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Willingness to Pay and the Sovereign Debt Contract.

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Abstract. This paper applies contract theory to discuss the sovereign debt contract. Models of corporate finance discussing the standard private debt contract are the appropriate theoretical frameworks if sovereign immunity is accounted for. Under the law of the state of New York there are two fundamental groups of legal provisions that are particularly relevant in sovereign debt contracts. One group providing for unanimous action clauses (UACs) requiring approval of hundred per cent of bondholders before any hair-cut is enacted. This provision has been questioned because just one holdout may cause efforts to modify the payment obligations of a bond to fail. The other group are generally denominated *exit consents* covering matters such a negative pledges, governing law, submissions to jurisdiction and listing provisions, that can be used to circumvent the unanimity requirement. Liquidity crisis affecting sovereigns generates a widespread opinion favoring modifications of covenants enhancing the probability of successful renegotiations. But a closer inspection to the nature of sovereign debt contract indicates that covenants ruling debt renegotiations are important to assure the sovereign willingness to pay. A *new financial architecture* attempting to modify the standard debt contract without paying attention to the incentive constraints could end up jeopardizing capital flows to emerging economies. On the contrary, paying more attention to incentive constraints could enhance a more transparent and better access of emerging economies to capital markets.

1. Introduction.

Several models of corporate finance have evaluated the standard debt contract and have derived second best results as a consequence of asymmetric information and verifications costs. Incentive constraints are incorporated to rule out strategic defaults and to assure debtor's willingness to pay. Some of these models could be extended to consider the case of a sovereign debt contracts, but with several caveats with respect to the possibility that sovereigns debt contracts can have the same effective legal mechanisms than private agents in case of financial distress.

The debate on effective mechanisms to restructure the debt of nations in financial distress evolved first in the direction of involving the official sector in generalized bail-outs, but moral hazard considerations changed the directions of the debate towards market oriented solutions involving the private sector in the open capital markets. This new approach has not been widely acknowledged, and representatives of the official sector in international organizations have permanently complained about the reluctance of private lenders in accepting hair-cuts as a necessary contribution to complement a package of limited official resources to alleviate the financial conditions of distressed borrowers. Most of the time the private sector would argue that the legal provisions of standard debt contracts are needed to assure international lending to emerging economies (Folkerts-Landau, D., and Garber, P., 1999).

An important share of emerging market debt contracts are issued with legal provisions under the law of the state of New York that provide for unanimous action clauses (UACs) requiring approval of hundred per cent of bondholders before any hair-cut is enacted. Unanimity makes it difficult for bondholders to provide relief to the sovereign issuer in times of liquidity crisis because just one holdout may cause efforts to modify the payment obligations of a bond to fail. Holdouts reflect both: the existence of agents with different perceptions regarding debtor's willingness to pay, as well as the existence of difference in litigation technology. Vultures are significant players in most defaults because they seem to be extremely efficient to contest in legal proceedings, and holdouts are exercised most of the time. In contrast, bondholders are regular investors seeking stable returns through a diversified portfolio and are not akin to vultures, who target defaulted exposures relying in the efficiency of their own economic analysis as well as in their litigation and holdout ability. Vultures are speculators in financial markets and perform similar functions as speculators in commodities markets.

Although severely criticized, vultures are willing to work at the extremes providing liquidity to defaulted assets at the very time when everybody is considering selling the asset.

Also working at the extremes is the International Monetary Fund (IMF) providing liquidity to countries in financial distress, and on the verge of loosing access to capital markets. Curiously enough, many academicians seem more prone to accept vultures as welfare enhancing but not the IMF. There are two groups of critics to the IMF: on the one hand are those who consider the IMF as not aggressive enough in providing liquidity, thinking that financial distress is the result of weak aggregate demand and should be corrected with more government spending, borrowing and fiscal expansion; on the other hand are those considering that the IMF intervention implies a serious moral hazard for the official sector, and in some instances improper liquidity assistance helped to postpone structural reforms financing capital flights aggravating the severity of the crisis. For this last group the IMF seems to act as a natural predator to vultures, on the one hand providing liquidity when nobody would, except vultures, and on the other hand urging sovereign bond issuers to modify their contracts enabling easier restructurings through majority actions, or collective action clauses (CACs), instead of unanimity clauses. Supposedly these modifications would help the extinction of most vultures holdouts.

But sovereigns, investment funds, and some economic research argued that sovereign immunity plus weak CACs could accelerate the extinction of both: vultures and the international private lending to emerging markets. The argument is that UACs, and other contractual provisions affecting the probability of successful renegotiation, enforce the debtor's willingness to pay. Allowing partial coalitions of bondholders relaxing incentive constraints would weaken the willingness to pay, jeopardizing international capital flows to emerging markets.

To evaluate the coalition possibilities, either in restructuring or in the post default negotiations, it is necessary to understand some of the intricacies of the legal provisions in debt contracts, in particular, it is important to review other provisions denominated "exit consents". These are other contractual clauses covering matters such a negative pledges, governing law, submissions to jurisdiction and listing provisions, that can be used to circumvent the unanimity requirement. Changing these clauses requires in some cases simple majority, in other cases, requires 66.66% of the outstanding bonds.

Choi and Gulati (2003), have evaluated a sample of 50 bond issuances governed under New York law including samples of Ecuador, Uruguay, Argentina and other emerging markets economies and have found that exit consent offers several possibilities of strategic coalitions of players, some of these coalitions have already facilitated the restructuring of Ecuador, and possibly will rule the post default negotiations of most future defaults of sovereigns issuing bonds with UACs.

To illustrate, imagine the case of outstanding bonds having UACs covering just payments dates for principal and interest, and the sovereign in financial distress has managed to work out a coalition with a majority of domestic bondholders to enact a restructuring deal. Suppose that external bondholders in coalition with vultures refuse to go along with the deal because they have expectations of a better deal. Exit consents could be used by the sovereign in coalition with domestic bondholders prior to their exit from the old bonds. Through exit consents, domestic bondholders exchange their old bonds for the new restructured bonds simultaneously consenting to changes in the terms of the old bonds not covered under UAC provision. Through changes in the governing law, listing provisions and other terms, the exit consent procedure can diminish dramatically the value of the old bonds. Changing the governing law from that of New York to that of the home country that could be less sympathetic to holdout behavior would make it harder for the holdouts to sue. Alternatively, exit consent may be used to rescind the issuer's waiver of sovereign immunity or its consent to jurisdiction in New York, both of which would complicate the ability of holdouts to bring suit to enforce their rights under the old bond covenant.

This could be considered to be abstract legal theory, but it is not. As a practical matter these sort of exit consent were used by Ecuador and Uruguay in sovereign debt contracts governed under the New York Law. The highly stylized contract theory model developed in the following sections will attempt to address these issues.

2. The complete and incomplete debt contract

A simple method for analysing the government's willingness to pay is to imagine that a sovereign asks for a loan to a creditor promising to repay "b", which represents the nominal value of the sovereign bond at expiration date. The debtor owns "k" liquid assets (with k<1) but needs to borrow (1-k). In addition, assume that the creditor has the option of an alternative investment at a risk free rate "r".

The sovereign, using its own and borrowed resources, generates an economic and social environment that can produce a fiscal primary surplus, which is used to repay the capital and interests on the amount borrowed. This amount can be produced in two periods in the following way[1]: imagine the debtor's country GDP resulting from two sectors: the first sector is an agricultural sector where the "crop" is collected in the first period, and the other sector is non-agricultural and produces in the second period. Therefore the first period primary surplus is random (because output is random), and the second period primary surplus is deterministic. The idea is to reproduce a typical "external shock" of the sort affecting countries where government revenues are dependent on some commodities like soybeans in the case of Argentina or copper in Chile. In a favorable state, the primary surplus obtained in the first period is enough to pay the outstanding debt. In an unfavorable state, the first period primary surplus is not enough to pay the debt, and the second period primary surplus is used to cancel the outstanding debt.

Suppose that the first period surplus, "z", has a uniform distribution in the interval [0; 2s]. Note that "z" is random with expected value, "Ez", equal to "s", but in the second period is a predetermined variable of value "s"[2].

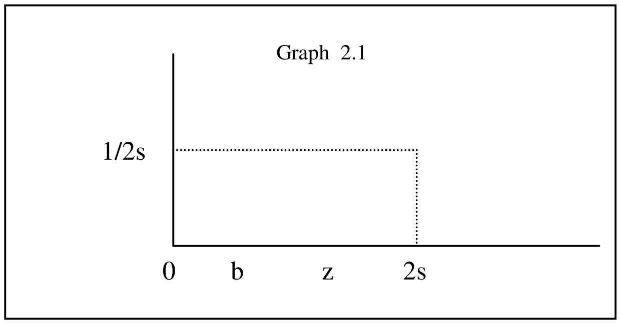
If perfect information exists, and both debtor and creditor are risk neutral, and the expected surplus is higher than (1-k)(1+r) (representing the creditor's alternative investment at a risk free rate, "r"), a debt contract is possible with the following characteristics:

a) The creditor makes a loan of (1-k) and expects to receive an amount equal or higher to (1-k)(1+r).
b) Once the creditor has been paid, the debtor has an expected surplus of Ez + s-(1-k)(1+r).

[1] This modelling for output has been developed by **Bolton, P., and Scharfstein, D. S., 1996,** and **Dooley, M., and Verma, S., 2002.**

[2] The uncertainty of the first period output based on uniform distribution was analysed for the case of a private firm by **Romer, David**, 1996, following the theoretical framework proposed by **Gale Douglas, and Hellwig, Martin, 1985. Fernández, 2003,** extended the analysis to the case of a sovereign debt. The fact that the expected primary surplus of the first period and deterministic surplus of the second period are equal is unsubstantial.

As "z" is uniformly distributed, if the primary surplus realized "z" exceeds the nominal value of the bond, "b", (as shown in graph 2.1) a favorable state occurs. Therefore, the probability of a favorable state is: $\theta(b)= (2s-b)/2s$ and the probability of an unfavorable state is $1- \theta(b)=b/2s$.[3]



The simple example of a two sectors economy -agricultural and non-agricultural- can be taken to illustrate the sequence of events. At the beginning of the first period (covering spring and summer), (1-k) is borrowed from the creditor. This amount is essential for buying seeds, fertilizers and other expenses for plowing and harvesting. At the end of the first period and beginning of the second period (covering fall and winter), the crop is collected and sold generating a primary surplus z. With probability $\theta(b)$, the primary surplus is large enough to service the debt. With probability $(1 - \theta(b))$ the surplus is not large enough to service the debt and it should be "renegotiated". At the end of the second period a non random "s" is produced that can be used to service the debt in case that it was not paid at the end of the first period.

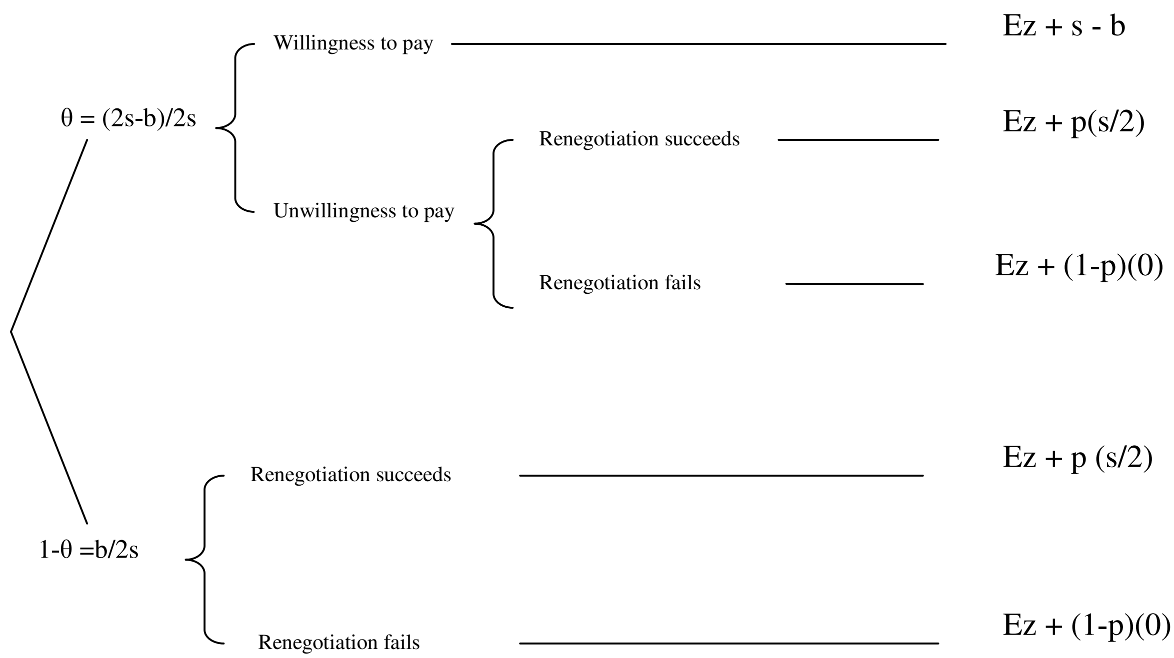
Note that a **complete debt contract** could be arranged if it were possible to issue a bond with clauses taking in consideration the different possible states. For example, the contract might say "If the weather is favorable and a large crop can be collected, the bond will be paid at the end of the summer, in any other case, it will be paid at the end of the winter". The problem is that, in many instances, there is a "costly state verification" (Townsend, Robert M., 1979), meaning that a state can be *observed* but not *verified* in a court settlement. This generates **incomplete contracts**, where clauses as described above, cannot be found.

[3] In Bolton and Sharfstein (1996), Dooley (2000), and Dooley and Verma (2002) the state probability is exogenous reflecting different kinds of shocks (as weather, or sudden stop of capital inflow Calvo, G., Izquierdo, A., y Talvi, E. , 2002), while in this model the probability is endogenous and depends on the nominal value of the bond. That is, the higher the level of indebtness the higher the probability of an unfavorable state.

Incompleteness admits the possibility of the debtor's unwillingness to pay; even in a favorable state the sovereign could use the primary surplus in his own benefit at the expense of the creditor. This means that if the debt is not paid, it can be attributed to two reasons: *liquidity crisis* corresponding to an adverse state, or *strategic default* corresponding to a favorable state and the debtor's unwillingness to pay.

A feasible contract should penalize a default but it should also consider the possibility of an adverse state. In the context of this model a default is penalized by creditor's action limiting the possibilities of the sovereign to fully take advantage of the primary surplus at the end of the second period. The fact that the default state is of public knowledge, creditors could take some executive actions to jeopardize the primary surplus in the second semester. These actions should not be understood as the confiscation of assets held abroad that usually have wide press coverage and a reputation effect for the sovereign. In our framework the relevant actions are those affecting real economic activity such as suspension of short term trade financing, or elimination of long run credit financing of capital goods and intermediate inputs.

Taking in consideration the potential damage on output (or surplus) of such actions let's consider that at the end of the first period the sovereign declares default on his debt and the contract is renegotiated. If renegotiation fails, with probability "1-p", the primary surplus of the second period is zero. If renegotiation succeeds with probability "p", the primary surplus is "s", which is shared in equal parts between debtor and creditor. The following decision tree illustrates the debtor's country expected payoff under the assumption that the risk free interest rate is zero:



The value of “p” is crucial in defining the debtor’s willingness to pay. To accept a debt contract, the creditor needs covenants to rule out a strategic default. It is assumed that the choice variable "p" is a probabilistic representation of explicit or implicit covenants such as UACs, CACs, and exit consents that rules the process of debt renegotiations. A high “p” implies a contractual framework where renegotiation is obtained with high probability, while a low “p” implies a low probability to achieve a successful renegotiation. This choice variable is necessary to enforce an incentive constraint (IC) to motivate the willingness to pay as follows:

$$Ez + s - b \geq Ez + p\left(\frac{s}{2}\right) + (1-p)(0) \tag{2.1}$$

This expression means that the expected payoff when the debtor is willing to pay, must be at least equal to the expected payoff of a strategic default..

In addition to a willingness to pay constraint, there is a creditor constraint, given that the creditor will not accept an expected value anything less than the alternative risk free investment. Therefore, the following "creditors constraint" (CC) condition must be met:

$$\frac{(2s-b)}{2s}b+\frac{b}{2s}p\frac{s}{2}-(1-k)\geq 0 \tag{2.2}$$

The first term is the expected payoff if the state is favorable; the second term is the expected payoff when the state is unfavorable and the creditor receives half of the second period surplus when negotiation is successful, and zero otherwise. The last term represents the amount lent by the creditor. The constraint shows that the creditor's expected payoff must be at least equal to lending the same amount, 1-k, at a risk free (zero) interest rate.

The government whishes to maximize its expected revenue from the activity it produces with its own and borrowed resources. The government's objective function (OF) is represented by:

$$OF=\left(\frac{2s-b}{2s}\right)[Ez+s-b]+\left(\frac{b}{2s}\right)\left[Ez+p(\frac{s}{2})+(1-p)(0)\right] \tag{2.3}$$

When the state is favorable, which occurs with probability (2s-b)/2s, the government receives Ez + s and pays the bond of value "b"; when the state is unfavorable, which occurs with probability b/2s a renegotiation lottery is enacted. If renegotiation is successful, which occurs with probability "p", the government obtains Ez + ps/2, if renegotiations fails, which occurs with probability (1-p) the government obtains just Ez. Note that the objective function does not include the possibility of a strategic behavior, which is ruled out by imposing the willingness to pay constraint.

3. Results for Complete and Incomplete debt Contracts.

3.1 The solution for the complete debt contract

The complete debt contract is possible if states are not costly to verify and commitments can be legally enforced. This situation implies that the incentive constraint (reflecting the debtor's willingness to pay) is not required, since a favorable or unfavorable state can be verified at no cost; thus, the sovereign has no motivation to deviate the surplus in the first period. The creditor's constraint must be binding at the optimum, that is, the expected pay-off to the creditor can not be greater than a risk free investment. If this were not the case, the sovereign has the option of searching for another creditor in a competitive market.

A complete debt contract reaches two first best solutions. This is illustrated in Graph 3.1[4]. As debtor and creditor observe all the states, a default is not possible. The creditor collects "b" in a favorable state or s/2 in an unfavorable state. Renegotiation never occurs, or equivalently, "p" is always equal to one. Since the shape of the creditor's constraint is convex and the objective function is concave, there are two values corresponding to the government's bond. Without further considerations both solutions are equilibrium solutions where debtor and creditor receive the same payoff. The solution with a lower b has a higher probability of a favorable state where the creditor is paid "normally", while the solution with a larger b has a lower probability of a favorable state and the creditor does not obtain the full value of the nominal bond. This result resembles some of the analysis in the literature where multiple equilibriums are discussed as a possible feature of emerging economies.[5]

For simplicity this model has considered a single creditor, but in a competitive capital market with several creditors, the highest value of "b" could be discarded since the debtor will always find a creditor willing to receive a bond at the lower nominal value minimizing the potential reputation effect of default.

Graphically, the intersection of OF and CC shows the first best result for the nominal value of the government bond "b" and the probability of a successful renegotiation, that in the complete contract is p=1. A comparative statics exercise when $p = 1$ gives $db/ds<0$ (for values of b less than 2s, which is the maximum repayment capacity of the project). This implies that if the primary surplus is increased,

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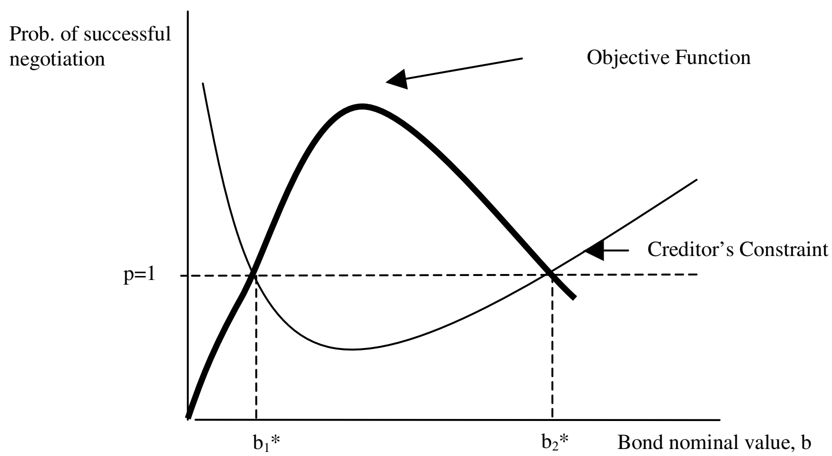
[4] The graph reproduces the shapes of the curves OF and CC. Solution exists for a range of parameter values. For example, for $s = 0.8$ and $k = 0.5$, there is one solution for p=1 corresponding two solutions for b, 055 and 1.45, respectively. Both solutions generate the same value of 1.10 for the objective function. As a probability of a favorable state depends on "b", a low level of indebtness implies a high probability of favorable state with debt being serviced at the end of the first period. On the contrary, when indebtness is high, there is a high probability of an unfavorable state with debt being serviced in the second period. To illustrate a practical application of this conclusion, Argentina entered in default at the end of the 80s and in 2001, in both cases debt to GDP ratio just exceeded 40% (a ratio that could be considered fairly low for any country), this would suggest that close to this ratio a default has a high probability in Argentina. Of course, the uniform distribution for the surplus is not unsubstantial on this issue.

[5] Calvo, 2002, develops the argument that debt service and government expenditures are financed with distortionary output taxes and there is a region where high and low growth equilibria coexist. High growth implies low taxes sustaining high growth, while low growth implies high taxes sustaining low growth. The policy implication is that International Financial Institutions will help to coordinate the high growth equilibrium.

CC moves leftwards, allowing the issue of a lower value government bond. In a context of emerging markets, this would mean that an increase of the primary surplus would reduce the country's risk premium allowing for a bond of lower value for the same amount of money borrowed. A higher primary surplus and a lower nominal bond increase the probability of a favorable state and decrease the probability of default.

Graph 3.1 – First Best Solution



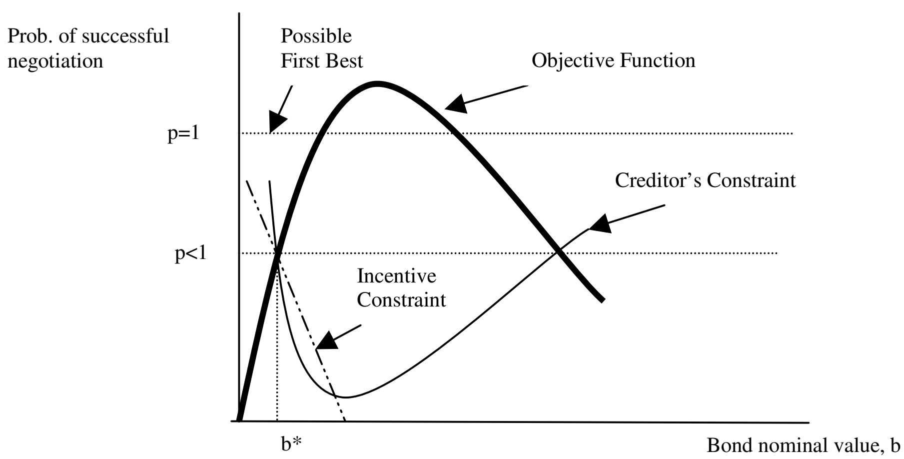
3.2 The solution for the incomplete debt contract

As mentioned in section 1, when state verification is costly or there is no possibility to verify the different states in a court settlement, an Incomplete Contract has to be analysed giving place to a second best solution. This calls for the inclusion of an incentive constraint (IC) assuring debtor's willingness to pay to avoid a strategic default.

The solution is obtained using restrictions (2.1), (2.2), the objective function (2.3), and remembering that Ez = s. Note that, in the incomplete contract, the creditor's constraint (2.2) is also binding using the same argument as in the complete contract case.

The difference between this problem and the complete case is that now the incentive constraint (2.3) plays an important role. As shown in Graph 3.2, when the IC is added, a second best solution is located to the southeast of the first best indicating a lower value for the objective function, a higher value of the nominal bond and a lower probability of a successful renegotiation. The added IC intersects the creditor's constraint at two values of "b", but only the lower value is an optimum as the objective function improves moving upwards.

Graph 3.2 – Second Best Solution



They key element of the optimal contract is the probability of renegotiation when first period surplus is not enough to repay the loan. The threat of failure in renegotiation induces the sovereign to avoid keeping the first period surplus. If he were to keep it, the sovereign renegotiates with probability of failure (1-p), and in case of failure the second period payoff is 0, which is a lower total payoff to what the debtor would have otherwise received if he had not opted for strategic default. That is, when first period surplus is in fact $z > b$, the sovereign will prefer a net payoff of $z - b + s$ rather than $z + ½ s$. If first period surplus were in fact $z < b$, a liquidity default is produced and renegotiation might fail with probability (1-p). It is this last outcome which produces the welfare loss of the incomplete contract.[6]

[6] This result is frequently observed in the "Principal-Agent" literature. Normally, optimum contracts are determined by ex-post bargaining considerations, a topic that has received considerable attention in corporate finance literature, for example, Diamond, 1993.

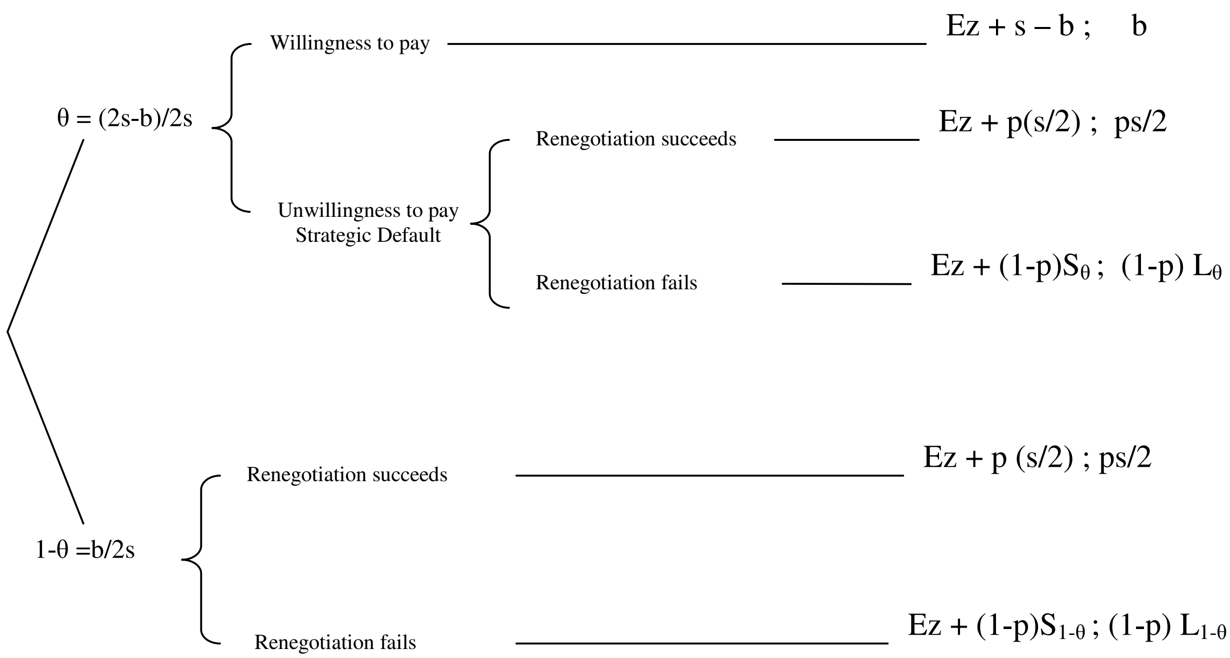
4. Renegotiations after default

The previous model assumed that the failure of renegotiations at the end of the first period, which occurs with probability (1-p), implied that the primary surplus of the second period vanished. Now we will introduce a more realistic assumption contemplating the possibility that, even in default, some primary surplus is obtained in the second period. To include this possibility in the design of debt contract we must consider the expected actions and decisions of sovereign, bondholders, as well as outside buyers, sometimes referred as "vultures". The vulture is defined as an agent who has the financial and risk capacity to purchase deeply discounted debt of a defaulted sovereign in the expectation of increasing its value.

First, ignore for the moment the willingness to pay constraint; imagine a sovereign that plays a strategic default, and renegotiations fails with probability (1-p). In the second period the defaulted economy is able to produce a primary surplus of $s' < s$ and legal procedures and negotiations can be enacted by the sovereign and bondholders to claim that primary surplus. Suppose that the sovereign, using cash accumulated from the first period can offer side payments to bondholders and expects to obtain a net value of S_θ in the second period. On the other hand bondholders can negotiate with the sovereign and vultures and expect a liquidation value L_θ.

Second, imagine a liquidity default; similar arguments indicate that the sovereign expects to obtain $S_{1-\theta}$ and bondholders $L_{1-\theta}$.

Now, reconsider the decision tree:



In this decision tree, the creditor's expected payoff was added, separated by a "semicolon" from the debtor's expected payoff. The difference between this decision tree and the one in the basic model is the introduction of the variables S_θ, $S_{1-\theta}$, L_θ and $L_{1-\theta}$ that in the basic model were all set to zero.

In contrast with the original bondholder, the vulture is assumed to have a highly efficient legal technology that allows him to extract a larger part of the second period surplus. Furthermore, it will be assumed that the vulture bears no cost in negotiating and litigating, and that the maximum amount he can recover from the second period is total surplus s'. Next we start analysing the simplest case of a post default negotiation game with the sovereign, one bondholder and one vulture.

4.1 One Creditor and One Vulture.

Without loosing any substance in the analysis, we will start assuming that the creditor gets no value from keeping a defaulted bond, therefore he may decide to sell it to a vulture to recover as much as he can.

-*Liquidity Default*: Suppose that the state is unfavourable, the first period primary surplus is not large enough to pay the bond, and the sovereign defaults. If renegotiation is successful, with probability "p", assuming Nash bargaining, the second period surplus will be divided equally between debtor and creditor. But if renegotiation fails, the second period surplus is reduced to s', and the vulture enters the game. Given that it is a liquidity default it is assumed that the sovereign has not enough cash to compete with the vulture, and since the maximum amount a vulture can recover is s', this amount (again assuming Nash bargaining) will be divided equally between vulture and creditor.[7]

Therefore, the bondholder's expected profit in a liquidity default after failed renegotiation is:

$L_{1-\theta} = [\, ½\, s']$

And the sovereign's payoff when renegotiation fails is:

$S_{1-\theta} = 0$

-*Strategic Default*: Suppose that the state is favorable and the sovereign defaults. The cash surplus from the first period is enough to cancel the bond, but the sovereign decides to default with the intention to use the available cash in its own benefit, or to compete with the vulture in post-default negotiations. Assume that the expected pay-off from post-default negotiations represents to the sovereign a value S_θ. There are now three potential parties to the negotiations: the sovereign, the bondholder and the vulture. For the negotiation game we follow an approach originally developed by Shapley (1953). The specific framework is a three person coalitional game with side payments. The Shapley-Value is an a priori measure of what each player expects to obtain by participating in the game. This value also shows what contribution each player can make when they cooperate in a coalition and it is expected that each participant will receive its Shapley Value. In the appendix we analyze the different coalitions and show that the sovereign's Shapley Value is $S_\theta = s'/6$.

Therefore, the incentive constraint that motivates the sovereign's willingness to pay is:

[7] It can be shown that if the vulture bore some cost of litigating, "c", and the cost is uniformly distributed in the interval [0, C], and unknown at the beginning of the first period, it pays for the vulture to get involved if $c \leq s'/2$ and this occurs with probability (1/C) (½) (s'), so $L_{1-\theta} = 1/C\, (½\, s')^2$.

$$Ez + s - b \geq Ez + p\frac{s}{2} + (1-p)\frac{s'}{6} \qquad (4.1.1)$$

On the other hand, the creditor will include the expected liquidation value post-default and will not accept a debt contract with lower expected value than an alternative risk free investment:

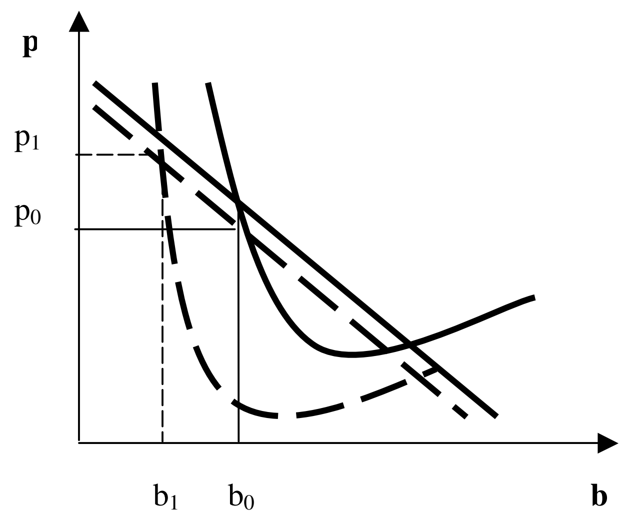
$$\left(\frac{2s-b}{2s}\right)b + \frac{b}{2s}\left[p\frac{s}{2} + (1-p)\left(\frac{1}{2}s'\right)\right] - (1-k) \geq 0 \qquad (4.1.2)$$

The government's objective function does not change and is the same described in previous sections. When the contract takes in consideration expectations of post default negotiations the solution changes, as illustrated[8] in Graph 4.1, from b_0, p_0 to b_1, p_1, obtaining a lower value for the bond and higher probability of a successful renegotiation. The sovereign also increases his payoff , and all these results are due to the possibility of having a second period surplus. The assumptions in the original model were that if renegotiation failed with probability 1-p, the second period surplus was zero. This assumption seems to be too strong when evaluating sovereign defaults. What frequently is observed is a short period of output loss, and a lot of market transactions of defaulted debt with the expectations that some value can be recovered when the sovereign becomes normal again. Vulture's participation contributes to a positive liquidation value when renegotiation fails after a liquidity default. The main reason is the assumption that the bondholder has no litigation ability. The same result could be obtained with the bondholder hiring the services of lawyer and sharing the full liquidation value.

In the case of a strategic default the vulture's participation is ex-ante, that is, at the time of designing the contract and not ex-post because the willingness to pay constraint rules out strategic defaults. Perhaps this is the main reason why vultures have such a bad reputation. They contribute to rule out strategic defaults and nobody notices them, but, to be credible, they must prove their existence in liquidity defaults when nobody wants them around, except bondholders out of cash.

[8] As the model presents multiple solutions the comparative statics is performed in the economically reasonable solution, that is the solution with a bond with lower nominal value. The existence of the solution is also sensible to parameters values, and the solution illustrated in Graph 4.1, correspond to parameter values of s=0.98, and k=0.5. The model including expected post-default negotiations is equivalent to a comparative statics exercise shifting s' from s'=0 to s'=0.80. With these parameter values, the optimal solution when s'=0 is b_0=0.511 and p_0 =0.957 (which are the same as in the original model), while the optimal solution when s'=0.80 is b_1=0.505 and p_1=0.959 where the value of the bond decreases, the probability of a successful renegotiation increases, and the value of the objective function increases.

Graph 4.1. Solution Including Post Default Negotiations.



4.2 One Governing Law, two Managers and One Vulture.

Suppose an emerging economy issuing a bond under New York governing law. Suppose that there is one investor holding 50% of his bonds in the domestic country and the other 50% of the same bond in a foreign country[9]. Therefore, there are two types of claims on the sovereign: domestic and foreign. Suppose that the investor has two independent portfolio managers (working at no cost to the investor) one resident and the other non-resident. In case of default, both managers are left with a claim with zero value. If the vulture participates in the post-default negotiation in coalition with the managers they extract a surplus, s' < s.

[9] This is a simplifying assumption to introduce a difference in jurisdiction during a litigation process. The alternative assumption would be to consider two totally different bondholders one resident and one non resident. This assumption would require two creditors' constraints increasing the complexity of the solutions.

There are now four potential parties in the negotiation: two managers, the vulture and the sovereign. In the many coalitions that can be produced, it will be assumed that each party receives its Shapley Value. It will also be assumed that the coalition of vulture *or* sovereign *with* the foreign manager receives $\gamma s'$ ($0<\gamma \leq 1$) from the second period surplus, while the coalition between vulture *or* sovereign *with* the domestic creditor obtains $\alpha\gamma s'$, $\alpha \leq 1$. These assumptions can be rationalized on the basis of the following considerations. As mentioned at outset, "exit consents" create the possibility that sovereigns might form a coalition with domestic residents to modify covenants not requiring UACs. There is also the possibility that domestic managers could be "persuaded" by the government not to take an aggressive litigation stance in case of default. So domestic managers, either in coalition with the government or with a vulture, might accept a lower recovery value[10]. The parameter α, can be set equal to 1 when domestic and foreign creditor can extract from the debtor the same amount, but α can be less than 1 when the there are independent managers acting in different environments and jurisdictions. It is also assumed that the coalition of the two managers with the sovereign receive s'.

-*Liquidity Default*: Suppose that the state is unfavourable and the country defaults. If renegotiation is successful, with probability "p", assuming Nash bargaining, the second period surplus will be divided equally between sovereign and bondholder. But if renegotiation fails, the vulture enters in the game, and s' will be divided according to their Shapley Values. Now, $L_{1-\theta}$ will be the sum of both managers Shapley Values. It can be shown that this equals to:

$$L_{1-\theta} = s'.2/3 - \gamma s'(1+\alpha)/6.$$

The vulture's Shapley Value ($V_{1-\theta}$) is

$$V_{1-\theta} = s'/3 + \gamma s'(1+\alpha)/6$$

The Shapley Value of the sovereign is zero ($S_{1-\theta} = 0$), because in a liquidity default it is assumed that the sovereign has not enough cash to compete with the vulture and does not enter the game.

[10]This can be illustrated in the following quotation from a politician: "Repaying Argentina's debts, he has said, means "paying with the sweat and toil of the people". Foreign bondholders don't vote, and politicians are reluctant to repay them with the sweat and toil of the people who do." Published by "The Economist", February 19 2004, "The End of the Affair?"

Notice that the sum of Shapley Values corresponding to each player adds up to s'. Also notice that the managers' Shapley Value depends negatively on γ and α while the vulture's Shapley Value depends positively on those parameters. This implies that if the sovereign can discriminate against the local manager with a reduced value of α, the sum of both managers Shapley Value increases.

-*Strategic Default*: Suppose now that the state is favorable but the sovereign defaults. The strategic behavior of the sovereign represents a net value of S_θ . The model of four people bargaining implies that each participant will receive its Shapley Value, and S_θ can be shown to be:

$S_\theta = s'/12 + \gamma s'(\alpha + 1)/12$

With these values, the model is described as follows. The objective function does not change and the willingness to pay constraint is the following:

$$Ez + s - b \geq Ez + (1-p)[\frac{1}{12}s' + \frac{1}{12}\gamma s'(\alpha+1)] + p\frac{s}{2} \qquad (4.2.1)$$

The creditor's constraint is set to:

$$\left(\frac{2s-b}{2s}\right)b + \frac{b}{2s}\left[p\frac{s}{2} + (1-p)\left(\frac{2}{3}s' - \frac{1}{6}\gamma s'(\alpha+1)\right)\right] - (1-k) \geq 0 \qquad (4.2.2)$$

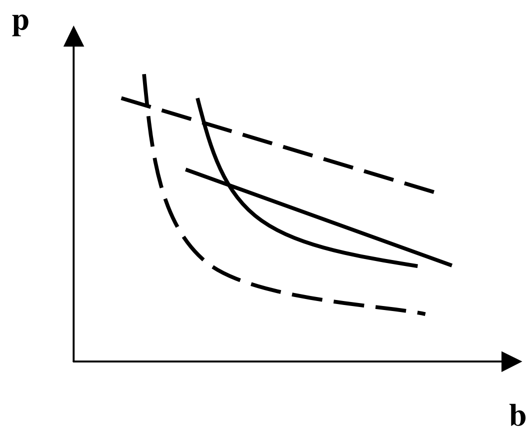
.

The conclusions for this case are similar to the case of one creditor and one jurisdiction. If the government falls into a liquidity default, second period surplus s' is divided between the vulture and both managers according to their Shapley Value, whereas the government receives zero.
Contract design includes a willingness to pay constraint ruling out the possibility of strategic behaviour by the sovereign. This means that the sovereign will always be better off honouring the bond in a

favourable state than playing the game of a strategic default. Again, the existence of the vulture is a priori speculation in a strategic default and a sure thing in a liquidity crisis.

Another conclusion is that, if the domestic portfolio manager can be discriminated against in post-default negotiations, the sovereign could issue contracts with lower nominal values for bonds and a higher probability of renegotiation. This seems a controversial result but can be illustrated with a comparative static exercise. A discrimination against the local manager implies a lower value for α: the willingness to pay constraint shifts upwards and the creditor's constraint shifts leftwards as indicated in Graph 4.2 from the solid line to the dashed lines.

Graph 4.2. Discrimination against local managers.



The explanation is as follows. As local managers are discriminated (α reduced) the Shapley Value of the bondholder represented by the local and the foreign manager increases, while the Shapley Value of the vulture is reduced. As more of the second period surplus, s', is expected to be received by the bondholder the nominal value is reduced and the bond has higher probability of a successful renegotiation. This result depends upon the assumption of one bondholder and two managers. The local manager litigates "inefficiently", either by himself or in coalition with the vulture, reducing his own payoff and vulture's payoff in benefit of the foreign manager. If instead of two managers we had two bondholders (one local and one foreigner) to produce similar results we would need capital controls to allow for discrimination against the local bondholder.

5. Conclusions.

The application of contract theory that we have developed in this paper indicates that several controversial issues of what has been denominated as a *new international financial architecture* can be analyzed in a framework of standard economic theory . With reasonable assumptions it is possible to address topics that economists have not paid too much attention but are at the heart of day to day contract design of bond issues for emerging economies. Governing law, UACs, CACs, exit consents, and litigation procedures are fundamental aspects that are permanently ignored except at the time of restructuring a defaulted sovereign debt.

As the model presented in the preceding sections indicates, post default renegotiations are important elements to be taken in consideration at the time of contract design. The analysis performed so far, indicates that the flow of capital funds, badly needed by emerging economies, could be jeopardized if renegotiations are considered to be just a "political" problem out of the context of contract design. Ignoring the fundamental reasons why contracts are the way they are will not help the international capital markets. Paying attention to topics so far exclusively monopolized by professional lawyers specialized in sovereign debt could enrich the understanding of a better financial architecture.

Ignoring the role of incentive constraints assuring the willingness to pay in sovereign's debt contracts might be beneficial at the time of a liquidity crisis but will promote strategic defaults increasing the uncertainty and the long run stability of emerging capital markets.

Governing law is an important element to be considered, as well as the distribution of debt in local and foreign markets, subject to one jurisdiction. The analysis performed so far indicates that post default coalitions to renegotiate debt contracts are important in determining ex-ante the nature of the contract and a fundamental requirement in covenants assuring a transparent and economically efficient access to markets.

All this analysis suggests that a better approach to a new financial architecture is perhaps to deepen the understanding of debt contracts, governing law, and the working of post default coalitions, including vultures. These fundamental issues in debt contract design might need to be taken in consideration in proposals for a statutory approach involving the IMF (for example, Krueger, (2002)) in crisis resolution. A promising approach would be to define international standards for UACs, CACs, governing law, jurisdiction, and exit consents. A limited role of lender of last resort was discussed by Dooley and Verma (2002) under the assumption that the IMF cannot distinguish between strategic and liquidity defaults, and the present model could be extended in that direction. Another possibility is to think the lender of last resort participation as a lump sum transfer moving the distribution of "z" to the right, decreasing the probability of an unfavorable state. However, when this action is included in the analysis, the sovereign's strategic behavior is modified, and Moral Hazard must be taken into account. A recent paper by Federico Weinschelbaum and José Wynne, 2003, address some of these issues.

Appendix - Calculation of the Shapley Value[11]

The Shapley Value measures the "value" of each player in a framework of "n-person games in coalitional form with side payments". For our purposes a very simple framework can be presented as follows.

There is a set N of actors and a function "*v*" that associates to every subset S of N where *v*(S) is a real number and represents the maximum value of the coalition.

The Shapley Value of player *i* in a game *v* turns out to be exactly the expected marginal contribution of the player *i* to a random coalition S. For a coalition S not containing *i*, the marginal contribution of *i* to S is the change in the worth when *i* joins S, i.e. *v*(S U {*i*}) – *v*(S). A random coalition S not containing *i* is obtained by arranging all *n* players in line (e.g. 1,2,…,*n*), and then putting in S all those that precede *i*; it is assumed that all *n*! orders are equally likely.

The Shapley Value has several desirable properties and the amount the actor *i* gets if the gain function *v* is being used is:

$$\phi_i(v) = \sum_{i \notin S \subseteq N} \frac{|S|!(n-|S|-1)!}{n!} \left(v(S \cup \{i\}) - v(S) \right)$$

where *n* is the total number of actors and the sum extends over all subsets S of N not containing actor *i*. |S| represents the number of elements in S. The applications of Shapley Value in the preceding sections of the paper were developed first for three players and then for four players as follows.

<u>The case of One Creditor, One Vulture and the Sovereign</u>

<u>Strategic Default</u>

If "a" represents the creditor (or bondholder), "b" the vulture and "d" the sovereign (or debtor country), the possible (n!=3!=6) coalitions are:

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[11] Hart (1987). Additional information can be found in the original document: Lloyd S. Shapley, " A Value for n-person Games. In Contributions to the Theory of Games", vol II by H.W. Kuhn and A.W. Tucker, editors. Annals of Mathematical Studies v.28, pp. 307-317. Princeton University Press.

abd bad dab

adb bda dba

Each coalition is equally likely with probability of 1/6.

The Shapley Value for the creditor, "a", ϕ_a*:*

The random coalitions are formed with all the elements that precede "a" in the possible coalitions defining elements in S =

∅ b d

∅ bd db

where ∅ represents an empty coalition. The contribution of "a" to a coalition in S is shown in the following table where the marginal contribution is described as $v(S \cup \{i\}) - v(S)$, and displayed at the right of each coalition. For example, the marginal contribution of "a" to the coalition with elements (bd) is calculated as follows: $v[(bd) \cup \{a\}] - v(bd) = s' - 0 = s'$, since the vulture and the sovereign do not get anything by themselves ($v(bd) = 0$) but when "a" gets into the coalition they get s'.

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
∅	0	b	s'	d	s'
∅	0	bd	s'	db	s'

$\phi_a = (1/6)[v(ab) - v(b)] + (1/6)[v(ad) - v(d)] + (2/6)[v(abd) - v(bd)]$

$\phi_a = (1/6)[s'] + (1/6)[s'] + (2/6)[s']$

$\phi_a = 1/6\,[4s'] = s'\,2/3$

Notice that empty coalitions have no value and the last term includes coalitions abd and adb which are weighted (2/6)

The Shapley Value for the vulture, "b", ϕ_b*:*

All the elements that precede "b" define S, representing the possible coalitions. Next to it, the contribution of "b" to the coalition is shown.

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
a	s'	∅	0	da	0
ad	0	∅	0	d	0

ϕ_b= (1/6) [s']= s'/6

The Shapley Value for the Sovereign (debtor country), "d", ϕ_d:

All the elements that precede "d" define S, representing the possible coalitions. Next to it, the contribution of "d" to the coalition is shown.

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
ab	0	ba	0	∅	0
a	s'	b	0	∅	0

ϕ_d= 1/6 [s']= s'/6

It can be easily verified that the sum of Shapley Values for all players add to s'.

<u>The case of four players: Two Jurisdictions, One Vulture and the Sovereign</u>

<u>I) Liquidity Default</u>

The parties to the coalition are: the manager "a" (managing assets in the domestic jurisdiction), the manager "c" (managing assets in the foreign jurisdiction) and the vulture "b". The next possible coalitions are equally likely with probability 1/6 :

abc bac cab

acb bca cba

Shapley Value for manager, "a", ϕ_a:

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
$\varnothing$	0	b	$\alpha\gamma s'$	c	0
$\varnothing$	0	bc	$s' - \gamma s'$	cb	$s'-\gamma s'$

$\phi_a = [\ \alpha\gamma s' + 2(s'-\gamma s')]\ /6 = s'\ /3\ - \gamma s'(2-\alpha)\ /6$

Shapley Value for manager, "c", ϕ_c:

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
ab	$s'-\alpha\gamma s'$	ba	$s'-\alpha\gamma s'$	$\varnothing$	0
a	0	b	$\gamma s'$	$\varnothing$	0

$\phi_c = [\ 2(s'- \alpha\gamma s') + \gamma s')]\ /6\ = s'/3 - \gamma s'(2\alpha -1)\ /6$

Shapley Value for the vulture, "b", ϕ_b:

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
a	$\alpha\gamma s'$	$\varnothing$	0	ca	s'
ac	s'	$\varnothing$	0	c	$\gamma s'$

$\phi_b = [\ \alpha\gamma s' + \gamma s' + 2s')]\ /6\ = s'/3 + \gamma s'(\alpha+1)\ /6$

The comparative statics of Shapley Values indicates that an increase in α increases the Shapley Value of the Vulture and decreases the sum of Shapley Values of managers, that is:

$\phi_a + \phi_c = L_{1-\theta} = s'2/3 \ -\gamma s'(1+\alpha)/6$

Comparative statics of changing α ,

$d(\phi_a + \phi_c) = d\,L_{1-\theta} = (-\gamma s'/6)d\alpha$

$d\phi_b = (\gamma s'/6)d\alpha$

Consequently, if the sovereign could discriminate against the local managers reducing α, the vulture receives less and the bondholder receives more, the reason is that the foreign manager captures the loss of the local manager plus the loss of the vulture.

II) Strategic Default

There are now 4 parties to the coalition: the manager "a", the manager "c" , the sovereign "d", and the vulture "b". The next possible coalitions are equally likely with probability 1/24:

abcd	bacd	cabd	dabc
abdc	badc	cadb	dacb
acbd	bcad	cbad	dbac
acdb	bcda	cbda	dbca
adbc	bdac	cdab	dcab
adcb	bdca	cdba	dcba

Shapley Value for the creditor, "a", ϕ_a:

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
$\varnothing$	0	b	$\alpha\gamma s'$	c	0	d	$\alpha\gamma s'$
$\varnothing$	0	b	$\alpha\gamma s'$	c	0	d	$\alpha\gamma s'$

∅	0	bc	s'-γs'	cb	s'-γs'	db	αγs'
∅	0	bcd	s'-γs'	cbd	s'-γs'	dbc	s'-γs'
∅	0	bd	αγs'	cd	s'-γs'	dc	s'-γs'
∅	0	bdc	s'-γs'	cdb	s'-γs'	dcb	s'-γs'

ϕ_a= [6 (αγs')+ 10(s'-γs')] /24

Shapley Value for the creditor, "c", ϕ_c:

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
ab	s'-αγs'	ba	s'-αγs'	∅	0	dab	s'-αγs'
abd	s'-αγs'	bad	s'-αγs'	∅	0	da	s'-αγs'
a	0	b	γs'	∅	0	dba	s'-αγs'
a	0	b	γs'	∅	0	db	γs'
adb	s'-αγs'	bda	s'-αγs'	∅	0	d	γs'
ad	s'-αγs'	bd	γs'	∅	0	d	γs'

ϕ_c= [10 (s'-αγs')+ 6(γs')] /24

Shapley Value for the vulture, "b", ϕ_b:

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
a	αγs'	∅	0	ca	s'	da	0
a	αγs'	∅	0	cad	0	dac	0
ac	s'	∅	0	c	s'γ	d	0
acd	0	∅	0	c	s'γ	d	0

ad	0	∅	0	cda	0	dca	0
adc	0	∅	0	cd	0	dc	0

ϕ_b= [2 ($\alpha\gamma$s')+ 2(γs') + 2s'] /24

Shapley Value for the debtor country, "d", ϕ_d:

Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution	Coalition	Marginal Contribution
abc	0	bac	0	cab	0	∅	0
ab	0	ba	0	ca	s'	∅	0
acb	0	bca	0	cba	0	∅	0
acd	s'	Bc	0	cb	0	∅	0
a	$\alpha\gamma$s'	b	0	c	γs'	∅	0
a	$\alpha\gamma$s'	b	0	c	γs'	∅	0

ϕ_d= S_θ = [2 ($\alpha\gamma$s')+ 2(γs') + 2s'] /24

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