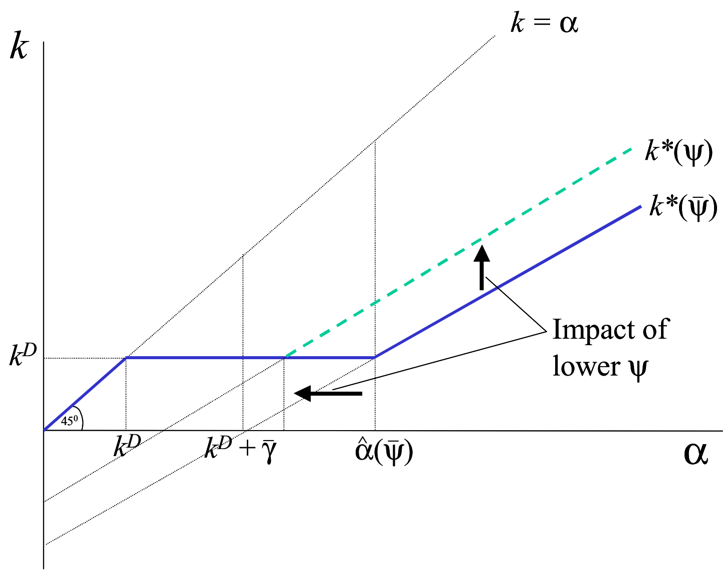


Figure 12: Optimal capital flows at $t = 1$ as a function of PSI.

Costly crisis The second addition we make to our baseline set-up here is to assume that the IMF always prefers a no-crisis outcome to a crisis one. In the debtor moral hazard case this was the case because of the presence of a level of unconditional bail-out funds βk which the IMF had to disburse in the event of crisis (and which also generated the debtor moral hazard problem); here we assume, for simplicity, an exogenous loss to the IMF from a crisis, which takes the form of a reservation utility $\bar{U}$, which the IMF earns if a crisis does *not* take place.

We set $\bar{U}$ to be higher than the IMF's maximum utility if a crisis takes place (which is obtained by setting $\psi^c = 0$, $e_2^c = 1 + \lambda$ and $b^c = \frac{\lambda}{2}$), so that the IMF always finds a crisis costly, independently of the effectiveness of its crisis-resolution. This implies the following restriction on $\bar{U}$:

$$\bar{U} > \bar{U}_{\min} \equiv 1 + \frac{\lambda}{2} + \frac{(1+\delta_k)k^D + \bar{\gamma} - \alpha}{1 + 2\delta_k}$$

Why is there investor moral hazard ? The fact that the Fund (i.e. the principal) always finds a crisis costly, and that foreign investors (i.e. the agent, in this set-up) have some control over the likelihood of a crisis taking place, generates a moral hazard setting (in the sense discussed in the case of debtor moral hazard): the agent may not autonomously choose an efficient level of investment from the principal's point of view.

As in the case of debtor moral hazard, the potential for inefficient agent behaviour is generated by the presence of IMF 'insurance': it is the Fund's inability (or unwillingness) to make the agent's participation constraint bind ex-post which is at the root of the moral hazard problem. In the debtor's case this was by assumption (i.e. in Section 4 we assumed that the Fund could not commit not to transfer βk unconditionally if a crisis took place). In the case of investor moral hazard the investors' IRC may be slack because of the Fund's ex-post incentives to increase debt repayment to creditors relative to the no-IMF benchmark, to be able to maximise the effectiveness of its conditionality (i.e. obtain the most favourable combination of debtor reform effort and bail-out). This increases the investors' utility in a crisis situation relative to a no-IMF counterfactual, inducing an increase in ex-ante capital inflows which in turn increases the likelihood of the crisis occurring.

As we show in the next sub-section, given both the ex-ante and ex-post impact of its PSI policy, the IMF may find it optimal to accept an inferior crisis resolution outcome and commit to make the investors' IRC bind ex-post, in order to deter capital inflows at $t = 1$, and reduce investor moral hazard. As we show below, the IMF will have incentives to depart from ex-post optimum PSI ($\psi^c = 0$) and pre-commit to a positive level of ψ if the crisis is sufficiently costly and if the impact of capital inflows on the probability of crisis is relatively high.

5.3.2 The IMF's Optimal Choice of PSI

The IMF's PSI program consists of the maximisation of its expected utility at $t = 1$ with respect to the PSI variable ψ, subject to both the debtor's and the investors' IRCs. As shown above, in the case of the relief-tolerant IMF, any choice of ψ (as long as the IMF can commit to it ex-ante, and that it respects the investors' IRC) uniquely determines the optimal levels of effort level and the bail-out at $t = 2$ if a crisis takes place. This allows us to express the Fund's ex-ante utility uniquely as a function of ψ, and also to ignore the constraints associated with ex-post conditionality, since these are met by the optimal baseline conditionality contract implied by ψ.

Formally, defining as $V(\psi)$ the IMF's expected utility at $t = 2$, the IMF ex-ante program is as follows:

$$\begin{aligned} \max_{\psi} V(\psi) &= (1-\gamma(\psi))\bar{U} + \gamma(\psi)(U(\psi)) \\ s.t. &: \quad \psi < \bar{\psi} \text{ (Investors' IRC)} \end{aligned} \tag{8}$$

where $\gamma(\psi)$ is short form for $\gamma(k^*(\psi))$, and $U(\psi)$ denotes the Fund's utility if a crisis occurs and optimal (ex-post) conditionality is implemented with debt-repayment equal to $k^r(\psi)$. $U(\psi)$ is given by equation (5), omitting the IMF superscript for notational simplicity. $k^*(\psi)$ and $k^r(\psi)$ are given by equation (7), substituting ψ for $\bar{\psi}$.

A first step to note for the solution to this program is that we can restrict our attention to positive values of ψ, given the assumption of IMF PSI-tolerance, which implies that the ex-post optimal ψ is 0. The only reason for the IMF to depart from this level is to reduce the probability of a crisis occurring by increasing ψ, which implies that any level of ψ less than 0 has to be sub-optimal ex-ante.

A second simplification of the program is to note that optimal solution for ψ depends on the value of α, the productivity of investing abroad for the investor at $t = 1$.[61] It is possible to incorporate the effect of different values of this parameter on the IMF's optimal choice of ψ by amending the investors' IRC, i.e. limiting the range of possible values of ψ^c. If $\alpha > \hat{\alpha}(\bar{\psi})$, then any value of ψ^c lower than $\bar{\psi}$ has an impact on ex-ante investment behaviour and on the probability of crisis. If however $\alpha \in [\hat{\alpha}(0), \hat{\alpha}(\bar{\psi})]$, then the choice of ψ by the IMF has an impact on ex-ante capital flows only if $\psi^c < \hat{\alpha}^{-1}(\alpha)$, i.e. if PSI is low enough, relative to α, so that

[61] Note that the IMF's program is uninteresting if $\alpha < \hat{\alpha}(0)$ given that if this is the case $k^*(\psi) < k^D$ always, and the Fund's PSI policy cannot affect ex-ante capital flows. This in turn implies that the ex-ante optimal level of PSI coincides with the ex-post optimum, i.e. $\psi^c = 0$. We can therefore restrict our attention to cases where $\alpha \geq \hat{\alpha}(0)$.

ex-ante investment reacts positively to the level of PSI chosen by the Fund. If ψ is above this threshold value, ex-ante investment remains constrained at k^D (i.e. the investor prefers to avoid the risk of default), and the IMF's PSI policy is not capable of affecting the probability of the crisis occurring. Given that the only reason why a relief-tolerant IMF might wish to depart from its ex-post optimal policy of $\psi^c = 0$ is to reduce the probability of a crisis taking place by increasing PSI, values of ψ above $\hat{\alpha}^{-1}(\alpha)$ can be ruled out as solutions to the IMF's ex-ante program. This implies that we can impose $\psi^c < \min(\bar{\psi}, \hat{\alpha}^{-1}(\alpha)) \equiv \hat{\psi}$. Accounting for the implications of IMF relief-tolerance noted above, the range of possible values of ψ^c is therefore $\psi \in [0, \hat{\psi}]$.

Given the above restriction on the possible values of ψ, it is straightforward to derive that $V(\psi)$ is convex in ψ, i.e. $V''(\psi) = 2\gamma'(\psi)U'(\psi) > 0$, as long as $k^r(\bar{\psi}) > \frac{\lambda}{2}$ (which implies that $U''(\psi) = 0$).[62] This is because both $\gamma'(\psi)$ and $U'(\psi)$ are negative for $\psi \in [0, \hat{\psi}]$.[63] This in turn implies that there is no interior solution to the IMF's ex-ante program and that, depending on parameter values, the IMF will either choose to set $\psi^c = 0$ (i.e. follow its ex-post optimal PSI policy) or to set $\psi^c = \hat{\psi}$ (i.e. pre-commit to a higher level of PSI to deter capital inflows).[64]

Substitution of the values for these two corner solutions into equation (8) shows that $V(\hat{\psi}) > V(0)$ (i.e. $\psi^c = \hat{\psi} > 0$) if the following condition holds:

$$\delta_k^2(1-\kappa)\bar{U} > F + \frac{(1+\delta_k)\,\delta_k^2}{1+2\delta_k}(2-\hat{\psi})k^D \qquad (C(PSI))$$

where $\kappa \equiv \frac{1+\frac{\lambda}{2}}{\bar{U}}$, and $F \equiv \frac{\delta_k(\alpha-\bar{\gamma})}{1+2\delta_k} + (1+\delta_k)\bar{\gamma} > 0$.

C(PSI) shows that the IMF finds it optimal to pre-commit to increase PSI relative to its ex-post optimal level if *both* δ_k and $\bar{U}$ are high enough - i.e. the level of capital inflows has a sufficiently high impact on the probability of crisis, and the crisis is sufficiently costly. In particular $\bar{U}$ needs to be strictly higher than $\bar{U}_{\min}$ for *C(PSI)* to be satisfied. Defining $\Delta\bar{U} = \bar{U} - \bar{U}_{\min}$, *C (PSI)* implies that $\Delta\bar{U} > \frac{1+\delta_k}{1+2\delta_k}\left[\frac{\delta_k\alpha+(1+\delta_k)\bar{\gamma}}{\delta_k^2} + (1-\hat{\psi})k^D\right] > 0$. Figure 13 illustrates the ratio $\frac{\Delta\bar{U}}{\bar{U}_{\min}}$ as a function of δ_k, showing how for low values of δ_k, $\bar{U}$ needs to be considerably higher than the maximum utility earned by the IMF in a crisis situation (i.e. $\bar{U}_{\min}$) for the Fund

[62] The condition $k^r(\bar{\psi}) \equiv \frac{p(1-p)}{1+\lambda} > \frac{\lambda}{2}$ is necessary to set $U''(\psi) = 0$ (see equation 6). If this is not satisfied, we have $V''(\psi) = 2\gamma' U' + \gamma U''$, which, for U'' negative enough, might be negative. If this is the case, there might be an interior solution to the ex-ante IMF program (i.e. the investors' IRC never binds), which would still imply the possibility of a departure from the ex-post optimal PSI policy of setting $\psi^c = 0$. The main policy implication of this analysis of investor moral hazard and PSI would therefore be unaffected.

[63] In particular, $\gamma'(\psi) = -\frac{\delta_k^2}{1+2\delta_k}k^D$. $U'(\psi)$ is given by equation (6).

[64] The reason why no interior solution exists to the IMF's ex-ante PSI program can be seen by considering the marginal benefit and marginal cost to the IMF of increasing PSI relative to 0 and moving towards $\hat{\psi}$. The first derivative of the Fund's ex-ante utility is as follows:

$$V'(\psi) = -\gamma'(\psi)(\bar{U} - U(\psi)) + \gamma(\psi)U'(\psi)$$

The first term of this expression can be interpreted as the marginal benefit of increasing ψ above 0: the reduction in the probability of a crisis times the opportunity cost of a crisis. This is positive and increasing in ψ, given that $U'(\psi) < 0$ and $\gamma''(\psi) = 0$. The negative of the second term is the marginal cost of increasing ψ: the expected loss in utility if a crisis occurs. This is decreasing in ψ, given that $U'(\psi)$ is constant and $\gamma(\psi)$ is decreasing in ψ. Therefore, when deciding whether to depart from its ex-post optimum of $\psi^c = 0$, the IMF is faced with an increasing marginal benefit schedule, and a decreasing marginal cost one: if it is beneficial to increase ψ above 0 it is therefore always optimal to do so as much as possible (i.e. make the investors' IRC bind, whenever possible).

to find it optimal to depart from its ex-post optimal PSI policy.[65]

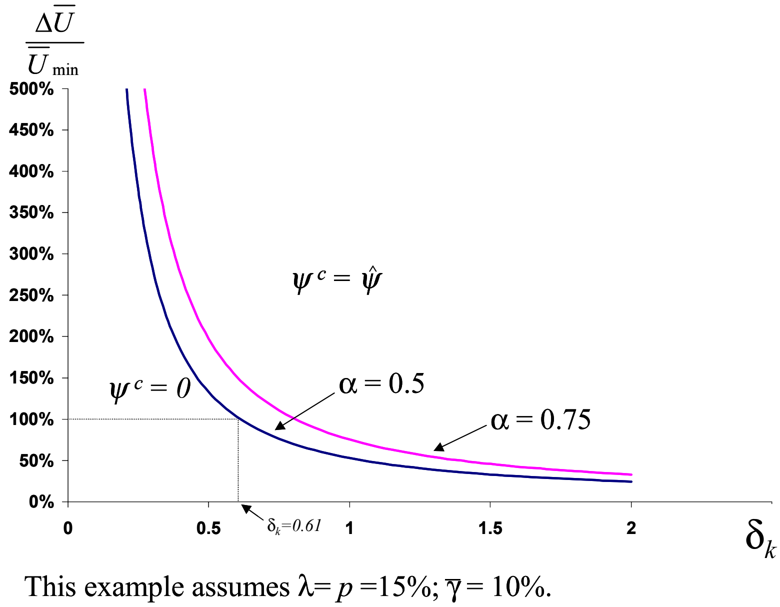


Figure 13: Threshold values for $\frac{\Delta \bar{U}}{\bar{U}_{\min}}$ as a function of δ_k.

Summarising the results obtained in this sub-section, we have found that there are conditions under which the IMF faces incentives to use its PSI policy to reduce the incidence of investor moral hazard and, by implication, the level of ex-ante capital inflows. If these conditions are satisfied the IMF finds it optimal to 'promise' to engage in sub-optimal ex-post crisis resolution, characterised by 'excessive' PSI. If the Fund is unable to commit to this ex-post sub-optimal PSI policy, we have that ex-ante capital inflows may be too high (i.e. there is investor moral hazard), and that investors earn positive rents as a result of IMF intervention.

5.4 Discussion

This section has discussed the role of PSI in both crisis prevention and resolution. It has shown that, ex-post (i.e. after a crisis), the extent to which PSI takes place has an impact on the conditionality contract, and on the IMF's 'returns' from conditionality. In the presence of high levels of external debt ($k > k^H$), PSI is a pre-condition for effective crisis resolution. At lower levels of debt ($k \leq k^H$), a PSI-tolerant IMF finds it optimal to allow for some PSI as part of its conditionality, in order to enhance the effectiveness of crisis resolution.

Ex-ante (i.e. before a crisis), expected PSI affects the inflow of foreign capital and, in the presence of investor moral hazard considerations, the probability of a crisis taking place.

Given this role of PSI, we have identified some key drivers which can be expected to affect the level of PSI included in the Fund's overall conditionality package following a crisis. These include the attitude of the Fund to PSI (i.e. *aversion* vs. *tolerance*), its ability to credibly commit before a crisis to an ex-post sub-optimal level of PSI, the investors' outside option (which is a function of their ability to act collectively following a crisis) and, finally, the seriousness of the concern

[65] The restriction on $\bar{\gamma}$ stated in Footnote 58 is satisfied for all the parameter values plotted in Figure 13.

for investor moral hazard. We have shown that a relief-tolerant IMF with access to commitment technology has incentives to commit to maximise PSI ex-ante, if investor moral hazard is strong and if investors are relatively weak (in the sense that they are unable to co-ordinate on an efficient resolution of the crisis). If one of these two conditions does not hold (or if the IMF is not credible in its promises), PSI will be at its ex-post optimum. If the reason why maximum PSI is not attainable is either lack of commitment power on the part of the Fund or the ability of investors to co-ordinate following a crisis, then investor moral hazard may not be mitigated in equilibrium.

The discussion of PSI presented in this section also raises distributional and efficiency considerations with regard to the Fund's post-crisis intervention. Ex-post (i.e. following a crisis) debtor countries are indifferent to the Fund's choice of conditionality contract (including its PSI component) if the IMF can commit to make their IRC bind (as in our baseline model). If the IMF's commitment power is limited, as in our debtor moral hazard extension, the debtor country may able to benefit from any rents extracted by the Fund as a result of its PSI policy (i.e. the β parameter introduced in Section 4 may be a function of ψ). If this is the case, the Fund may be facing a trade-off between the mitigation of investor and debtor moral hazard respectively.

Investors on the other hand are never indifferent to the Fund's choice of ψ, and their welfare is maximised by a PSI-averse IMF (i.e. one which sets $\psi^c = -\lambda$). Any choice of PSI above this level implies a utility transfer from the investors to the IMF. If the IMF's and the investors' utility is weighed equally from the point of view of global welfare, this enhances overall efficiency.[66]

Finally, from the point of view of ex-ante efficiency, the ex-post optimal PSI policy followed by a PSI-tolerant Fund may be sub-optimal. If debtors benefit from the commitment technology afforded by IMF conditionality in terms of a reduction in inefficient credit-rationing (see Section 3.2), a more lenient PSI policy might benefit both debtors and investors in expected utility terms, offsetting the benefits to the Fund of higher PSI ex-post. If the IMF is concerned about the issue of ex-ante credit-rationing (and if investor moral hazard is not too much of a concern) the Fund may in fact find it optimal to set $\psi^c < 0$ (or at least refrain from setting $\psi^c = \bar{\psi}$), thus increasing the ex-ante utility of both debtors and investors.[67]

6 Conclusion

This paper has presented an agency framework to analyse IMF conditional lending. This model can account for both a standard interpretation of IMF conditionality as a 'safeguard' of scarce IMF resources (e.g. as applied until the debt crisis of the 1980s) and for a more contemporary approach to conditionality, which stresses the implications of conditionality on debtor-commitment, debtor-moral hazard, and PSI. We have shown that "conditionality as a safeguard" of limited IMF resources can be compatible with "conditionality as commitment technology", and it can relieve inefficient ex-ante credit rationing.

We have also described a context in which the IMF can induce both debtor and investor

[66] This is clear from the expression for the Fund's marginal utility from PSI (see Figure 11). Lowering ψ below 0 has a marginal cost for the Fund of at least $\frac{k^D}{\lambda}$, which is always greater than the investors' marginal benefit of lower ψ (i.e. -$\frac{\partial k^r(\psi)}{\partial \psi} = k^D$).

[67] For instance, if the IMF's ex-ante utility includes a concern for credit rationing, e.g. $V(\psi) = (1-\gamma(\psi))\bar{U} + \gamma(\psi)U - (\alpha - k^*(\psi))$, then the condition for $\psi^c = \hat{\psi}$ $(C(PSI))$ is harder to satisfy, given that it includes an extra δ_k term on the right-hand side.

moral hazard, because of its inability to pre-commit to extract all the rents from its efficient crisis intervention. Debtor moral hazard can only be mitigated via ex-ante conditionality (or pre-qualification). However, especially in the presence of strict IMF budget constraints (which may be partially due to its inability to commit to limited ex-post bail-outs), moral-hazard reduction may have to be traded-off with less effective safeguards on IMF loans. If the IMF is constrained to lend under adequate safeguards, it may bias its intervention towards crisis resolution rather than crisis prevention, leading to a sub-optimally high probability of crisis.

We have also shown that PSI is a central component of IMF's rescue packages. PSI can be an enabling condition for effective crisis resolution, and it determines the IMF's 'returns' from intervening in a crisis. The optimal level of PSI if a crisis occurs may however lead to excessive ex-ante capital inflows, generating an investor moral hazard problem. This implies that the Fund may find it optimal to commit to a tougher stance of PSI ex-ante, to reduce capital inflows.

A general theme which has emerged throughout this paper is that are conflicts between the various functions which IMF conditionality can fulfill. For instance, between the mitigation of investor moral hazard and relaxation of inefficient ex-ante credit rationing; between debtor program ownership (or the transfer of efficient ex-post commitment technology) and the presence of debtor moral hazard; between ex-ante conditionality (crisis-prevention) and ex-post conditionality (lending under adequate safeguards); and, finally, between efficient crisis resolution (from the Fund's perspective) and reducing the rents of foreign investors (which has implications for investor moral hazard).

This variety of trade-offs shows that designing the optimal IMF conditionality contract is a complex issue and that policy-makers need to be aware of the potential pitfalls of a partial-equilibrium analysis when considering possible reforms of the International Financial Architecture.

A Appendix

A.1 IMF Lending Practices[68]

Strictly speaking, the IMF does not lend money to its members. It instead allows members which are experiencing external disequilibrium to purchase foreign exchange from the IMF's usable resources (made up of the quota contributions of members whose currency is sufficiently strong) using their own currency, which needs to be "re-purchased" within the timeframe imposed by the Fund. To finance these operations the IMF can draw on its quotas (which are currently at about $300bn, following a 45% increase in 1999), and on Agreements to Borrow additional funds with a number of its members.[69]

The rationale for the IMF's lending practices originates with the desire of the architects of the Bretton Woods system to establish an institution through which creditor countries could support debtor countries in their adjustment efforts, and eliminate (or at least reduce) their temptation to resort to measures which could compromise or damage international cooperation.[70] The

[68] This section is partially based on IMF (2000a), IMF (2000b), IMF (2001) and Boughton (2000).

[69] The General Agreement to Borrow (of 1962) was resorted to in July 1998, to support an EFF to Russia, and a New Agreement to Borrow was set up with 23 lending countries in 1998, and used later that year to help finance a Standy-By to Brazil.

[70] Such as competitive depreciations and foreign trade restrictions, which had characterised the inter-war years

practice of conditionality emerged soon after Bretton Woods, after an initial debate on whether access to IMF funds should be "automatic" or "managed" (Friedman (1983)). Conditionality was introduced in 1952, with the establishment of Stand-By Arrangements, to "balance the safeguards for the Fund with assurance to the member of the availability of resources" (IMF (2000b), p. 36).

The current conditionality practices (as set out in the 1979 Guidelines on Conditionality) combine the phasing of lending and the use of quantitative performance criteria for "upper tranche credit", that is credit in excess of the first 25% of the member's quota (which is instead subject to very light conditionality). The standard vehicle of conditional lending is the Stand-By Arrangement (SBA), which is intended to implement the IMF's mandate by providing limited (given the presence of access limits) and temporary assistance to countries experiencing cyclical external disequilibrium. After the fall of Bretton Woods and the first oil shock, with current account deficits becoming more pronounced, the IMF introduced an additional lending facility (the Extended Fund Facility (EFF)), which was intended to facilitate adjustment to more structural external disequilibrium, and is therefore longer (see Table 1). Both SBAs and EFFs are subject to a basic rate, which is based on the interest on risk-free assets in industrial countries (the SDR rate), plus a small surcharge.[71]

In the 1980s these two facilities were supplemented by the Structural Adjustment Facility and Enhanced Structural Adjustment Facility (subsequently renamed the Poverty Reduction and Growth Facility (PRGF)) for concessional lending to low-income countries. More recently, to deal with the larger and more rapid capital-account crises of the 1990s, the IMF introduced the Supplementary Reserve Facility (SRF), which is larger than SBAs but subject to higher ("penal") charges, and a Contingent Credit Line (CCL), intended to deal with "contagion"-induced capital outflows, and which is subject to "ex-ante conditionality" (or pre-qualification). The SRF was first used to finance the assistance package to Korea (in December 1997), which was 20 times its quota, and has subsequently been used for Russia (1998), Brazil (1998), Turkey (2000/2001), and Argentina (2000/2001). No IMF member has so far used the CCL. The features of these IMF facilities are summarised in Table 1 below, which incorporates some of the recent modifications introduced by the Fund following a review of its facilities undertaken in 2000.

Figure 14 plots the commitments made by the Fund since 1950, both in monetary terms (in 2000 US$) and in terms of number of programs. IMF lending picked up during the Suez Crisis, and also following the collapse of the Bretton Woods system, with large packages to Italy and the UK in the late 1970s. The largest financial interventions by the IMF have however occurred since the 1980s, following the debt crisis of 1982, the Mexico crisis of 1995, and the Asian and Russian crises of 1997-98.

Overall 80% of the IMF's "loans" since 1950 have been SBAs. Since the 1990s however 13% of programs have been EFFs and 35% PRGFs.[72] In terms of monetary commitments, the IMF estimates that during the 1990s 40% of its lending has been for "capital-account crises", 20% for transition economies and the remaining 40% for more "traditional" current-account disequilibria (IMF (2000b)). No industrial country has resorted to IMF lending since 1983.

after the collapse of the Gold Standard.

[71] For example, in January 2001 the SDR rate was at 4.4%, and the basic IMF rate at 5.1%.

[72] For the purpose of this classification, used by the IMF in its annual report, SBAs and EFFs include SRFs.

Facility	*ati al*	*t*	*a*	*cc li it ta*	*ay t i*	*i tal t*
Stand-by Arrangement	Cyclical disequilibrium	1-2 years	asic rate*	100% annually	3.5-5 years	8 (quarterly)
Extended Fund Facility	Structural disequilibrium	3 years	asic rate*	300% cumulati e	4.5-10 years	12 (semi-annual)
Supplementary Reserve Facility	Capital-account disequilibrium	Short	asic rate ith surcharge**	one	2-2.5 years	2
Contingent Credit Line	Contagion	Short	asic rate ith surcharge***	one (but need to prequalify)	2-2.5 years	2
PRGF	Concessionary	ong	0.5% p.a.	140% o er 3 years	5.5-10 years	10 (semi-annual)

* There is a surcharge for large loans (greater than 200% of quota).
**Currently set at 3%, rising to 5% for delayed repayment.
*** Currently set at 1.5%, rising to 3.5% for delayed repayment.

Table 1: IMF Lending Facilities

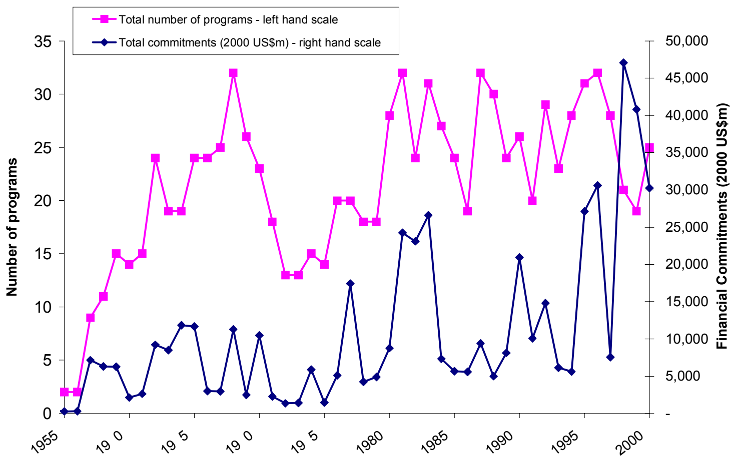


Figure 14: IMF financial commitments since 1955

A.2 Omitted Proofs

A.2.1 Proof of Proposition 1

Proof. It is convenient to solve the IMF's program by assuming at first that only the IRC binds (which is always the case, since it is optimal for the IMF to minimise transfers b), and check whether the "no transfers constraint" and the "adequate safeguards" constraint are satisfied by the solution of the simpler program.

The IRC gives the following condition for the optimal level of bail-out b:

$$b^c = \frac{U_2^{R,*} - e_2 + \frac{(e_2)^2}{2} + (1+\lambda)k}{\lambda} \tag{9}$$

Substituting into the IMF's objective function and optimising w.r.t. e_2 gives the following first order condition:

$$1 + \frac{1 - e_2}{\lambda} = 0$$

which delivers the first best level of conditionality $e_2^c = 1 + \lambda$. Plugging this back into equation (9) and substituting for the appropriate value of $U_2^{R,*}$ (depending on whether k is above or below k^D) yields the values for b^c given in Proposition 1(i).

Two conditions can therefore be identified for when the $b^c \leq k$ constraint binds: $k < \min(\frac{\lambda}{2}, k^D)$ (which follows directly from the unconstrained solution for b^c); and $k \geq \max(k^D, k^M)$. This second condition derives from the unconstrained solution for b^c for $k > k^D$. This is greater than k for $k > k^M$ (as straightforward calculation reveals). Comparing k^M and k^D shows that $k^M > k^D$ iff $k^D > \frac{\lambda}{2}$. If the latter is not the case we therefore have that the $b^c \leq k$ constraint binds for both $k \geq k^D$ and $k < k^D$, i.e. for all values of k.

The values for e_2 given in Proposition 1(ii) are obtained from equation (9) by imposing $b = k$, and substituting for the relevant value of $U_2^{R,*}$. For $U_2^{R,*} = \frac{1}{2} - (1 + \lambda)k$ (which is the case for $k < k^D$), this yields the following quadratic in e_2:

$$e_2^2 - 2e_2 + 1 - 2\lambda k = 0$$

where the optimal root is $1 + \sqrt{2\lambda k}$ which is less than the first best level $1 + \lambda$ given that $k < \frac{\lambda}{2}$.

For $U_2^{R,*} = \frac{(1-p)^2}{2}$ the IRC yields:

$$e_2^2 - 2e_2 + 1 + 2k + (1-p)^2 = 0$$

which gives the following optimal root, $e_2 = 1 + \sqrt{p(2-p) - 2k} = 1 + \sqrt{2\left(k^H - k\right)}$ which is less than $1+\lambda$ for $k > \max(k^D, k^M)$. For $k > (1+\lambda)k^D \equiv k^H$ the determinant of this expression is negative, i.e. no conditionality can be imposed by the IMF.

Turning now to the "adequate safeguards" constraint, this never binds for $p \geq \bar{p} = \frac{2\lambda}{1+\lambda}$, which is given by making ASC binding for $k = k^H$. For lower values of p, ASC will bind for k high enough (but always above $\max(k^D, k^M)$, as straightforward comparison of the ASC with the solution for $\{e_2, b\}$ obtained ignoring the ASC shows) and conditionality will collapse or be weakened for k sufficiently high.

To determine how conditionality needs to be adapted to satisfy the ASC consider the case where all three constraints bind and ASC is tangent to IRC. This is the case for $p = \hat{p} < \bar{p}$, where $\hat{p}$ is obtained by jointly satisfying $e_2 = 1 + \frac{\lambda}{1+\lambda}p \equiv e_2^t$ (ASC-IRC tangency condition), $e_2 = 1 + \sqrt{2\left(k^H - k\right)}$ (given that $b \leq k$ binds), and $k = \frac{p}{1+\lambda}e_2$ (from a binding ASC), and equals the value given in Proposition 1.

The nature of $\hat{p}$ implies that at $p = \hat{p}$ there is a value of k ($k = k^{\hat{p}} \equiv \frac{\hat{p}}{1+\lambda}(1 + \frac{\hat{p}\lambda}{1+\lambda}) < k^H$) such that for $k > k^{\hat{p}}$ conditionality collapses (i.e. it is not possible to meet all three constraints), and for lower values of k the solution for conditionality is the same as the one obtained ignoring the ASC, and given in case (ii) of the Proposition (see Figure 15).

For $p < \hat{p}$, conditionality collapses "earlier", i.e. for $k > \hat{k}^H = k^{AS}$, where k^{AS} is given by the tangency of IRC and ASC (i.e. $k^{AS} = \frac{e_2^t(1 - \frac{e_2^t}{2} + \frac{\lambda}{1+\lambda}p) - \frac{(1-p)^2}{2}}{1+\lambda} < k^{\hat{p}}$). At $k = k^{AS}$ the bail-out b is less than the capital outflow k (i.e. the $b \leq k$ constraint is slack), which implies that conditionality is lowered relative to the level implied by ignoring the ASC. This is so because lowering k relative to $k^{\hat{p}}$ and towards k^{AS} implies that the IRC shifts downwards by more than k in (b, e_2) space, which in turn implies that at the tangency with ASC $b < k$. As k takes values which are lower than k^{AS} the level of e_2 under conditionality converges to the level obtained ignoring the ASC (i.e. given in case (ii) of the Proposition).

For $p \in (\hat{p}, \bar{p}]$ conditionality can be implemented also if $k > k^{\hat{p}}$. In this case conditionality collapses for $k > \hat{k}^H = k^{3C}$, where $k^{3C} \in (k^{\hat{p}}, k^H]$ is given by the value of k for which all three constraints bind. For $k \in (\max(k^D, k^M), k^{3C}]$ conditionality can be imposed, and its solution is the one obtained ignoring the ASC. ■

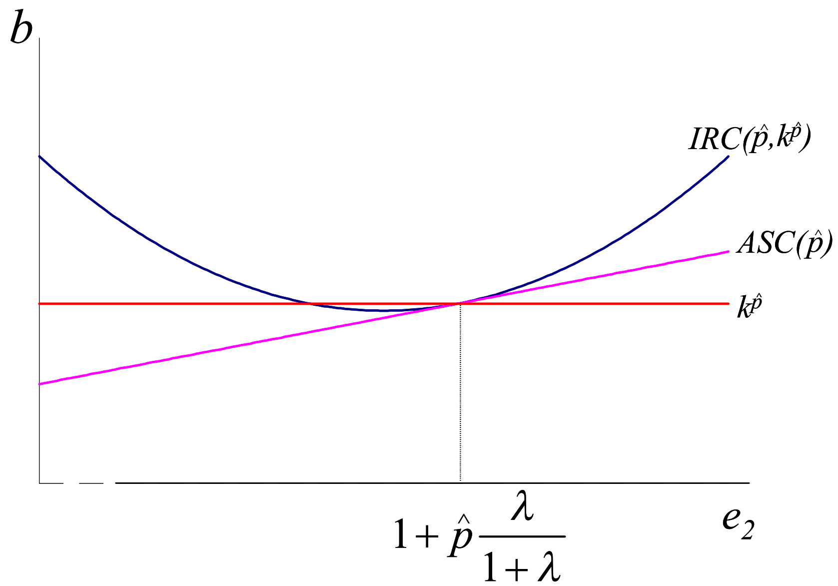


Figure 15: Conditionality at $p = \hat{p}$ and $k = k^{\hat{p}}$.

A.2.2 Proof of Proposition 3

Proof. Part (i) follows from the maximisation of the IMF's objective function, after substituting for b from the (binding) IR constraint. This shows that the minimisation of $\gamma(e_1)b$ is equivalent to maximising $\frac{E\left[U^R(e_1,\beta=0)\right]-E\left[U^R(e_1^*,\beta k)\right]}{\lambda}$, and that therefore $e_1^c = e_1^{FB}$, as long as $b \leq k$ does not bind.

The value of b^c is then obtained by replacing e_1^{FB} for e_1 in the IRC, substituting for $E\left[U^R(e_1^*, \beta k)\right]$, and solving for b. This yields:

$$\gamma(e_1)b^c = \beta k \left(\gamma(\bar{e}_1) - \frac{\lambda \delta_e^2 \beta k}{2}\right)$$

which simplifies to the expression for b^c given in the Proposition.

The value of k^T is then obtained by equating the solution for b^c with k. Differentiation of k^T w.r.t. β shows that $\frac{\partial k^T}{\partial \beta} < 0$.

(ii) From part (i), $k \geq k^T(\beta)$ implies that the $b \leq k$ constraint binds, and the conditional effort level is therefore lower than e_1^{FB}. In this case e_1^c is given by substituting k for b in the IRC and solving for e_1. This yields the following solution: $e_1^c = e_1^{SB}(\beta, k) = 1 + \delta_e k + \sqrt{\left[2(\bar{\gamma} - \delta_e) - \delta_e^2 k(2 + \lambda(1-\beta))\right](1-\beta)\lambda k}$, which equals e_1^{FB} for $k = k^T(\beta)$, and lies below it for higher values of k.

Equating $e_1^{SB}(\beta,k)$ and $\bar{e}_1(\beta,k)$ yields $k = \frac{\bar{\gamma}-\delta_e}{\delta_e^2(1+\lambda(1-\beta))} \equiv k^U(\beta)$, which is increasing in β. This is the same value of k obtained by setting $\gamma(\bar{e}_1(\beta,k))$ to 0.

Imposing $\beta = 0$ shows that $k^U(0) = k^T(0)$. Given that $k^U(\beta)$ is increasing in β and $k^T(\beta)$ is decreasing in β, this implies $k^U(\beta) \geq k^T(\beta)$.

Finally, differentiation of $e_1^{SB}(\beta,k)$ w.r.t. k shows that $\frac{\partial e_1^{SB}(\beta,k)}{\partial k} \geq 0$ for $k \leq k^U(\beta)$. This implies that if $k < k^U(\beta)$, then $\gamma(e_1^c) > 0$. ■

A.3 Micro-foundations

A.3.1 Derivation of the nature of adjustment effort and of the liquidity cost λ

This section of the Appendix outlines possible micro-foundations for the baseline model of conditionality presented in Section 2. It describes a more structural model than the one presented in the main text, to account for the nature of adjustment effort e and for the presence of a liquidity cost of sudden capital outflows λk.[73]

Assume that the debtor country can produce two goods, exportables x and non-tradeables n, and that it can direct resources from one sector to the other by changing the level of the internal exchange rate between the two goods (i.e. $\frac{p_x}{p_n}$).[74] The effort variable employed in the main text can be interpreted as representing this real exchange rate, i.e. $e = \frac{p_x}{p_n}$. The country's welfare is determined by the consumption of non-tradeables n and imports m. The latter can be purchased with exports and with foreign capital inflows k.

Given this general set-up, the policy-makers in the debtor country set the internal exchange rate e to maximise welfare, and find it optimal to adjust its level to reflect the availability of foreign exchange given by k. If internal prices are sticky in the short-run, a sudden scarcity of foreign capital due to a balance of payments crisis will be associated with a liquidity 'penalty' λ.

To see this effect explicitly it is useful to assume specific functional forms for the production function of m and x, and for the country's utility function. In particular we assume:

$$x = x(e) = e$$

and

$$n = n(x(e)) = 1 - \frac{e^2}{4}$$

These two functions imply a concave production possibility frontier between n and x, and illustrate how the choice of effort e by the policy makers determines both the production of exports and non-tradeables. We assume that exports can be exchanged one-for-one with imports (i.e. the external exchange rate is 1), and that inflows of foreign capital, are used to buy imports. That is, $m = x + k$.

The debtor country earns utility from the consumption of non-tradeables and imports according to the following quasi-linear function, $U^R = m - \frac{m^2}{4} + n$, which implies, in terms of effort e:

$$U^R(e) = (e+k)\left(1 - \frac{e+k}{4}\right) + \left(1 - \frac{e^2}{4}\right)$$

[73] This set-up partially follows Fafchamps (1996), and is outlined in Foonote 16 in the main text.

[74] We omit time subscripts for notational simplicity.

Maximising w.r.t. e we obtain the following first order condition:

$$\begin{aligned} 1 - \frac{e}{2} - \frac{k}{2} - \frac{e}{2} &= 0 \\ &\Rightarrow \; e^* = 1 - \frac{k}{2} \end{aligned}$$

The solution for e^* shows that the greater the availability of foreign capital the lower is the production of exportables, given the increased ability to purchase imports. This implies a lower price of tradeables to non-tradeables, i.e. an appreciation of the real exchange rate .

Turning now to the situation described in the baseline model, consider an inflow of k at $t = 1$, and the possibility that at $t = 2$ a crisis might take place. Assume now that the level of e can only be changed at the end of each period t, and that at the end of $t = 1$ the debtor sets $e = 1$ (which is optimal if the probability of γ is low enough).[75] If a crisis then occurs, and e is sticky in the short-run (i.e. it can only be changed at the end of $t = 2$), the debtor needs to pay k back to the investor without being able to change e to produce more tradeables (which would be efficient given the higher marginal utility of imports associated with a negative capital outflow).[76]

Comparing the utilities associated with the sticky-prices scenario ($\bar{e} = 1$) and the flexible price scenario ($e^* = 1 + \frac{k}{2}$), both with an outflow of $-k$, we obtain:

$$\begin{aligned} \Delta U &= (e^* - \bar{e}) + \frac{1}{4}\left[(\bar{e} - k)^2 - (e^* - k)^2 + \bar{e}^2 - (e^*)^2\right] \\ &= \frac{k^2}{8} > 0 \end{aligned}$$

This positive difference in welfare levels measures the cost of a sudden withdrawal of foreign capital, in the presence of sticky prices. Relating this result to the baseline model in the main text, we therefore have that $\lambda k = \frac{k^2}{8}$, i.e. $\lambda = \frac{k}{8}$. This shows that the liquidity cost associated with a sudden crisis can be micro-founded, and that it is a function of k (which is intuitive, and which is a feature we abstract from in the reduced-form model presented in the main text).

The policy conflict described in the text between the IMF and the debtor can also be introduced in this extended set-up by assuming, for instance, that the IMF attaches less utility to the debtor's consumption of non-tradeables than the debtor himself (e.g. this could be because the IMF wants to promote global trade, or because the debtor has political-economy reasons to favour the non-tradeable sector), e.g.:

$$U^{IMF} = (e + k)\left(1 - \frac{e + k}{4}\right) + (1 - \omega)\left(1 - \frac{e^2}{4}\right)$$

where $\omega > 0$.

This yields, $e^{*,IMF} = \frac{e^*}{1 - \frac{\omega}{2}} > e^*$. The model in the main text reproduces this policy conflict by assuming that the IMF want to maximise e, which is locally consistent with this.

[75] The optimal level of e will in fact be slightly above 1 to reflect "insurance" against the probability of crisis. Allowing for this, as opposed to assuming $e = 1$, would not add particular insights to the analysis, but would complicate the algebra significantly.

[76] This is consistent with the possibility of debt-overhang setting in (which we allow for in the main text), if we assume that the penalty in case of default is paid at the end of $t = 2$, when domestic prices can be varied.

A.3.2 Derivation of unconditional transfer level βk in the debtor moral hazard extension

The assumption that the IMF cannot commit not to transfer a level of unconditional funds βk following a crisis can formalised by assuming the following IMF utility function:

$$U^{IMF} = \underbrace{e_2 - b}_{\text{standard}} + \underbrace{\left(\hat{\beta}\Delta U^R(e_2, b) - \left(\Delta U^R(e_2, b)\right)^2\right)}_{\text{additional ``altruism'' term}}$$

where $\Delta U^R(e_2, b) = U_2^R(e_2, b) - U_2^{R,*}$. This revised utility function implies that, up to a point, the IMF benefits from leaving some rents to the recipient when intervening ($\Delta U^R(e_2, b) > 0$), and not making the recipient's IRC binding.

The definition of $\Delta U^R(e_2, b)$ implies:

$$b = \frac{U_2^{R,*} - \Delta U^R - e_2 + \frac{e_2^2}{2} + (1+\lambda)k}{\lambda}$$

which in turn implies

$$\frac{\partial U^{IMF}}{\partial \Delta U^R} = -\frac{1}{\lambda} + \hat{\beta} - \Delta U^R$$

Setting $\frac{\partial U^{IMF}}{\partial \Delta U^R}$ to zero we obtain the optimal level of rents ΔU^R which the IMF wants to leave to the recipient:

$$\Delta U^{R,c} = \hat{\beta} - \frac{1}{\lambda}$$

which is positive (i.e. IRC is slack) as long as $\hat{\beta} > \frac{1}{\lambda}$.

Substituting for ΔU^R and b^c in the IMF's objective function we finally obtain $e_2^c = 1 + \lambda$ (assuming that the $b \leq k$ constraint and ASC do not bind), as in the baseline case. This implies that the optimal bail-out level is increased by $\frac{\hat{\beta} - \frac{1}{\lambda}}{\lambda}$ relative to the binding IRC case, which measures the level of unconditional IMF lending. That is, the level of β assumed in the debtor moral hazard extension in the main text can be computed as: $\beta = \frac{\hat{\beta} - \frac{1}{\lambda}}{\lambda k}$, which is a function of both λ and k (in addition to the original altruism parameter $\hat{\beta}$).

References

[1] Boughton, J. (2000), "From Suez to Tequila: the IMF as a Crisis Manager", *Economic Journal*, 110(460), 273-291.

[2] Chang, R. and A. Velasco (1999), "Liquidity Crises in Emerging Markets: Theory and Policy", Working Paper No. 7272, NBER.

[3] Claessens, E. and I. Diwan (1990), "Investment Incentives: New Money, Debt Relief, and the Critical Role of Conditionality in the Debt Crisis", *World Bank Economic Review,* 4(1), 21-41.

[4] Collier, P., P. Guillamont, S. Guillamont and J. Gunning (1997), "Redesigning Conditionality", *World Development*, 25(9), 1399-1407.

[5] Corsetti, G., P. Pesenti and N. Roubini (1999), "Paper Tigers? A Model of the Asian Crisis", *European Economic Review*, 43(7), 1211-1236.

[6] Diwan, I. and D. Rodrik (1992), "External Debt, Adjustment, and Burden Sharing: a Unified Framework", *Princeton Studies in International Finance* No. 73, Princeton University.

[7] Dooley, M. (2000), "A Model of Crises in Emerging Markets", *Economic Journal*, 110 (460), 256-272.

[8] Eaton, J. and R. Fernandez (1995), "Sovereign Debt", in G. Grossman and K. Rogoff, eds., *Handbook of International Economics*, Vol. 3, Amsterdam: North Holland.

[9] Eichengreen, B. (1999), *Towards a New International Financial Architecture*, Washington: Institute of International Economics.

[10] Eichengreen, B. (2000), "Can the Moral Hazard Caused by IMF Bailouts be Reduced ?", *Geneva Reports on the World Economy*, Special Report No. 1, London: Centre for Economic Policy Research.

[11] Fafchamps, M. (1996), "Sovereign Debt, Structural Adjustment and Conditionality", *Journal of Development Economics*, 50(2), 313-335.

[12] Fischer, S. (1999), "On the Need for an International Lender of Last Resort", *Journal of Economic Perspectives*, 13(4), 85-104.

[13] Friedman, I. (1983), "Private Bank Conditionality: Comparison with the IMF and the World Bank", in J. Williamson (1983).

[14] Giannini, C. (1999), " "Enemy of None but a Common Friend to All"? An International Perspective on the Lender-of-Last-Resort Function", Working Paper No. 99/10, IMF.

[15] Goldstein, M. (2000), "Strengthening the International Financial Architecture - where do we Stand?", Working Paper No. 00-8, Institute of International Economics.

[16] Guitian, M. (1981), *Fund Conditionality: Evolution of Principles and Practices*, Washington: IMF.

[17] Guitian, M. (1995), "Conditionality: Past, Present and Future", *IMF Staff Papers*, 42 (4), 792-835.

[18] International Financial Institution Advisory Commission (2000), *Report of the International Financial Institution Advisory Commission*, Washington.

[19] International Monetary Fund (1993), *Articles of Agreement*, Washington: IMF.

[20] International Monetary Fund (2000a), *Annual Report*, Washington: IMF.

[21] International Monetary Fund (2000b), *Review of Fund Facilities - Preliminary Considerations*, Washington: IMF.

[22] International Monetary Fund (2001), *Conditionality in Fund-Supported Programs - Policy Issues*, Washington: IMF.

[23] Jeanne, O. (2000), “Foreign Currency Debt and the Global Financial Architecture”, *European Economic Review*, 44(4-6), 719-727.

[24] Keynes, J. M. (1919), *The Economic Consequences of the Peace*, London: Macmillan.

[25] Krugman, P.R. (1979), “A Model of Balance of Payments Crises”, *Journal of Money, Credit and Banking,* 11(3), 311-325.

[26] Krugman, P.R. (1988), “Financing vs. Forgiving a Debt Overhang: Some Analytical Notes”, *Journal of Development Economics*, 29(3), 253-268.

[27] Lane, T. and S. Phillips (2000), “Does IMF Financing Result in Moral Hazard?”, Working Paper No. 00/168, IMF.

[28] Marchesi, S. and J. Thomas (1999), “IMF Conditionality as a Screening Device”, *Economic Journal*, 109(454), C111-125.

[29] Masson, P. and M. Mussa (1995), *The Role of the IMF: Financing and its Interactions with Adjustment and Surveillance*, Washington: IMF.

[30] Radelet, S. and J. Sachs (1998), “The East Asian Financial Crisis: Diagnosis, Remedies, Prospects”, *Brooking Papers on Economic Activity*, 0(1), 1-74.

[31] Rodrik, D. (1996), “Why is there Multilateral Lending ?”, in M. Bruno and B. Pleskovic (eds.), *Proceedings of the World Bank Conference on Development Economics 1995*, Washington: World Bank.

[32] Sachs, J. (1989a), “The Debt Overhang of Developing Countries”, in G. Calvo, R. Findlay, P. Kouri and J. de Marcelo (eds.), *Debt, Stabilisation and Development*, Oxford: Blackwell.

[33] Sachs, J. (1989b), “Conditionality, Debt Relief and the Developing Country Debt Crisis”, in J. Sachs (ed.), *Developing Country Debt and Economic Performance: the International Financial System*, Vol. 1, Chicago: Chicago University Press.

[34] Schadler, S., A. Bennett, M. Carkovic, L. Dick-Mireaux, M. Mecagni, J. Morsink and M. Savastano (1995), “IMF Conditionality: Experience under Stand-By and Extended Arrangements. Part I: Key Issues and Findings”, Occasional Paper No. 120, IMF.

[35] Williamson, J. (ed.) (1983), *IMF Conditionality*, Washington: Institute of International Economics.

[36] Williamson, J. (2000), “The Role of the IMF: A Guide to the Reports”, Policy Brief No. 00-5, Institute of International Economics.

[37] Zettelmeyer, J. (2000), “Can Official Crisis Lending be Counterproductive in the Short Run?”, *Economic Notes*, 1(29), 13-29.