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Quid pro Quo: National Institutions and Sudden Stops in International Capital Movements

by

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Abstract

We explore the incidence of sudden stops in capital flows on the incentives for building national institutions that secure property rights in a world where sovereign defaults are possible equilibrium outcomes. This paper builds upon the benchmark model of sovereign default and direct creditor sanctions by Obstfeld and Rogoff (1996). In their model it is in the debtor country's interest to "tie its hands" and secure the property rights of lenders as much as possible because this enhances the credibility of the country's promise to repay and prevents default altogether. We incorporate two key features of today's international financial markets that are absent from the benchmark model: the possibility that lenders can trigger sudden stops in capital movements, and debt contracts in which lenders transfer resources to the country at the start of the period, which have to be repaid later. We show that under these conditions the advice "build institutions to secure repayment at all costs" may be very bad advice indeed.

JEL Classification: F34; F36; F51
Keywords: Sudden Stops; National Institutions; Debt Accumulation; Default; Sanctions.

1. Introduction

Countries wanting to develop are told time and again to "fix your institutions" and "protect property rights." The two are related, for one main task of good institutions is to keep property rights from being violated. If countries follow this advice, then presumably traders and investors carry out profitable trades and projects and the country prospers.

International borrowing and lending provides a concrete application of this general advice. Countries can guarantee repayment by entering into binding international agreements, designing rules or institutions that make non-payment costly or making themselves vulnerable to international sanctions. If they do, then capital inflows occur, profitable projects are financed and opportunities for international risk-sharing do not go to waste.

We call this the "tie your hands and prosper" strategy, or THAP. The Washington Consensus included THAP among its commandments,[1] and Washington International Financial Institutions have been enthusiastically prescribing THAP to their member countries.[2]

In this paper we argue that when applied to international borrowing and lending, the THAP strategy may well be incorrect. Or, more precisely, that it is correct only under very narrow and specific circumstances. Under other conditions, which are more prevalent in today's financial markets, the advice "build institutions to secure repayment at all costs" may be very bad advice indeed.

Take the standard risk-sharing model of Obstfeld and Rogoff (1996), for example. The model focuses on the insurance aspects of international capital markets (i.e., there is no expected gain or loss from borrowing abroad, but borrowing helps shield countries from unexpected shocks) and makes the assumption that foreign insurers can credibly make commitments to a future state-contingent payment stream, whereas the borrower cannot. Foreign claimholders thus have no legal rights to apply sanctions unless the borrower does not comply with the payments. They show that unless debt default is ruled out by sufficiently strong sanctions, the borrower can never take full advantage of open capital markets to diversify all the risk away and smooth consumption. The source of the problem is simple: the borrower can not credibly pre-commit to a future state-contingent payment stream. Thus, the prescription is also simple: increase as much as possible the share of output that lenders can seize in the event of non-payment. If that share is

[1] Williamson (1990).
[2] See, for example, Williamson (2000).

one, then the contract offered by lenders will entail full insurance. The country's consumption will be fully stabilized no matter how large the shocks to its income, and the country's utility will be as large as can be.

In this paper we consider two variations on the simple Obstfeld-Rogoff framework. First, lenders are not always well behaved: in any period when lenders have to make a net transfer to the country, there is an exogenous probability that transfer will not occur. We can think of this as an example of the "sudden stops to capital movements" phenomenon discussed in the by now very voluminous literature started by Calvo (1998).[3, 4] Second, consider not only an insurance contract but also a debt contract, in which lenders transfer resources to the country at the start of the period, which have to be repaid later.

These apparently minor changes have a strong impact on the policy implications arising from the standard international risk-sharing model *a la* Obstfeld-Rogoff (1996). The first and key change is that THAP is no longer optimal. Tying your hands as much as possible, or making yourself extremely vulnerable to sanctions, may well decrease rather than increase expected country welfare. The reason is that sanctions can be applied because debt repudiation is a possible equilibrium outcome in a world with sudden stops. Therefore, by making itself vulnerable to sanctions in the aftermath of default, the country is giving away to lenders a greater share of output in the event of a crisis.

The extended model also yields a theory of the optimal size of international debt. In the standard model the size of debt is irrelevant. Here that is not the case. The size of debt matters: with larger debt, the country gets more relief from non-payment. And that relief may be necessary if in equilibrium lenders do not make the net transfers they were supposed to make under the contract. We find that the optimal debt stock depends, among other things, on the perceived risk of sudden stops. If borrowers expect that lenders will not make the promised

[3] A key feature of that literature is that the sudden stops in capital inflows occur for reasons that are exogenous to the country. The same is true in our model. Alternatively, in a more complicated setting one could think of this sudden stop as the outcome of a coordination problem among lenders, in the spirit of Sachs (1982) and, more recently, Morris and Shin (1998). Then, the probability "q" of a sudden stop can be thought of as the probability associated with a sunspot in a model with multiple equilibria. See also Rodrik and Velasco (2000).

[4] On the causes of sudden stops, see for example, Calvo Izquierdo and Mejía (2003), Edwards (2004), Cavallo and Frankel (2004) and Cavallo (2005). On the consequences of sudden stops see for example, Calvo, Izquierdo and Talvi (2003) and Guidotti, Sturzenegger and Villar (2004).

transfers, they will want to have more defaultable debt to cushion the adverse consequences of sudden stops.[5]

We get these results in a one-period model of a small open economy with a representative risk-averse agent ("the borrower") and a pool of competitive lenders ("the insurers"). The model follows the basic structure of the benchmark Obstfeld and Rogoff (1996) model but departs from it by incorporating badly-behaved lenders and debt contracts.

This paper is related to the rich literature on sovereign defaults and national institutions recently summarized by Sturzenegger and Zettelmeyer (2005). A key insight from this literature is that to a large extent, international borrowing and lending is feasible because it involves repeated interactions between agents and/or because one of the parties can impose direct sanctions on the other. In other words, borrowers pay back their international debts because the punishment for non-compliance is the possibly worst outcome of no new lending thereafter (as in Eaton and Gersovitz, 1981), or perhaps they pay back because lenders can impose greater unilateral sanctions (as in Bulow and Rogoff, 1989). We depart from this body of literature by considering the possibility that sovereign default is a strategic decision by borrowers in response to prior actions on the part of lenders. In doing so, we shed light on the strategic interaction between borrowers and lenders and formulate a novel theory of institutional reform and the optimal size of international debt. Methodologically, this paper is similar to Kletzer and Wright (2002). These authors have argued that a positive level of sovereign debt can be sustained once we introduce a double commitment problem (i.e., neither borrowers or lenders can commit to a predictable steam of payments in the future). We focus on the effects that the commitment problems of the lenders have on the incentives of the borrowers to undertake institutional reforms and for prudent debt management.

We conclude that institutional reform and the protection of property rights are surely desirable goals for all countries. But the prescription for achieving those goals cannot be made independently of the international environment that countries face. This paper shows that, if a country faces a benevolent external environment in which lenders always behave as they should, then maximal protection of lenders' rights is the optimal strategy for that country. But if circumstances are more adverse, with lenders misbehaving from time to time, then THAP may

[5] Sachs (1982) makes a similar point, arguing that the default option can be a way for developing countries' borrowers to transfer economic risk to creditors.

be counterproductive, and only partial protection of lenders' property rights is best for the borrowing nation. A corollary of these results is that domestic and international reform must be undertaken jointly: a better international lending environment, with fewer sudden stops in capital movements, makes it more likely that nations will undertake institutional reforms at home.

The plan of the paper is as follows. In the next section we set up the basic model and define the concept of equilibrium. Then, we compute the equilibrium for different cases by resorting to computer simulations. In the last section we present the conclusions.

2. Basic Model

There is one period. A small open economy with a representative agent borrows and lends internationally and produces at home. The representative agent's expected utility is given by

$$Eu(c) \qquad (1)$$

where c is consumption and $u(c)$ is concave.

Domestic output has two components. The first is random and given by $\bar{y}+\varepsilon$ where $\bar{y}$ is constant and ε is a random variable of mean zero and support $\left\{-\bar{\varepsilon},\bar{\varepsilon}\right\}$. The country borrows an exogenous amount d in international credit markets at the beginning of the period and repays at the end of the period after uncertainty is realized. Payments $p(\varepsilon)$ take place in each state of nature. We have written $p(\varepsilon)$ to show that p may depend on ε to highlight the "insurance" component of international credit markets (more on this below). In particular, we assume that $p(\varepsilon)$ is a linear function of ε, so $p(\varepsilon)=\alpha+\beta\varepsilon$ where α and β are constants to be determined endogenously. The amount borrowed can be invested locally with a linear technology, so that at the end of one period the country has $(1+r)d > d$. This is the second component of output. It follows that total national output in any given period is $\bar{y}+\varepsilon+(1+r)d$.

Consumption, in turn, is simply

$$c=\bar{y}+\varepsilon+(1+r)d-p(\varepsilon) \qquad (2)$$

Foreign lenders are risk neutral and competitive. For them the opportunity cost of funds (the world riskless interest rate) is r. Lending will take place so that expected profits by lenders are zero. This requires

$$\int_{-\bar{\varepsilon}}^{\bar{\varepsilon}} p(\varepsilon) f(\varepsilon) d\varepsilon = (1+r)d \qquad (3)$$

where $f(\varepsilon)$ is the p.d.f. of ε.

This setup highlights the "insurance" component of international credit markets, since with the world rate of interest equal to the domestic marginal product of capital, there is no expected gain or loss from international borrowing. But borrowing does help shield the home country from unexpected shocks, since loan repayment can be made contingent on the state of nature (the shock ε), in such a way that the country makes relatively larger net payments when output is high and relatively smaller payments when output is low. Note that if international credit markets did not provide some insurance against stochastic shocks (i.e., $\beta = 0$), then $p(\varepsilon) = \alpha = (1+r)d$ (the borrower would have to pay back the amount owed in any state of nature) and consumption would be the state-contingent amount $c = \bar{y} + \varepsilon$.

2.1 The Case of Full Insurance

Suppose that the borrowing country can pre-commit to pay in all states of nature. Then, the representative agent in the country can maximize utility by negotiating a contract with repayment schedule such that $\beta = 1$.

$$p(\varepsilon) = \alpha + \varepsilon \qquad (4)$$

where α is a constant. Such a contract (i.e., and output-indexed debt contract) provides full insurance to the borrower as payments are driven by the realization of the shock. The feasible level of α is obtained by substituting (4) into (3):

$$\int_{-\bar{\varepsilon}}^{\bar{\varepsilon}} (\alpha + \varepsilon) f(\varepsilon) d\varepsilon = \alpha = (1+r)d \qquad (5)$$

It follows that consumption is stabilized at

$$c = \bar{y} + \varepsilon + (1+r)d - \alpha - \varepsilon = \bar{y} \qquad (6)$$

This maximizes the utility of the borrower (relative to the no-insurance case), since he gets the same average consumption but now with zero variance. Given concave utility, this is welfare-improving.

2.2 The Case of Partial Insurance and Sudden Stops

Suppose instead that the borrowing country cannot pre-commit to pay in every state of nature. Note that this "incentive" problem arises only if, for a given ε, $p(\varepsilon) > 0$. That is, it is only if the borrower is supposed to make payments to the foreign lenders that he can refuse to do. To overcome, at least partially, the incentive problem, assume the borrower has an incentive to pay because foreign lenders can seize a portion η ε [0,1] of total national output. Thus, it is convenient to repay if

$$p(\varepsilon) \leq \eta(\bar{y} + \varepsilon + (1+r)d) \qquad (7)$$

The lenders know that the borrower is not totally reliable. This means that if sanctions are not high enough (in a sense to be made precise below), in equilibrium there will only be partial insurance (i.e., across a limited set of states of nature). To rule out full insurance and make the problem interesting we must impose the following. When the shock is at its "best" realization, so that $\varepsilon = \bar{\varepsilon}$, it must be true that $(1+r)d + \bar{\varepsilon} \geq \eta(\bar{y} + \bar{\varepsilon} + (1+r)d)$. This implies

$$\eta \leq \frac{(1+r)d + \bar{\varepsilon}}{(1+r)d + \bar{\varepsilon} + \bar{y}} \qquad (8)$$

which we assume from now on. In words, we assume there are realizations of the shock for which the borrower would prefer to default and be sanctioned rather than pay what he would have to under full insurance. Similarly, we also assume that the sanctions are sufficiently high so that the borrower does not always choose to default. For practical purposes, this means that it is only for realizations of the shock for which the borrower would be required to make transfers in excess of what he was originally lent at the beginning of the period (i.e., ε's such that $p(\varepsilon) > (1+r)d$) that he might refuse to do so.

Given the nature of the borrower's incentive problems, an incentive-compatible payment contract can be written to prevent misbehavior. This involves a $p(\varepsilon)$ schedule where the maximum payment that the borrower is ever supposed to carry out is $\eta(\bar{y} + \varepsilon + (1+r)d)$—the largest payment that can be supported via sanctions.

Key to our analysis is the assumption that the foreign lenders cannot pre-commit either to carry out the required transfers to the borrower. In particular, assume there is a probability $q \in [0,1]$ that lenders will refrain from making additional transfers (i.e., beyond what they originally lent) when the contract calls for them to do so. This problem can arise only if, for a given ε, $p(\varepsilon) < (1+r)d$. It is only in bad states of the nature for the borrower (i.e., for low realizations of ε) that lenders may be required to provide additional financing. If lenders refrain from making additional transfers, we call that a "sudden stop," following Dornbusch et al. (1995) and Calvo (1998). When lenders trigger a sudden stop, the borrowing country can either default on $(1+r)d$ to "ease the pain" or it can accept the outcome and pay back the debt. If it defaults, sanctions are imposed and foreign lenders can seize a portion η of total national output $\bar{y} + \varepsilon + (1+r)d$.

In that case, end-of-period transfers from the borrower to the lender are

$$p(\varepsilon) = \eta(\bar{y} + \varepsilon + (1+r)d) \qquad (9)$$

If the borrowing country chooses to repay, end-of-period transfers are simply

$$p(\varepsilon) = (1+r)d \qquad (10)$$

Note that the probabilistic nature of lenders' misbehavior cannot be prevented through the design of a suitable payment schedule. Thus, sudden stops and defaults can happen in equilibrium. Again to make the problem interesting, assume that there are certain realizations of the shock ε at which the borrower will find it convenient to default in the aftermath of a sudden stop. Thus, when $\varepsilon = -\bar{\varepsilon}$ it must be true that $(1+r)d > \eta(\bar{y} - \bar{\varepsilon} + (1+r)d)$, and the borrower prefers to default and face the sanctions rather than repay the debt. If this is true, then

$$\eta \leq \frac{(1+r)d}{\bar{y} - \bar{\varepsilon} + (1+r)d} \qquad (11)$$

Combining the two bounds for η derived in this section, we see that the subset of interesting η has the upper bound

$$\eta \leq Min\left(\frac{(1+r)d + \bar{\varepsilon}}{(1+r)d + \bar{\varepsilon} + \bar{y}}, \frac{(1+r)d}{(1+r)d + \bar{y} - \bar{\varepsilon}} \right) \qquad (12)$$

If η is greater than the smaller of these numbers, the problem is uninteresting because there would never be an incentive for the borrower to default.

3. The Incentive-Compatible Contract

Define x as the threshold of the shock ε below which (7) does not bind. By construction $p(x) > (1+r)d$ (because the debtor's incentive problems arise only if he is required to make a transfer to the lenders that exceed what he was originally lent).[6] Next, define z as the threshold of the shock ε below which there can be a sudden stop. By definition, $p(z) = (1+r)d$ (because lenders' incentive problems arise when the additional transfers to the debtor are positive).[7] Finally, define v as the threshold of the shock at which the borrower is indifferent between defaulting and paying back all the debt in the aftermath of a sudden stop. Hence, v satisfies the condition $(1+r)d = \eta(\bar{y} + v + (1+r)d)$, or

$$v = \left(\frac{1-\eta}{\eta}\right)(1+r)d - \bar{y} \quad . \tag{13}$$

In equilibrium, v, z, and x are such that $-\bar{\varepsilon} \le v \le z \le x \le \bar{\varepsilon}$. Note that, $v \le z$ is required because default in the aftermath of a sudden stop (which happens if $\varepsilon < v$) can only occur if there is a sudden stop (which can happen only if $\varepsilon \le z$). Also, $z \le x$ guarantees that the sanctions are sufficiently high so that, for some high realizations of ε, the borrower at least has incentives to pay back the initial debt.

The problem that the borrower solves is

$$Max\ Eu(c)$$

subject to

$$c = \begin{cases} \bar{y} + (1+r)d + \varepsilon - (\alpha'''' + \beta''''\varepsilon) & \text{if } \varepsilon < v \\ \bar{y} + (1+r)d + \varepsilon - (\alpha''' + \beta'''\varepsilon) & \text{if } v \le \varepsilon < z \\ \bar{y} + (1+r)d + \varepsilon - (\alpha'' + \beta''\varepsilon) & \text{if } z \le \varepsilon < x \\ \bar{y} + (1+r)d + \varepsilon - (\alpha' + \beta'\varepsilon) & \text{if } \varepsilon \ge x \end{cases} \tag{14}$$

where the endogenous variables are the four α's, the four β's, x and z (all the other variables, including v which is given by (13) are exogenous). Furthermore, (7) requires that

[6] Recall that we assume that sanctions are high enough to guarantee that the borrower has incentives to pay back the debt in good states of nature.

[7] The term "additional" is included to stress that the lenders have already lent the amount *d* to the borrower.

$$\alpha^i + \beta^i \varepsilon \le \eta(\overline{y} + (1+r)d + \varepsilon) \tag{15}$$

where i = $'$,$''$,$'''$, or $''''$ according to the four different regions into which the support of ε is divided; and subject to (3) which is rewritten as follows:

$$\Lambda = (1+r)d \tag{16}$$

where

$$\Lambda = \alpha'''' \int_{-\overline{\varepsilon}}^{v} d\varepsilon + \beta'''' \int_{-\overline{\varepsilon}}^{v} \varepsilon d\varepsilon + \alpha''' \int_{v}^{z} d\varepsilon + \beta''' \int_{v}^{z} \varepsilon d\varepsilon +$$
$$\alpha'' \int_{z}^{x} d\varepsilon + \beta'' \int_{z}^{x} \varepsilon d\varepsilon + \alpha' \int_{x}^{\overline{\varepsilon}} d\varepsilon + \beta' \int_{x}^{\overline{\varepsilon}} \varepsilon d\varepsilon \tag{17}$$

Therefore the Langrangian is

$$\begin{aligned}
L = &\int_{-\overline{\varepsilon}}^{v} u(\overline{y} + (1+r)d + \varepsilon - (\alpha'''' + \beta''''\varepsilon))d\varepsilon \\
&+ \int_{v}^{z} u(\overline{y} + (1+r)d + \varepsilon - (\alpha''' + \beta'''\varepsilon))d\varepsilon \\
&+ \int_{z}^{x} u(\overline{y} + (1+r)d + \varepsilon - (\alpha'' + \beta''\varepsilon))d\varepsilon \\
&+ \int_{x}^{\overline{\varepsilon}} u(\overline{y} + (1+r)d + \varepsilon - (\alpha' + \beta'\varepsilon))d\varepsilon \\
&+ \lambda\left[\alpha' + \beta'\varepsilon - \eta(\overline{y} + (1+r)d + \varepsilon)\right] \\
&+ \psi\left[\alpha'' + \beta''\varepsilon - \eta(\overline{y} + (1+r)d + \varepsilon)\right] \\
&+ \phi\left[\alpha''' + \beta'''\varepsilon - \eta(\overline{y} + (1+r)d + \varepsilon)\right] \\
&+ \kappa\left[\alpha'''' + \beta''''\varepsilon - \eta(\overline{y} + (1+r)d + \varepsilon)\right] \\
&+ \mu\left[\Lambda - (1+r)d\right]
\end{aligned} \tag{18}$$

and the first order conditions are: FOC w/r to α' is

$$\int_{x}^{\overline{\varepsilon}} u'(c)d\varepsilon = \lambda + \mu \int_{x}^{\overline{\varepsilon}} d\varepsilon \tag{19}$$

FOC w/r to α'' is

$$\int_{z}^{x} u'(c)d\varepsilon = \psi + \mu \int_{z}^{x} d\varepsilon \tag{20}$$

FOC w/r to α''' is

$$\int_{v}^{z} u'(c)d\varepsilon = \phi + \mu \int_{v}^{z} d\varepsilon \tag{21}$$

FOC w/r to α'''' is

$$\int_{-\bar{\varepsilon}}^{v} u'(c)d\varepsilon = \kappa + \mu\int_{v}^{z} d\varepsilon \qquad (22)$$

FOC w/r to β′ is

$$\int_{x}^{\bar{\varepsilon}} \left[u'(c)\varepsilon\right] d\varepsilon = \lambda\varepsilon + \mu\int_{x}^{\bar{\varepsilon}} \varepsilon d\varepsilon \qquad (23)$$

FOC w/r to β″ is

$$\int_{z}^{x} \left[u'(c)\varepsilon\right] d\varepsilon = \psi\varepsilon + \mu\int_{z}^{x} \varepsilon d\varepsilon \qquad (24)$$

FOC w/r to β‴ is

$$\int_{v}^{z} \left[u'(c)\varepsilon\right] d\varepsilon = \phi\varepsilon + \mu\int_{v}^{z} \varepsilon d\varepsilon \qquad (25)$$

FOC w/r to β⁗ is

$$\int_{-\bar{\varepsilon}}^{v} \left[u'(c)\varepsilon\right] d\varepsilon = \kappa\varepsilon + \mu\int_{-\bar{\varepsilon}}^{v} \varepsilon d\varepsilon \qquad (26)$$

FOC w/r to x is (using Leibniz's rule)

$$\begin{aligned} &u(\bar{y}+(1+r)d+\varepsilon-(\alpha'+\beta' x)) - u(\bar{y}+(1+r)d+\varepsilon-(\alpha''+\beta'' x)) \\ &= \mu(\alpha''+\beta'' x) - \mu(\alpha'+\beta' x) \end{aligned} \qquad (27)$$

FOC w/r to z is (using Leibniz's rule)

$$\begin{aligned} &u(\bar{y}+(1+r)d+\varepsilon-(\alpha''+\beta'' z)) - u(\bar{y}+(1+r)d+\varepsilon-(\alpha'''+\beta''' z)) \\ &= \mu(\alpha'''+\beta''' z) - \mu(\alpha''+\beta'' z) \end{aligned} \qquad (28)$$

There are four different cases to consider.

Case 1: $\varepsilon > x$

This is in the interval from x to $\bar{\varepsilon}$. Here we have that (7) is binding. Therefore payments are equal to the largest amount that can be supported via sanctions,

$$\alpha' + \beta'\varepsilon = \eta(\bar{y}+(1+r)d+\varepsilon) \qquad (29)$$

This implies that:

$$\beta' = \eta \qquad (30)$$

and

$$\alpha' = \eta(\bar{y}+(1+r)d) \qquad (31)$$

Therefore in this region, $p(\varepsilon)=\eta(\overline{y}+(1+r)d+\varepsilon)$ and $c=(1-\eta)(\overline{y}+\varepsilon+(1+r)d)$. This implies that capital markets do not allow the country to insure against the shocks that fall within this region. The reason is that the country would be required to make transfers that are bigger than what it can credibly commit to pay.

Case 2: $z \le \varepsilon \le x$

In the region from z to x (7) is not binding. Therefore, $\lambda = 0$ and FOC's (20) and (24) combined become

$$\int_z^x u'(c)d\varepsilon \times \int_z^x \varepsilon d\varepsilon = \int_z^x [u'(c)\varepsilon]d\varepsilon \times \int_z^x d\varepsilon \qquad (32)$$

That is, the covariance of $u'(c)$ and ε in the interval from z to x must be zero. That outcome is guaranteed if c—and therefore $u'(c)$—are constant. In turn, this requires the rule $\beta''=1$ (i.e., this guarantees that consumption is constant), so that $c=\overline{y}+(1+r)d-\alpha''$ where α'' is a constant to be determined below.

We solve for α'' using FOC (27), which implies

$$\alpha''+\beta''x=\alpha'+\beta'x \qquad (33)$$

which, given $\beta''=1$, $\beta'=\eta$ and $\alpha'=\eta(\overline{y}+(1+r)d)$, is equal to

$$\alpha''=\eta(\overline{y}+(1+r)d)-(1-\eta)x \qquad (34)$$

Thus in this region $p(\varepsilon)=\eta(\overline{y}+(1+r)d)-(1-\eta)x+\varepsilon$ and consumption is constant and given by $c=(1-\eta)(\overline{y}+(1+r)d+x)$. This implies that capital markets allow the country to insure against the shocks that fall within this region.

Case 3: $v \le \varepsilon < z$

In this range, incentive compatibility constraint (7) is not binding and $\phi = 0$. Therefore, the situation is similar to Case 2. But there is a caveat: there is now uncertainty about what $p(\varepsilon)$ is. With probability $(1-q)$ there is no sudden stop, and the situation is formally identical to Case 2 (and the region $v \le \varepsilon < z$ simply extends the region $\varepsilon \le x$). Therefore payments and consumption are as those in Case 2 (which implies that $\beta''' = \beta''$ and $\alpha''' = \alpha''$). But with probability q there is a sudden stop. Since $\varepsilon \geq v$, the borrower does not default and so $p(\varepsilon)$ is given by (10) which implies that $\beta''' = 0$ and $\alpha''' = (1+r)d$. Thus, consumption in this case is $c = \bar{y} + \varepsilon$. Therefore, in this range, consumption is state-contingent only if there is a sudden stop.

Case 4: $\varepsilon < v$

This case is identical to Case 3 (because (7) is not binding), with a caveat. If there is a sudden stop the borrower now finds it convenient to default on the outstanding debt in order to "ease the pain."[8] This is because the realization of the shock is sufficiently bad so that the portion of the stochastic GDP that lenders can capture through sanctions is smaller than the outstanding debt $(1+r)d$. Therefore, if there is a sudden stop, then $p(\varepsilon)$ is given by equation (9) which implies that $\beta'''' = \beta'$ and $\alpha'''' = \alpha'$. Thus, $c = (1-\eta)(\bar{y} + \varepsilon + (1+r)d)$. Once again, whether consumption is state contingent or not depends on whether a sudden stop occurs.

In cases 3 and 4 capital markets do not allow the country to insure against the shocks that fall within these regions. The reason is not (as in Case 1) that the borrower cannot credibly commit to repay, but that lenders can trigger a sudden stop.

4. Summing Up

Putting all the pieces together we find that in the optimal contract payments are as follows. With probability $(1-q)$ (i.e., no sudden stop),

$$p(\varepsilon) = \begin{cases} \eta\bar{y} - (1-\eta)x + \eta(1+r)d + \varepsilon & \text{if } [-\bar{\varepsilon}, z) \\ \eta\bar{y} - (1-\eta)x + \eta(1+r)d + \varepsilon & \text{if } [z, x] \\ \eta(\bar{y} + \varepsilon + (1+r)d) & \text{if } (x, \bar{\varepsilon}] \end{cases} \tag{35}$$

With probability q (i.e., sudden stop),

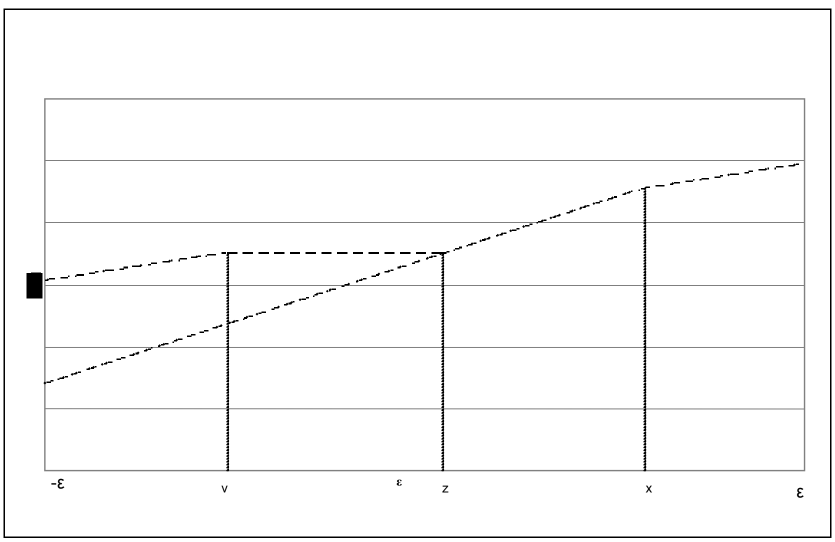
[8] If there is no sudden stop, then β‴=β″ and α‴=α″ because as in Cases 2 and 3, the incentive compatibility constraint is not binding and consumption is constant.

$$p(\varepsilon)=\begin{cases}\eta(\bar{y}+\varepsilon+(1+r)d) & \text{if } [-\bar{\varepsilon},v) \\ (1+r)d & \text{if } [v,z) \\ \eta\bar{y}-(1-\eta)x+\eta(1+r)d+\varepsilon & \text{if } [z,x] \\ \eta(\bar{y}+\varepsilon+(1+r)d) & \text{if } (x,\bar{\varepsilon}]\end{cases} \tag{36}$$

Note that the payment schedule is identical in both cases when $\varepsilon > z$ (i.e., when there is no risk of sudden stops). For the other cases, since sudden stops are unpredictable ex-ante (they occur with probability q), default can happen in equilibrium and thus the payment schedule depends on whether: (a) there is a sudden stop and, (b) if in the aftermath of a sudden stop the borrower defaults. We depict graphically $p(\varepsilon)$ in

Figure 1.

Figure 1. Payoff Function



For all shocks ε that fall in the region $x-z$, payments increase one to one with ε, as the borrower transfers to the lenders a constant amount α plus the amount ε. This is also the case for all shocks that fall in the region between $-\bar{\varepsilon}$ and z, but only if there is no sudden stop. If there is a sudden stop, then a) there is default if ε falls in the region between $-\bar{\varepsilon}$ and v (and therefore payments increase at the rate η as lenders impose sanctions), or b) there is no default if the shock falls in the region $z-v$ (and therefore payments are flat at $(1+r)d$). Note that for all shocks such that $\varepsilon < z$ only one of the two lines shown in the payoff schedule prevails, depending on whether a sudden stop materializes (top line) or not (bottom line). Finally, for all shocks such that $\varepsilon > x$, the borrower pays the maximum amount that lenders could otherwise take away through sanctions, and so payments increase at the rate η.

The consumption schedule is shown in Figure 2. With probability $(1-q)$,

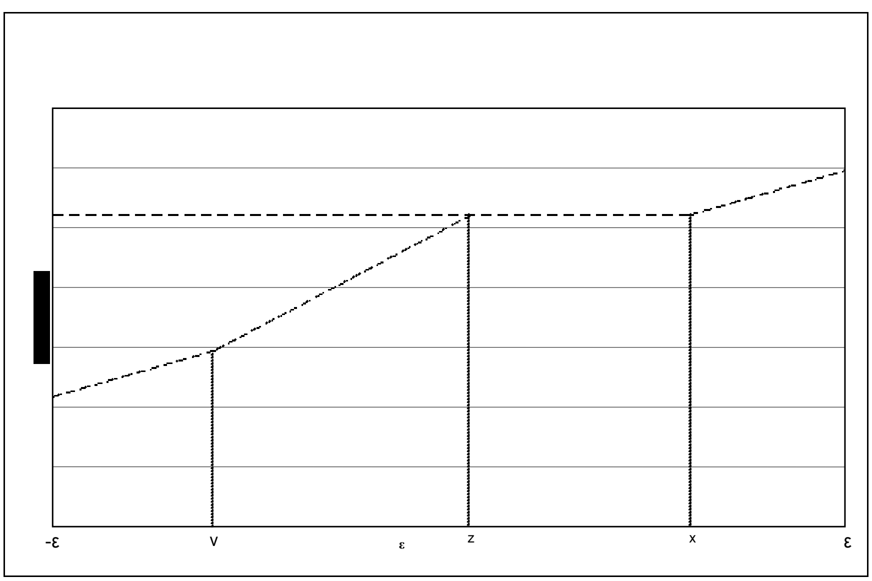
$$c(\varepsilon)=\begin{Bmatrix} (1-\eta)(\overline{y}+(1+r)d+x) & \text{if } [-\overline{\varepsilon},z) \\ (1-\eta)(\overline{y}+(1+r)d+x) & \text{if } [z,x] \\ (1-\eta)(\overline{y}+\varepsilon+(1+r)d) & \text{if } (x,\overline{\varepsilon}] \end{Bmatrix} \tag{37}$$

and with probability q,

$$c(\varepsilon)=\begin{Bmatrix} (1-\eta)(\overline{y}+\varepsilon+(1+r)d) & \text{if } [-\overline{\varepsilon},v) \\ \overline{y}+\varepsilon & \text{if } [v,z) \\ (1-\eta)(\overline{y}+(1+r)d+x) & \text{if } [z,x] \\ (1-\eta)(\overline{y}+\varepsilon+(1+r)d) & \text{if } (x,\overline{\varepsilon}] \end{Bmatrix} \tag{38}$$

Consumption is flat if either the shock ε falls in the region $x-z$, or if it falls in the region between $-\overline{\varepsilon}$ and z and there is no sudden stop. In all other cases, consumption is state-contingent and given by what the borrower can keep after payments are made.

Figure 2. Consumption Schedule



In the next subsection, we solve for the equilibrium values of z and x.

4.1 The Unknowns **z** ***and*** **x**

There are two unknowns, z and x. Solving for the former is easy using equation (28). It implies that

$$\alpha'' + \beta'' z = \alpha''' + \beta''' z \qquad (39)$$

Therefore,

$$z = \frac{\alpha''' - \alpha''}{\beta'' - \beta'''} \qquad (40)$$

which using the values of $\alpha''', \alpha'', \beta''$ and β''' from Cases 2 and 3, simplifies to:

$$z = -\eta \bar{y} + (1-\eta)(x + (1+r)d) \qquad (41)$$

As z is a function of x, we still need to solve for x in order to fully specify the equilibrium.

In order to solve for x one must use the zero profit condition (3). We have now broken the support $\{-\bar{\varepsilon}, \bar{\varepsilon}\}$ into five possible intervals according to the thresholds v, z, and x, and depending also on whether there is a sudden stop or not. To obtain a closed-form solution, assume that ε is uniformly distributed with mean zero. Then, the zero profit condition (3) (also re-printed in (16) and (17)) can be written as

$$\begin{aligned}(1+r)d &= q\int_{-\bar{\varepsilon}}^{v} (\eta(\bar{y} + \varepsilon + (1+r)d)\frac{d\varepsilon}{2\bar{\varepsilon}} + q\int_{v}^{z} (1+r)d\frac{d\varepsilon}{2\bar{\varepsilon}} \\ &+ (1-q)\int_{-\bar{\varepsilon}}^{z} (\eta\bar{y} - (1-\eta)x + \eta(1+r)d + \varepsilon)\frac{d\varepsilon}{2\bar{\varepsilon}} \\ &+ \int_{z}^{x} (\eta\bar{y} - (1-\eta)x + \eta(1+r)d + \varepsilon)\frac{d\varepsilon}{2\bar{\varepsilon}} \\ &+ \int_{x}^{\bar{\varepsilon}} (\eta(\bar{y} + \varepsilon + (1+r)d))\frac{d\varepsilon}{2\bar{\varepsilon}}\end{aligned} \qquad (42)$$

Note here x is the only remaining unknown. The solution to (42) is

$$x = A(B - C) \qquad (43)$$

where A, B, and C are functions of the exogenous variables η, $(1+r)d$, y and $\bar{\varepsilon}$ (see appendix for details). Recall that in equilibrium it must be true that $-\bar{\varepsilon} \le v \le z \le x \le \bar{\varepsilon}$.[9]

5. Simulations

5.1 Choosing the Optimal η

Given the nature of the problem and the incentive compatible contract, we now ask what is the optimal η that the borrower country chooses within the range of interesting cases. In other words, given a set of values for all exogenous parameters other than η, what is the "η" that would allow the borrower country to maximize utility?

In what follows, assume that the utility function takes the quadratic form

$$u(c) = -\frac{1}{2}((c(\varepsilon) - \bar{c})^2, \quad c \le \bar{c} \qquad (44)$$

where $\bar{c}$ is the bliss-point. It is readily verifiable that $u' > 0$ and $u'' < 0$.

We cannot solve for the optimal η analytically, so we resort to simulations and we look for the best among all interesting cases. We define the set of interesting η as those that, given all other exogenous variables, satisfy:

(i) $\eta \le Min\left(\dfrac{(1+r)d + \bar{\varepsilon}}{(1+r)d + \bar{\varepsilon} + \bar{y}}, \dfrac{(1+r)d}{(1+r)d + \bar{y} - \bar{\varepsilon}}\right)$. This condition was derived before and guarantees that the borrower has incentives to default for some realizations of the random variable.

(ii) η is such that the inequalities $-\bar{\varepsilon} \le v \le z \le x \le \bar{\varepsilon}$ are all simultaneously satisfied (this will determine a lower bound for η that is greater than 0, because the sanctions are sufficiently high to guarantee that the borrower does not always choose to default).

Before proceeding with the simulations, we re-write (1) in extensive form:

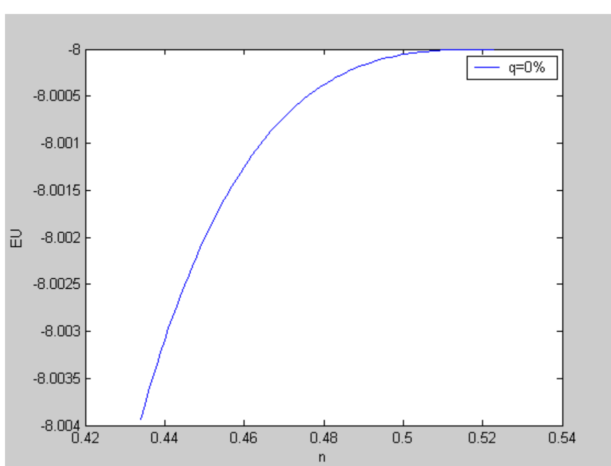
[9] Therefore, given the exogenous variables it is important to verify that in the resulting equilibrium all these inequalities are simultaneously satisfied. This control is performed when the model simulations are run.

$$
\begin{aligned}
Eu(c) = -\frac{1}{2}\Big(q\int_{-\bar{\varepsilon}}^{v}(c(\varepsilon)-\bar{c})^{2} f(\varepsilon)\frac{d\varepsilon}{2\bar{\varepsilon}} + q\int_{v}^{z}(c(\varepsilon)-\bar{c})^{2} f(\varepsilon)\frac{d\varepsilon}{2\bar{\varepsilon}} + \\
(1-q)\int_{-\bar{\varepsilon}}^{z}(c(\varepsilon)-\bar{c})^{2} f(\varepsilon)\frac{d\varepsilon}{2\bar{\varepsilon}} + \int_{z}^{x}(c(\varepsilon)-\bar{c})^{2} f(\varepsilon)\frac{d\varepsilon}{2\bar{\varepsilon}} \\
+\int_{x}^{\bar{\varepsilon}}(c(\varepsilon)-\bar{c})^{2} f(\varepsilon)\frac{d\varepsilon}{2\bar{\varepsilon}}\Big)
\end{aligned}
\tag{45}
$$

where $c(\varepsilon)$ is defined by (37) and (38) in each region. Note that for every possible η, the values of v, z and x change and so do $p(\varepsilon)$, $c(\varepsilon)$, and thus utility. To begin with, we normalize $\bar{y} = 1 = GNP$ (gross national product), and we set $\bar{\varepsilon} = 0.4$ (i.e., shocks can be as large as up to 40 percent of GNP), $(1+r)d = 0.7$ (i.e., debt represents 70 percent of GNP) and $\bar{c} = 5$. With this parameterization, the set of interesting η is (0.43, 0.53). If η is bigger than 0.53, then the problem is uninteresting because the borrower does not have incentives to default and we are in a world with perfectly enforceable property-rights. If η is less than 0.43, the borrower always defaults. The results are robust to alternative parameterization, as we shall see below.

We start with the standard Obstfeld and Rogoff (1996) example in which $q = 0$. In their setup there is no debt, but introducing it is straightforward and does not change the results. The simulations in Figure 3 show that setting the highest possible η is always in the best interest of the debtor. The reason is that, as Obstfeld and Rogoff (1996) state, *"As η rises, consumption can be stabilized across more states of nature, to the country's benefit. The sanctions are never exercised in equilibrium anyway, so their role here is the positive one of enhancing the credibility of the country's promise to repay"* (p. 360).

Figure 3. Expected Utility with q=0 (Benchmark case)



With or without debt this conclusion is the same because a) with zero profits for lenders, holding debt is not costly and b) the optimal payment contract is set so that the sanctions are never carried out. But things change when we allow for the possibility of a sudden stop by setting $q > 0$. This simple perturbation makes a big difference, since it allows for default as an equilibrium outcome. The simulation results in Figure 4 and Figure 5 show that now the relation between η and expected utility is no longer monotonic, but hump-shaped.

Figure 4. Expected Utility with q=0.3 (Benchmark case)

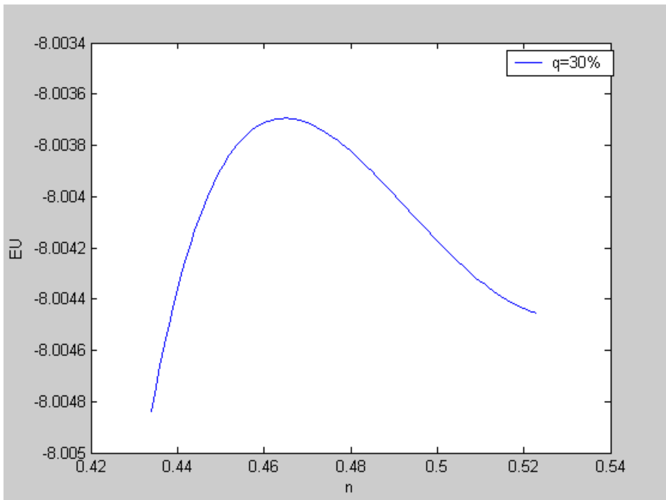
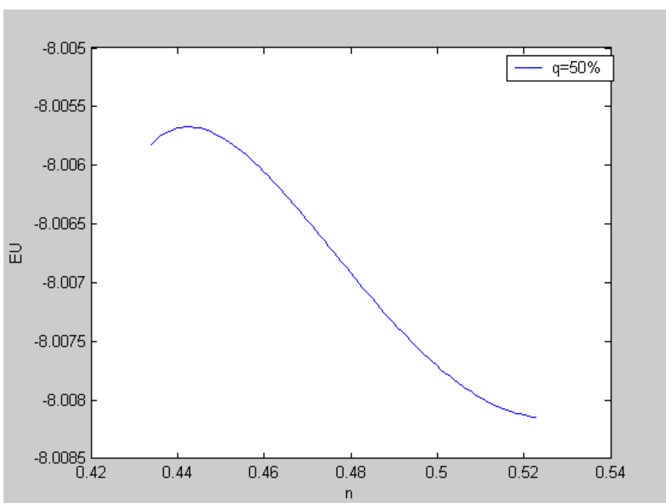


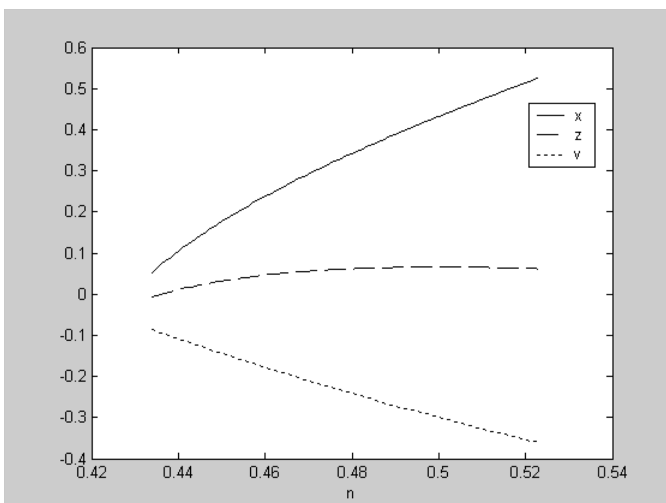
Figure 5. Expected Utility with q=0.5 (Benchmark case)



Unlike the case $q = 0$, with sudden stops the optimal value of η from the debtor's point of view is always less than the maximum value. Increasing η up to a certain threshold is beneficial because of the credibility-enhancing effect. But raising η also exposes the country to greater sanctions in the event of default. The adverse effect of raising η is stronger for higher values of q. The intuition behind this result is simple: increasing η enhances the credibility of the country's promise to repay. But raising η also reduces consumption in the aftermath of a crisis because it increases what lenders can take away through sanctions if there is default—and defaults do happen in equilibrium. In other words, a higher η reduces the attractiveness of default as an insurance against sudden stops.

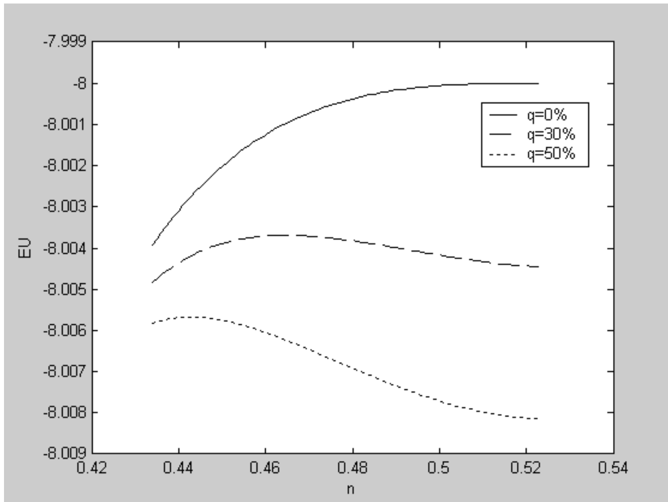
The point can also me made graphically. In **Figure 6** we plot x, z, and v against η to show how increasing η generates a trade-off between expanding region $x - z$ (i.e. the consumption-smoothing region) vis-à-vis expanding region $z - v$ (i.e. the region where in the aftermath of a sudden stop the borrower does not default).

Figure 6. *x*, *z*, and v (Benchmark case)



Interestingly, when we superimpose the expected utility graphs for different q's in Figure 7 we find that both, the optimal η and the borrower's utility fall as q increases. This means that the first best outcome from the borrower's point of view would be to set the maximum possible η (as in the standard Obstfeld and Rogoff model), but only if he can be guaranteed that there will not be sudden stops (i.e., $q = 0$).

Figure 7. Expected Utility Compared (Benchmark case)

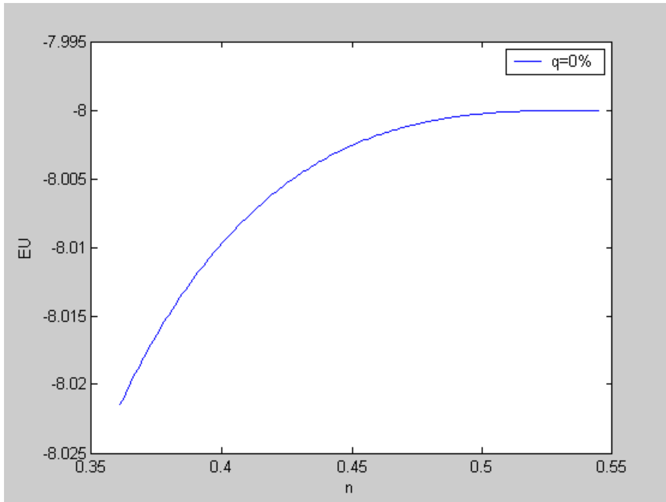


These results are robust to different parameter values. We have performed a battery of sensitivity tests to verify that our results are not driven by an arbitrary set of values for the exogenous variables. Next, we show the same set of graphs for the case when $\overline{y} = 1$ (normalization), $\varepsilon = 0.7$ (shocks can be as large as up to 70 percent of GNP), and $(1+r)d = 0.5$ (so debt represents 50 percent of GNP). This alternative parameterization has the effect of expanding the set of interesting η to (0.37, 0.55) because there is now a wider set of possible shocks. Reassuringly, all the qualitative results remain unchanged.

We start again with the case when $q = 0$ in

Figure 8. Without risk of sudden stops, the borrower is always better-off setting the highest feasible η.

Figure 8. Expected Utility with q=0 (alternative parameter values)



Let us now explore the intuition for this result again. Recall that in principle, there are two types of borrower default that could happen in this model. The first one is when the borrower unilaterally decides not to pay in "good" states of nature (i.e., high realizations of ε), while the other (pure debt-default) is triggered as a response to a sudden stop. When $q = 0$, the latter is ruled out. The first one is eventually prevented by the incentive-compatible payment contract. This involves a schedule where the maximum payment that the borrower is ever supposed to carry out is the largest payment that can be supported via sanctions. With greater sanctions, the credibility of the borrower's promise to repay, and consequently its creditworthiness, increase. There is no setback to the borrower in raising η because the sanctions are not exercised.

This conclusion changes when $q > 0$. In that case, default in the aftermath of a sudden stop is a possible outcome and therefore sanctions are a real possibility. This is illustrated in Figure 9 and Figure 10 by the hump-shaped format of the expected utility lines.

Figure 9. Expected Utility with q=0.3 (alternative parameter values)

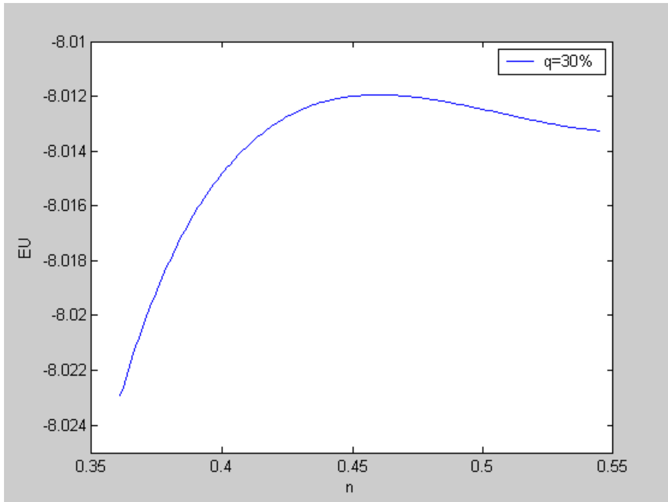
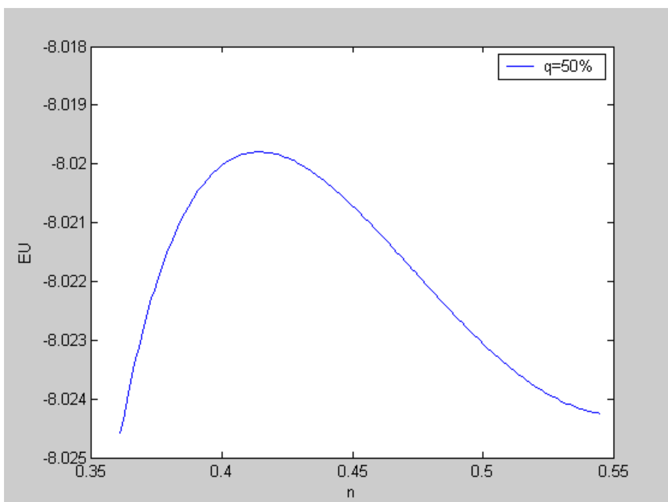


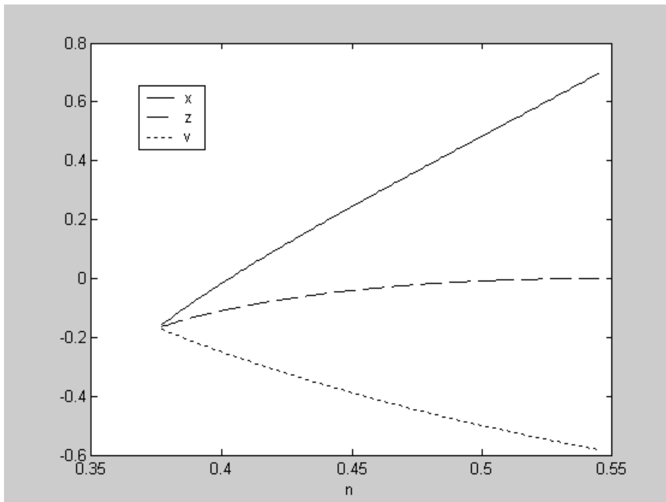
Figure 10. Expected Utility with q=0.5 (alternative parameter values)



When sanctions are a real threat, the borrower needs to weigh the advantages against the disadvantages of increasing η. The advantages have to do, as before, with the credibility-enhancing effect, the disadvantages relate to the real possibility that sanctions might be exercised. Note that as the probability of a sudden stop increases (i.e., as q increases), so does the probability of default. The reason is that default can only happen conditional on the occurrence of a sudden stop, so the two phenomena are linked. As sanctions are only imposed in the aftermath of a debt default, the relative importance of the disadvantages of raising η increase with the probability of debt-default. This is the reason why in Figure 10 with $q = 50\%$, the decreasing portion of the expected utility line is more extended than in Figure 9, where $q = 30\%$.

The advantages and disadvantages of raising η are also illustrated in Figure 11 where we plot v, z, and x against η.

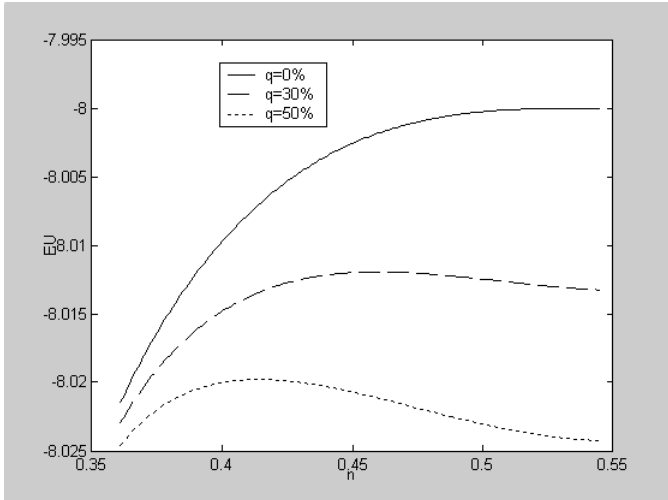
Figure 11. *x*, *z*, and *v* (alternative parameter values)



Just as before, with the new parameterization we observe how increasing η generates a trade-off between expanding region $x - z$ (i.e., the consumption-smoothing region) vis-à-vis expanding region $z - v$ (i.e., the region where in the aftermath of a sudden stop the borrower does not default). The region $z - v$ expands as η increases because it becomes less convenient for the borrower to default and face the sanctions. Yet the alternative to default is to pay back the debt in full. Thus, raising η exposes the borrower to more payments in the aftermath of a sudden stop and simultaneously decreases the attractiveness of default as a form of relief from sudden stops.

Finally, Figure 12 shows that the borrower would prefer to live in a world where sanctions for misbehavior are high and $q = 0$, but the threat of misbehavior (i.e., choosing a η below the maximum feasible) is the optimal response in a world where sudden stops are possible (i.e., $q > 0$).

Figure 12. Expected Utility Compared (alternative parameter values)



Graphs for other parameter values are available from the authors upon request.

5.2 Choosing the Optimal d

Suppose that η is fixed and that, given a set of values for all other exogenous variables, the country chooses the level of debt that maximizes utility. Since η is now fixed, equivalent restrictions on the interesting values of η apply presently to d. Therefore, we define the set of interesting d's as those that, given a set of values for all other exogenous variables, satisfy:

(i) $d \geq Max\left(\dfrac{\eta(1-\bar{\varepsilon})}{(1-\eta)(1+r)}, \dfrac{\eta(1+\bar{\varepsilon})-\bar{\varepsilon}}{(1-\eta)(1+r)}\right)$. This condition guarantees that there are incentives for the borrower to default in certain occasions.[10]

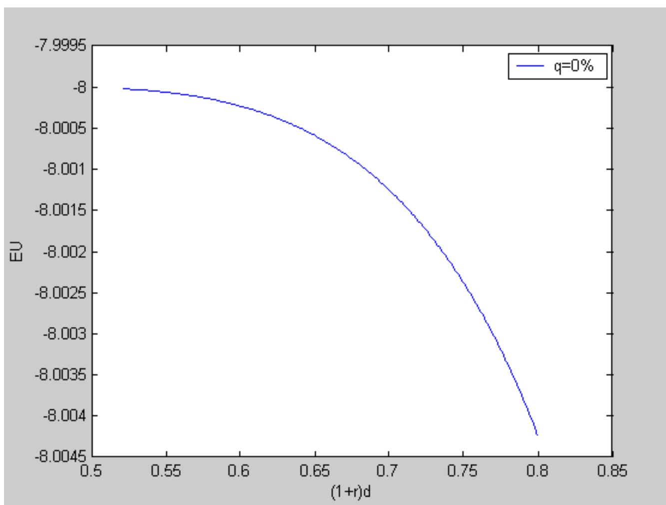
(ii) d is such that the inequalities $-\bar{\varepsilon} \leq v \leq z \leq x \leq \bar{\varepsilon}$ are all simultaneously satisfied (this defines an upper bound for d because, given the sanctions, if the debt level is too high then the borrower will never have incentives to pay back and there is no possible equilibrium).

[10] This condition is the reciprocal of condition (i) in the previous case. If d is not greater than the greater of these two bounds, then there are no realizations of the shock for which the borrower prefers to default and be sanctioned rather than repay. There are two bounds because one applies to good and the other to bad states of nature. Note that both bounds are, ceteris paribus, decreasing in $\bar{\varepsilon}$ (i.e., bigger shocks have the effect of lowering the minimum threshold of debt that supports an equilibrium with incentive problems), and increasing in η (i.e., countries exposed to more sanctions have to have more debt to be tempted to default).

We proceed with the same simulations of the previous section but for the interesting d 's instead of η 's. We set again $\overline{y}=1$ (normalization), $\overline{\varepsilon}=0.4$ (i.e., shocks can be as large as up to 40 percent of GNP), $\overline{c}=5$. We also fix $\eta=0.46$. With this parameterization, the set of interesting d 's is (0.52,0.80). If d is less than 0.52, then the problem is uninteresting because the borrower does not have incentives to default. If d is greater than 0.80, then the stock of debt is so high that the borrower will always default.

We start with the standard case where $q=0$. The simulation results in Figure 13 show that setting the lowest possible d is always in the best interest of the debtor.

Figure 13. Expected Utility with q=0 (Benchmark case)



The intuition for this result is as follows: because high levels of debt make it, ceteris paribus, more tempting for the borrower to curtail payments in good states of nature, the incentive compatible repayment contract is necessarily more stringent. Thus, minimizing d raises the welfare of the borrower by allowing him to smooth consumption across more states of nature. In other words, reducing the level of debt serves as a substitute to raising η: it raises the credibility of the borrower's promise to repay and, thereby, its creditworthiness. But things change when we allow for the possibility of sudden stops by setting $q>0$. When sudden stops can happen in equilibrium, borrowers have the option of defaulting to reduce the pain. Having higher levels of debt makes this relief more powerful, because after default the borrower retains a fraction $(1-\eta)$ of what he owes. The simulation results in Figure 14 and Figure 15 make two points. First, with $q>0$ expected utility is hump-shaped in the stock of debt, and the optimal debt level is interior. The intuition for this result is that when there is risk of sudden stops, the borrower weights the credibility enhancing advantages of having a lower stock of debt, against the disadvantages stemming from the reduced cushion against sudden stops. As η is now fixed, the level of debt is the adjusting valve: just as before the borrower could secure more resources in the aftermath of default by choosing the level of η to reduce sanctions, he can now do the same thing by choosing a higher level of defaultable debt. Second, the optimal debt stock is increasing in q. The higher the risk of a sudden stop, the better it is to have a larger debt level in order to "ease the pain" of a sudden stop through default. Because debt serves to cushion the adverse effects of sudden stops, the advantages of raising d increase with q and gradually outweigh the disadvantages.

Figure 14. Expected Utility with q=0.3 (Benchmark case)

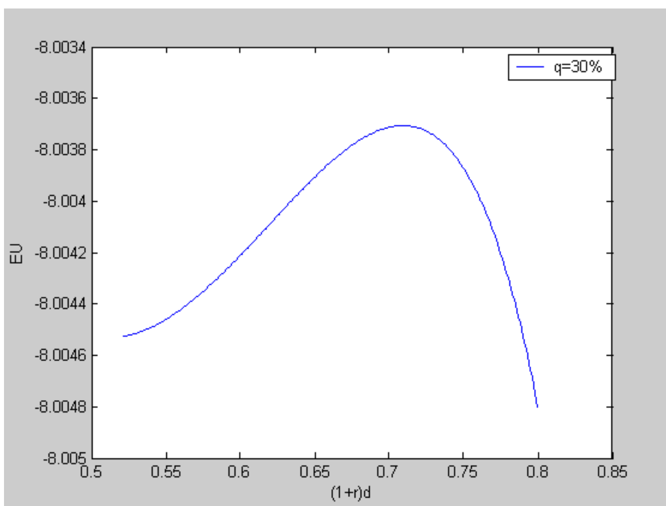
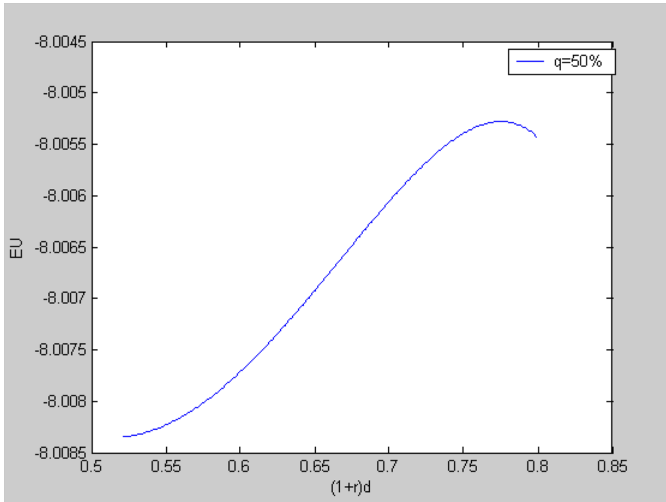


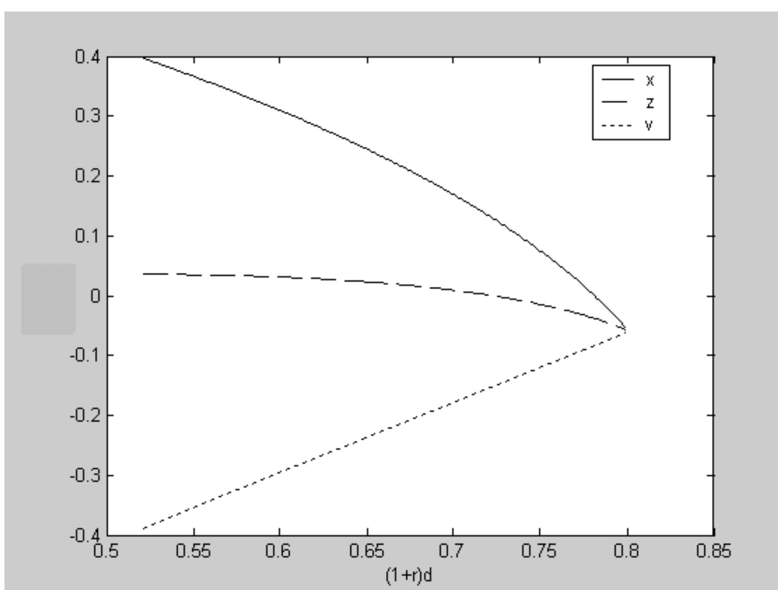
Figure 15. Expected Utility with q=0.5 (Benchmark case)



The intuition for this result can also be seen graphically. In

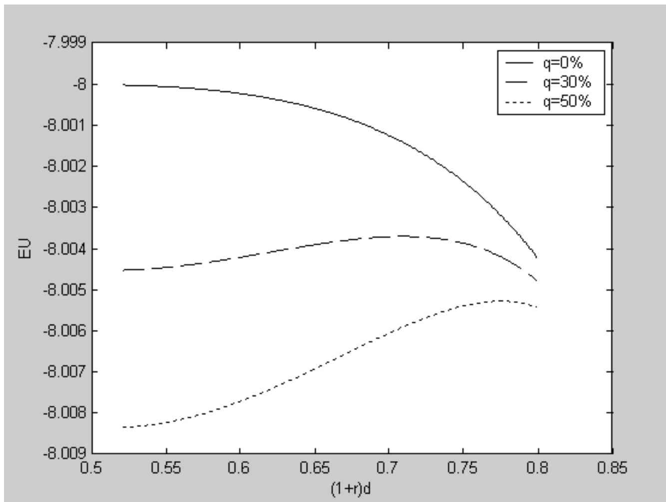
Figure 16, we show that the interval $z-v$ shrinks as d increases, meaning that increasing the level of debt makes the option of default more appealing. Yet this comes at the expense of reducing the possibility of smoothing consumption, since the region $x-z$ is also shrinking in d. The relative weights assigned to the advantages and disadvantages of raising d depend on the likelihood of sudden stops. With $q=0$, only the disadvantages matter, but with $q>0$ the advantages also weigh in.

Figure 16. *x*, *z*, and *v* (Benchmark case)



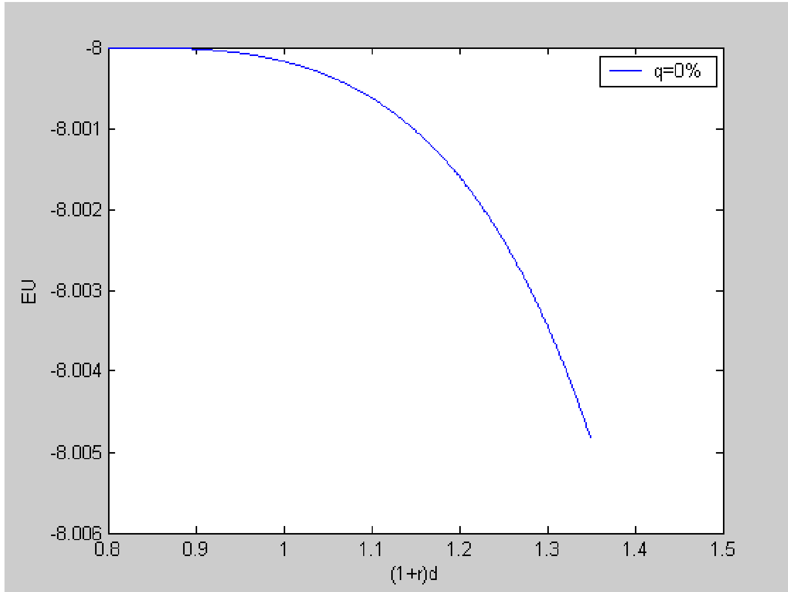
Finally, note that when we superimpose the expected utility graphs for different values of q in Figure 17, we find that the optimal level of debt increases with q, but that utility levels fall as q increases. Thus, the first-best for the borrower would be to set the minimum possible d, but the first best is not attainable when the borrower perceives the risk of sudden stops.

Figure 17. Expected Utility Compared (Benchmark case)



The results in this section are qualitatively robust to alternative parameter values. For example, below we set again $\bar{y} = 1$ and $\bar{c} = 5$, but we expand the support of the shock by setting $\bar{\varepsilon} = 0.7$ (i.e., shocks can be as large as up to 70 percent of GNP) and we set more severe sanctions, $\eta = 0.6$. With this parameterization, the set of interesting d's is now (0.8,1.35). Note that the minimum level of debt that supports an equilibrium where there are incentive problems is now higher. The intuition behind this result is that an economy that is exposed to greater sanctions needs a large stock of debt to be tempted to default and face the sanctions. We begin again with the case when $q = 0$ in Figure 18. Recall that this is the case when the possibility of default is completely ruled-out by a suitable incentive compatible contract. Therefore the borrower is always better-off by minimizing the stock of debt. Additional debt only has the effect of making the resulting contract more stringent, thus limiting the possibilities of consumption smoothing.

Figure 18. Expected Utility with q=0 (alternative parameter values)



Instead, when $q > 0$, default becomes a possible equilibrium outcome. Thus, the stock of debt can be used as insurance against sudden stops. There are now advantages to the borrower associated to raising d. In Figure 19 and Figure 20, it is shown that the advantages of increasing d can quickly outweigh its disadvantages.

Figure 19. Expected Utility with q=0.3 (alternative parameter values)

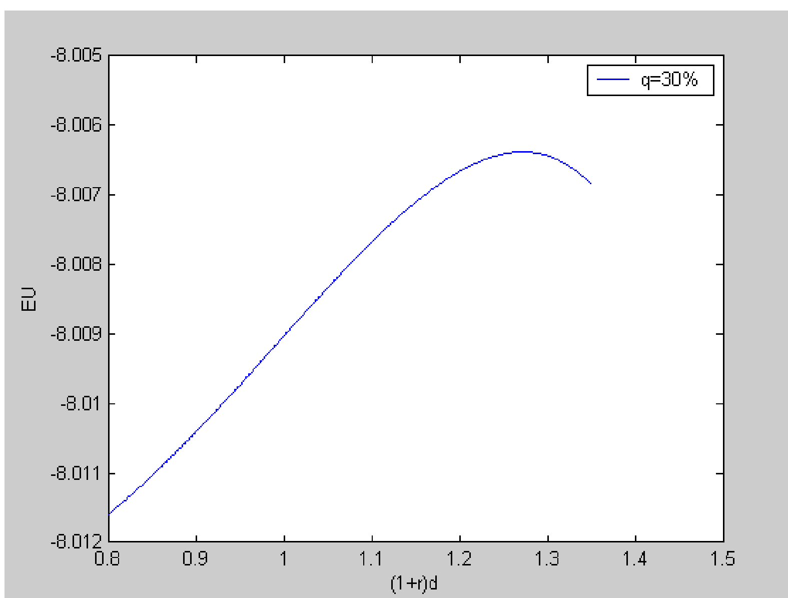
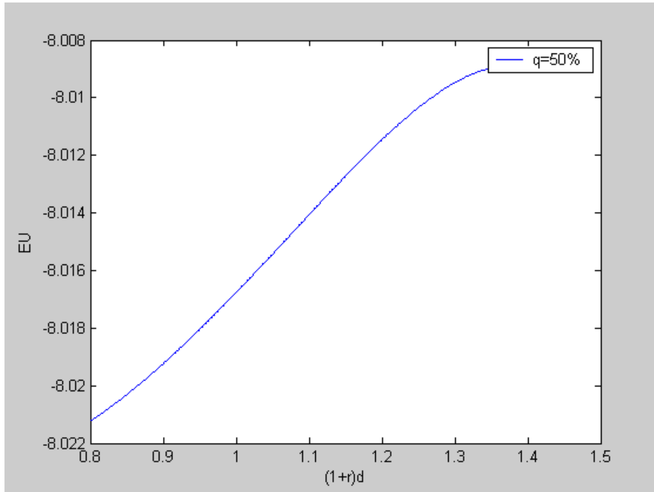


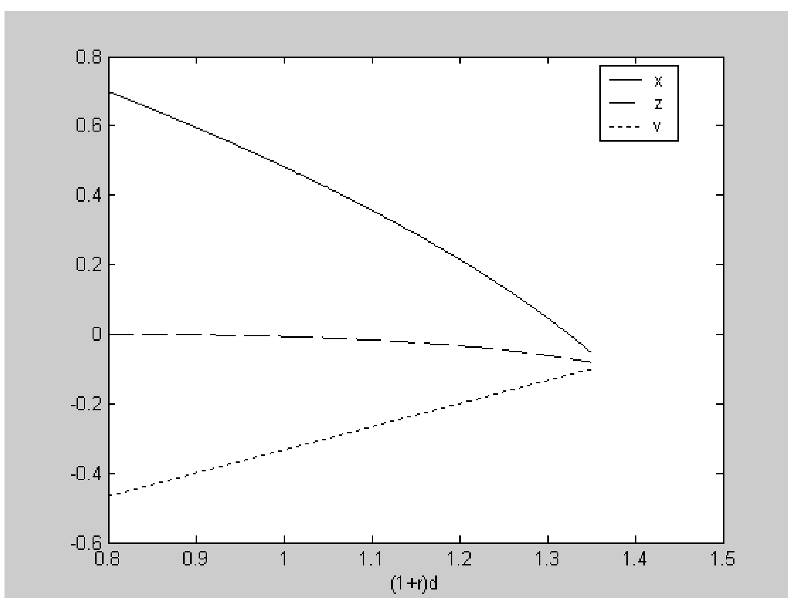
Figure 20. Expected Utility with q=0.5 (alternative parameter values)



For a predetermined level of sanctions, as the borrower can always retain a fraction $(1-\eta)$ of what he owes if he decides to default, it is in his best interest to acquire more debt than what he would if he felt safe (i.e., $q=0$). The higher the perceived risk, the more debt he wants to acquire.

Given that raising d has the effect of increasing the resources that the borrower can keep in the aftermath of a sudden stop if he decides to default, it also increases the attractiveness of the "default" option. This point is made graphically in Figure 21.

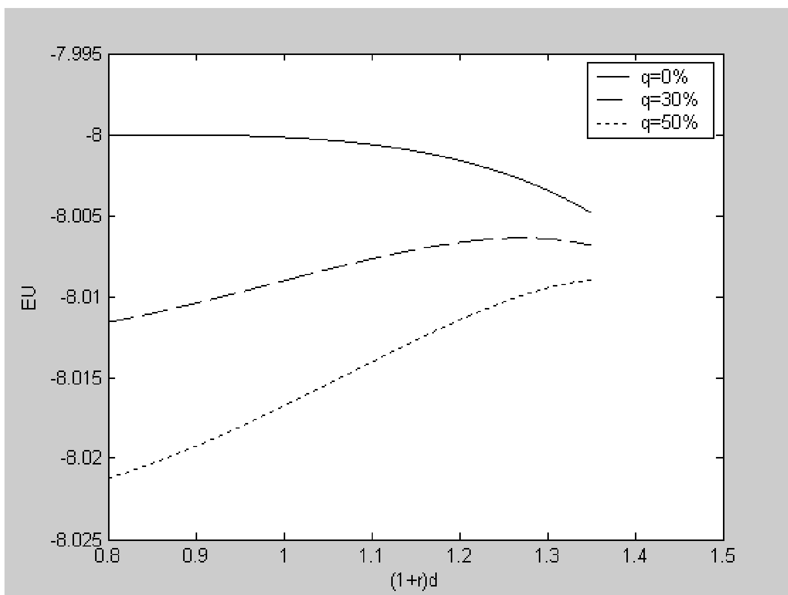
Figure 21. *x*, *v*, and *z* (alternative parameter values)



Note that as d increases, the segment $z-v$ shrinks. Recall that for all shocks that fall within the segment $z-v$, the borrower does not default in the aftermath of a sudden stop. Thus, as the segment shrinks, it becomes more likely that the borrower will default if there is a sudden stop. Also, note how increasing d also shrinks the segment $x-z$, reflecting the fact that more debt reduces the creditworthiness of the borrower. Therefore, increasing d imposes a trade-off to the borrower between reduced creditworthiness, and more insurance against sudden stops.

When we superimpose all the expected utility graphs in
Figure 22 we observe that it is again true that the borrower would prefer to live in a world where there is no risk of sudden stops and thus minimize the stock of debt. But an uncertain world leads to over-indebtedness, because debt works as self-insurance against sudden stops.

Figure 22. Expected Utility Compared (alternative parameter values)



Graphs for any other parameterization are available from the authors upon request.

6. Conclusions

The message of this paper is simple: in the presence of sudden stops in capital movements, borrower countries do not have incentives to build national institutions that secure the property rights of investors, as those guarantees might backfire if the country is forced to default. Similarly, they might choose to over-indebt as a way to self-insure against probable sudden stops.

Forcing or recommending countries to behave differently will not work unless those countries perceive that the world is also a safe place. This implies that strategies like THAP, which are embedded in policy prescriptions currently fashionable in many Washington-based multilateral institutions, can work only if they are accompanied by a better international lending environment with fewer sudden stops in capital movements.

This paper extends the benchmark model of sovereign default and direct creditor sanctions of Obstfeld and Rogoff (1996), by incorporating two key features of today's financial markets that have a strong impact on the policy implications: first, lenders are not always well behaved because they can trigger sudden stops in capital movements; and second, we consider not only insurance contracts, but also debt contracts.

We do not claim that either institutional reform to secure property rights, or prudent debt management policies, is an undesirable objective. On the contrary, we show that borrowers' would be interested in pursuing those policies, which we call THAP, but not under the conditions prevalent in today's international financial markets. Instead, a more stable international lending environment would go a long way towards promoting the correct incentives for countries to undertake THAP policies.

The corollary of this is that domestic and international reform must be undertaken jointly: a better international lending environment, with fewer sudden stops in capital movements, makes it more likely that nations will undertake institutional reforms at home.

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Appendix

In the appendix we solve (42) to get x. We begin by normalizing $\bar{y}$

$$\bar{y} \equiv 1 \qquad (46)$$

Next, for notational simplicity let:

$$(1+r)d \equiv D \qquad (47)$$

and

$$\bar{\varepsilon} = w \qquad (48)$$

Finally, recall from (41) that

$$z = -\eta\bar{y} + (1-\eta)(x+D) \qquad (49)$$

We replace all these in (42)

$$\begin{aligned} D = {} & q\int_{-w}^{-\eta+(1-\eta)(x+D)} (\eta(1+\varepsilon+D))\frac{d\varepsilon}{2w} \\ & + (1-q)\int_{-w}^{-\eta+(1-\eta)(x+D)} (\eta-(1-\eta)x+\eta D+\varepsilon)\frac{d\varepsilon}{2w} \\ & + \int_{-\eta+(1-\eta)(x+D)}^{x} (\eta-(1-\eta)x+\eta D+\varepsilon)\frac{d\varepsilon}{2w} \\ & + \int_{x}^{w} (\eta(1+\varepsilon+D))\frac{d\varepsilon}{2w} \end{aligned} \qquad (50)$$

and solve for x. This equation has two roots:

$$x = A(B-C) \qquad (51)$$

$$x = A(B+C) \qquad (52)$$

where

$$A = \frac{1}{2(-q\eta^2 + q\eta^3 - 1 + \eta + q - q\eta)}$$

$$B = -2q\eta^3 + 2q\eta^2 - 2qw - 2\eta w - 2q\eta D + 4q\eta^2 D + 2q\eta w + 2w - 2q\eta^3 D$$

$$C = 2\sqrt{L}$$

$$\begin{aligned} L = {} & -6q\eta^2 D^2 + 6q\eta^3 D + 2q\eta D + 4q\eta D^2 - 6q\eta^2 D + 4q\eta^3 D^2 + q^2\eta^2 w^2 \\ & -q\eta^2 w^2 + 4Dqw - q\eta^4 w^2 - 2q\eta^4 w + q^2\eta^4 w^2 - 2q^2\eta^3 w^2 + 2q\eta^3 w^2 \\ & +4q^2 w\eta^3 - 2q^2 w\eta^2 - 2q^2\eta^4 w - 2q^2\eta^4 wD + 6q\eta^2 Dw + 6q^2 w\eta^3 D \\ & +2q^2 w\eta D - 6q^2 w\eta^2 D + 2q\eta^3 Dw - 2q\eta^4 Dw - 4\eta^2 w \end{aligned}$$

It turns out that for all q and $\eta \in (0,1)$ (and any value of D) only the first root satisfies the condition that $x \in [-\bar{\varepsilon}, \bar{\varepsilon}]$. Therefore we drop the second root.