World Bank Discussion Paper Series

Insuring Sovereign Debt Against Default

David F. Babbel

Financial Sector Development Department
The World Bank

Insurance and Risk Management Department, and Finance Department
The Wharton School, University of Pennsylvania
3641 Locust Walk, #304
Philadelphia, PA 19104-6218
Tel. (215) 898-7770

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"An idea without at least some element of absurdity is not worth further consideration."
Albert Einstein

I. Introduction

In recent years there have been repeated calls for increased availability of insurance against the risk of default on sovereign loans.[1] Although some of these calls came over ten years ago,[2] relatively little progress has been apparent along this front. There are some governmental and quasi-governmental agencies, such as MIGA, OPIC in the USA, COFAS in France, HERMES in Germany, CASCE in Argentina, and various Export Import Banks that provide limited insurance against political risks such as currency inconvertibility, expropriation or nationalization, confiscation, and other political risks. In addition, a small handful of private insurers, such as American International Group, Citicorp International Trade and Indemnity, Unistrat, and Lloyds of London, have offered tiny amounts of coverage for some political risks. The World Bank has provided "backstop" guaranties on sovereign debt, but relative to the appetite for such coverage, what is currently available is certainly inadequate.

The purpose of this paper is to sketch an outline of an alternative approach to the pro-vision and pricing of insurance/guaranties on sovereign loans. Rather than dwell on the mathematical details of implementing this approach, I will focus on the larger questions that must be addressed and resolved first, before a foray into implementation details is justified. However, citations will be provided that, considered together, give the essential building blocks to the implementation, albeit in different contexts.

II. Sovereign Debt and the Criteria of Insurability

The insurance literature has dealt at length with the limits of insurability of risks. Focus traditionally has been on distinguishing between risks that are insurable and those that are not. In assessing the insurability of risks, the primary guideline has been the de-gree to which risk pooling could be employed to reduce the risk to manageable levels. (Two of the classic readings in this area are by Stone [1973a,b].)

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[1]These are loans made to public or private entities that are guaranteed against default by a sovereign nation, but where the ability of the sovereign guarantor to honor its commitments over the long term is itself subject to risk.

[2]Examples are given in several speeches by the President of the World Bank at that time, A. C. Clausen [1986], and in an essay by a governor of the Federal Reserve Board, Henry C. Wallich [1984].

An excellent review of this approach is given by Baruch Berliner [1982]. He lists eight criteria of insurability and indicates that, from an insurability point of view, the ideal risk has the following properties:

1) Losses occur with a high degree of randomness.
2) The maximum possible loss is very limited.
3) The average loss amount upon loss occurrence is small.
4) The average time interval between loss occurrences is short—losses occur frequently.
5) The insurance premium willing to be paid for the coverage is very high.
6) There is hardly any possibility of moral hazard.
7) Coverage of the risk is consistent with public policy.
8) The law permits the coverage.

While few risks meet all of these ideals, insurable risks tend to fall within acceptable ranges of these eight criteria. Some risks fall completely outside the bounds of insurability, for one or more of the criteria listed above. Examples of such risks include kidnapping insurance, coverage against punitive damages, insuring against the costs of speeding tickets, and coverage against civil commotion. Most people who have studied sovereign debt of emerging market economies would say that it fails at least six of the eight criteria of insurability listed above. Whether the seventh and eighth criteria are satisfied is debatable. Although the law may permit the coverage (or at least is often silent with regard to such coverage), it is questionable whether such coverage is consistent with public policy. While the coverage may be aligned with the objectives of government bodies and international organizations, it appears that at least some insurance regulators have been less than sanguine toward it.[3]

With regard to the first six criteria, there is less ambiguity. Sovereign default events are not random, but clustered. (See Exhibits 1 and 2.) The maximum possible loss is enormous, and the average loss is also huge. Losses are relatively infrequent—a country may go several years without defaulting on its sovereign-guaranteed debt. Most debtor countries are either unwilling or unable to pay a large insurance premium to

[3]More than a decade ago Cigna pioneered into this area and sold $900 million of such coverage to Citicorp. This created a great deal of consternation among insurance regulators in Pennsylvania, who had not reviewed the proposal prior to its implementation and who were, in any case, unlikely to approve of it. An interesting chronology of this experiment can be found in "Political Risk Cover Sparks Curiosity," *Journal of Commerce,* September 17, 1984; "N.Y. Insurance Chief Taking Close Look at Citicorp's Debt Policy with Cigna," *American Banker,* September 27, 1984; "Citicorp Covers Its Assets," *Dun's Business Month,* October 1984; "Citicorp's Cigna Insurance: A Tempest of Disputed Coverage and Bad Feelings," *American Banker,* October 12, 1984; "Citicorp and Cigna Cancel Insurance Banking Firm Bought for Foreign Loans," Wall *Street Journal,* February 4, 1985; "Cigna and Citicorp Agree to Terminate Insurance on Foreign Debt Exposure," *American Banker,* February 5, 1985; "Citicorp Loan Cover Killed by Reinsurance Disputes," *Business Insurance,* February 11, 1985; "Third World Debt Looks Risky to Insurers," *Business Week,* February 18, 1985. Even a decade later the issues still are not fully settled.

guarantee against default. Finally, declaration of default on sovereign debt is fraught with considerable moral hazard, as there is typically no recourse.[4]

In my opinion, most of these criteria of insurability, while sufficient to allow the risk pooling mechanism of insurance to operate, are not really necessary. They become necessary only to the extent that risk pooling is relied upon as the primary risk managing mechanism. What *is* necessary and sufficient for a viable insurance contract is simply that *the insurer have sufficient assets available to honor claims as they arise*. While an insurer can achieve this by pooling independent risks meeting the aforementioned criteria of insurability, it could also achieve this by investing in assets whose payoffs are contingent upon the occurrence of events that are related to the incidence of claims. Where risks are uncorrelated and aggregate loss distributions are stable or otherwise predictable, the pooling concept is fine. But in other cases, insurers either must rely on the risk-hedging mechanism in their investment policy, or else must have already accumulated sufficient reserves and surplus to cover any claims that may arise.

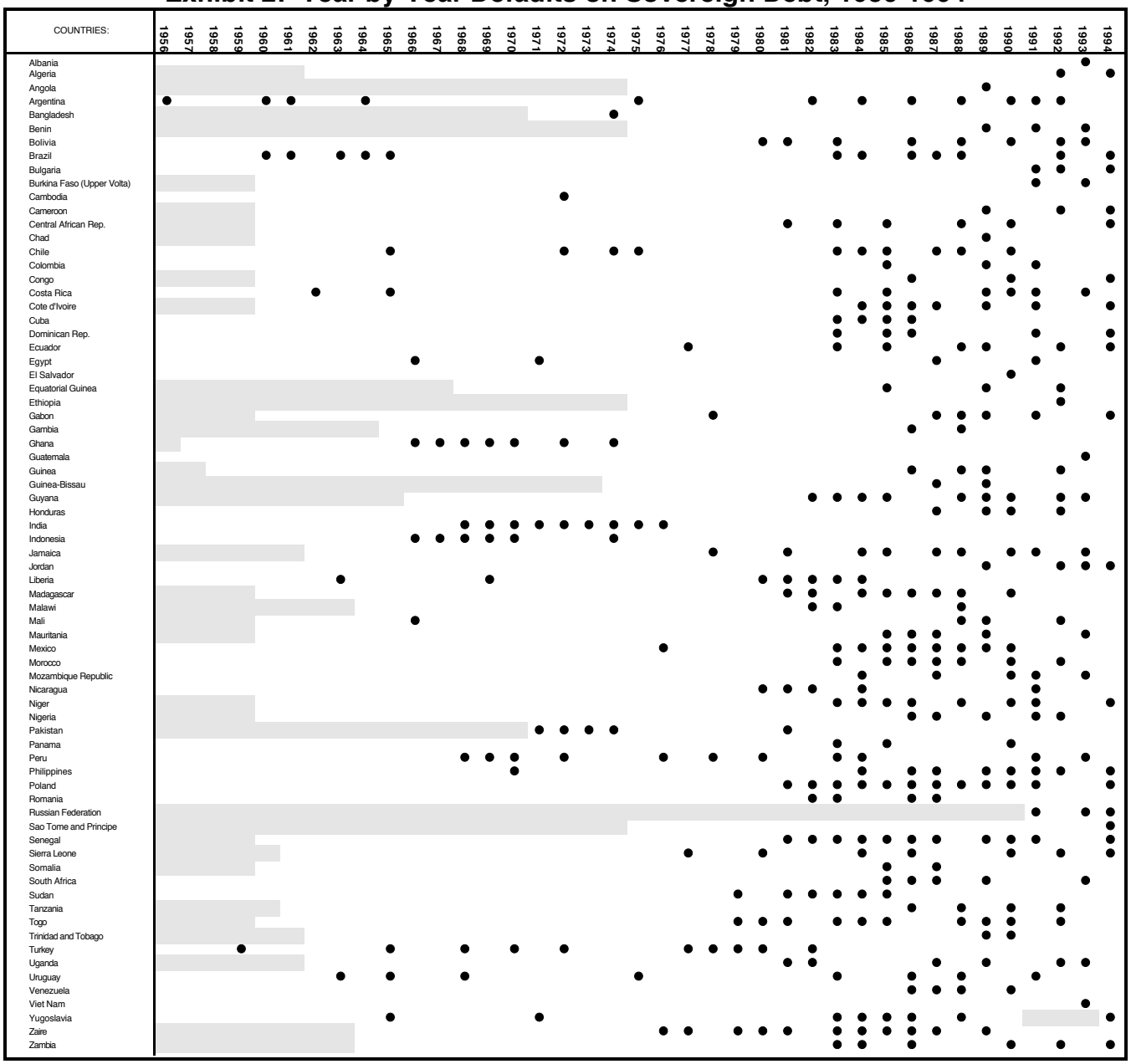
[4]Berliner [1985] expressed pessimism regarding the insurability of sovereign debt by private carriers, who would find the "possibility for such covers...very difficult, if at all possible to grant, even though there is a proven need."

Exhibit 1: Number of Sovereign Debt Defaults — 1956-1994

	1956-1965	1966-1975	1976-1985	1986-1994	Total per country
Albania	..	..	..	1	1
Algeria	..	..	..	2	2
Angola	..	..	..	1	1
Argentina	4	..	3	5	12
Bangladesh	..	1	..	..	1
Benin	..	..	..	3	3
Bolivia	..	..	3	5	8
Brazil	5	..	2	5	12
Bulgaria	..	..	..	3	3
Burkina Faso	..	..	..	2	2
Cambodia	..	1	..	..	1
Cameroon	..	..	..	3	3
Central African Rep.	..	..	3	3	6
Chad	..	..	..	1	1
Chile	1	3	3	3	10
Colombia	..	..	1	2	3
Congo	..	..	..	3	3
Costa Rica	2	..	2	4	8
Cote d'Ivoire	..	..	2	5	7
Cuba	..	..	3	1	4
Dominican Rep.	..	..	2	3	5
Ecuador	..	..	3	4	7
Egypt	..	2	..	2	4
El Salvador	..	..	..	1	1
Equatorial Guinea	..	..	1	2	3
Ethiopia	..	..	..	1	1
Gabon	..	..	1	5	6
Gambia	..	..	..	2	2
Ghana	..	7	..	..	7
Guatemala	..	..	..	1	1
Guinea	..	..	..	4	4
Guinea-Bissau	..	..	..	2	2
Guyana	..	..	4	5	9
Honduras	..	..	..	4	4
India	..	8	1	..	9
Indonesia	..	6	..	..	6
Jamaica	..	..	4	5	9
Jordan	..	..	..	4	4
Liberia	1	1	5	..	7
Madagascar	..	..	4	4	8
Malawi	..	..	2	1	3
Mali	..	1	..	3	4
Mauritania	..	..	1	4	5
Mexico	..	..	4	5	9
Morocco	..	..	2	5	7
Mozambique Rep.	..	..	1	4	5
Nicaragua	..	..	4	1	5
Niger	..	..	3	5	8
Nigeria	..	..	..	5	5
Pakistan	..	4	1	..	5
Panama	..	..	2	1	3
Peru	..	4	5	2	11
Philippines	..	1	1	7	9
Poland	..	..	5	7	12
Romania	..	..	2	2	4
Russian Federation	..	..	..	3	3
Sao Tome and Principe	..	..	..	1	1
Senegal	..	..	5	6	11
Sierra Leone	..	..	3	4	7
Somalia	..	..	1	1	2
South Africa	..	..	1	4	5
Sudan	..	..	6	..	6
Tanzania	..	..	..	4	4
Togo	..	..	6	4	10
Trinidad and Tobago	..	..	..	2	2
Turkey	2	3	5	..	10
Uganda	..	..	2	4	6
Uruguay	2	2	1	3	8
Venezuela	..	..	..	4	4
Viet Nam	..	..	..	1	1
Yugoslavia	1	1	3	2	7
Zaire	..	..	8	3	11
Zambia	..	..	2	4	6
TOTAL	**18**	**45**	**123**	**203**	**389**

Source: World Bank, Debtor Reporting System, World Debt Tables

Exhibit 2: Year by Year Defaults on Sovereign Debt, 1956-1994



An advantage of this risk-hedging alternative approach to insuring sovereign debt over the risk pooling mechanism is that unlike the risk pooling mechanism, the risk-hedging mechanism does not rest upon an ability to predict default in order to establish adequate premiums; rather, it hinges upon a knowledge of how economic factors are linked to default. In recent years, this risk-hedging mechanism has become more familiar to insurers. Some direct a portion of their investments to cover such risks as clustered policy surrenders, policy loans, and workers' compensation claims that are precipitated by systematic economic forces such as rising interest rates, changing tax laws, and recessions.[5]

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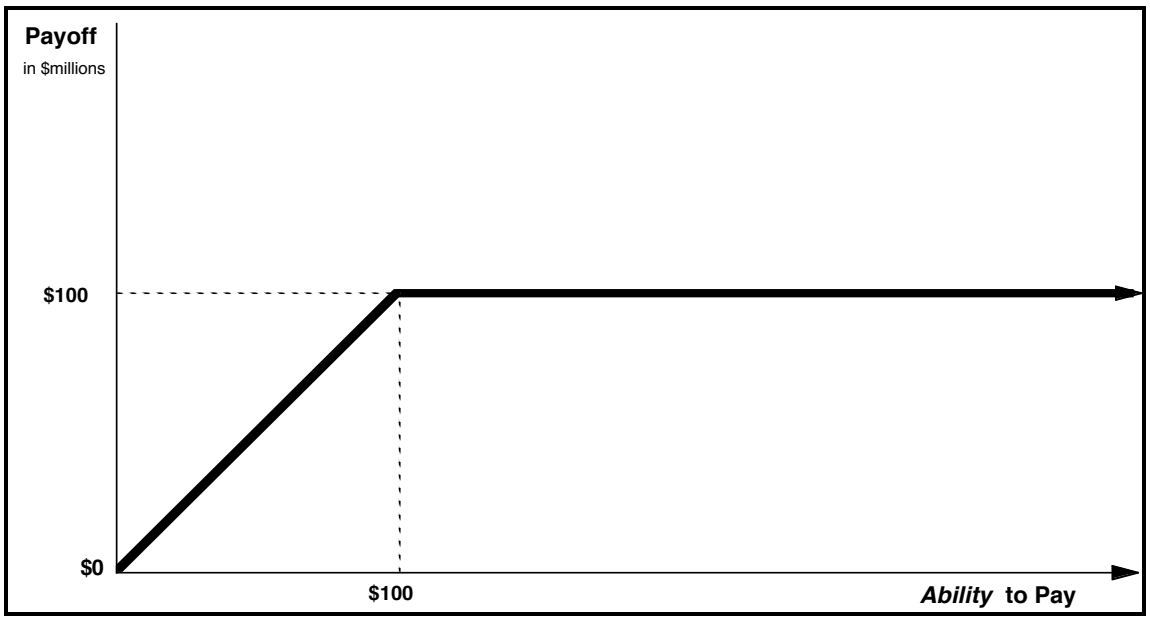
[5]A hedging technique for insurers faced with lapse and policy loan risks is described in Babbel and Stricker [1986] and Babbel, Bouyoucos, and Stricker [1988]. Lamm-Tennant [1994] gives

In the remainder of this paper, I will explore the hedging mechanism as an alternative to insuring sovereign-guaranteed debt against default. Section III discusses the economic structure of sovereign debt. Section IV presents the hedging mechanism itself. Section V follows with an analysis of the factors that would need to be examined in order to effectuate the kinds of hedges described in Section IV. Section VI gives a critical assessment of the feasibility of the approach and suggests some areas for further research. Section VII concludes.

III. The Contingent Structure of Sovereign Loans

To appreciate the hedging mechanism for insuring sovereign loans against default, it is useful to view debt in a contingent claims framework. Merton [1974] gives an early example of this approach to examining risky debt. A diagram of the payoff profile on risky corporate debt is provided in Exhibit 3.

Exhibit 3: Domestic Debt as a Contingent Claim



In this diagram, the thick black line illustrates the payoff on a $100 million corporate loan. The payoff is shown to be a function of the ability to pay, which in the case of corporate debt is a function of the value of firm assets. In the Merton framework, as long as the value of corporate assets exceeds the amount owed, the debt will be satisfied. This is because the corporation is presumed to be able to liquidate the assets, at their market value, and repay the debt with the proceeds, while keeping the excess proceeds. When ability to pay drops below $100 million, the firm declares bankruptcy and the lender seizes the firm's assets in partial satisfaction of the debt. This is shown by the diagonal line segment.

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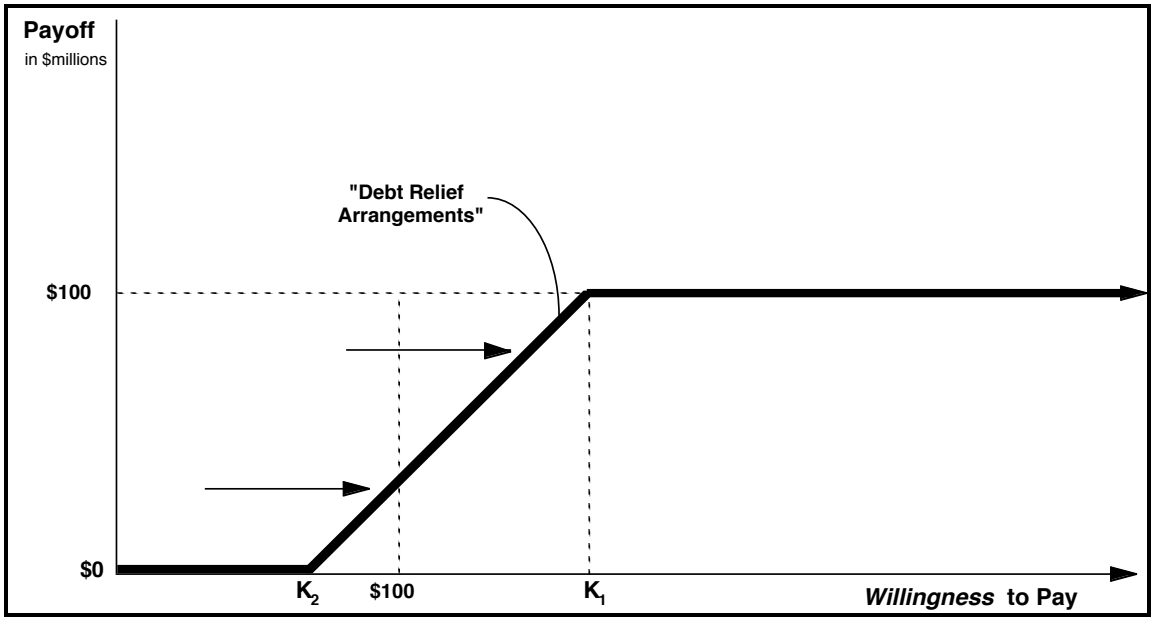
survey evidence regarding the incidence of usage of these and other hedging techniques by U.S. insurers.

One of the limitations of this analysis is that it relies on the assumption that default occurs only when the firm exhausts its assets. Black and Cox [1976] relaxed this assumption to accommodate the fact that firms often default long before they have depleted their assets. Their framework allows for default to occur when some lower threshold is reached. Such an extension is especially useful for sovereign debt, whose repayment depends more on a willingness to pay than an ability to pay. Thus, in a contingent claims framework, the horizontal axis is re labeled "willingness to pay," and the rightward shift in the payoff profile reflects the higher economic threshold below which default will occur.[6] This is shown in Exhibit 4.

Exhibit 4: Sovereign Debt as a Contingent Claim



The diagonal line segment in the payoff profile of corporate debt has its analogue in sovereign debt. When a country defaults on its sovereign debt, arrangements are typically made (except in the case of total debt repudiation) whereby partial payments, delayed payments, or reduced interest rates are negotiated. These "debt relief arrangements" often have the effect of lowering the economic value of the loan similar to that which would occur if the lender had recourse to the borrower's assets, as in the case of corporate debt. Hence, I have maintained the diagonal line segment, but with the rightward displacement, in Exhibit 4. In this case, the economic threshold below which some debt relief arrangements are demanded is at K_1, which is analogous to a "strike price" in option parlance. If the economic situation deteriorates below K_2, payoffs of the debt stop altogether, and the value of the sovereign debt drops to zero.

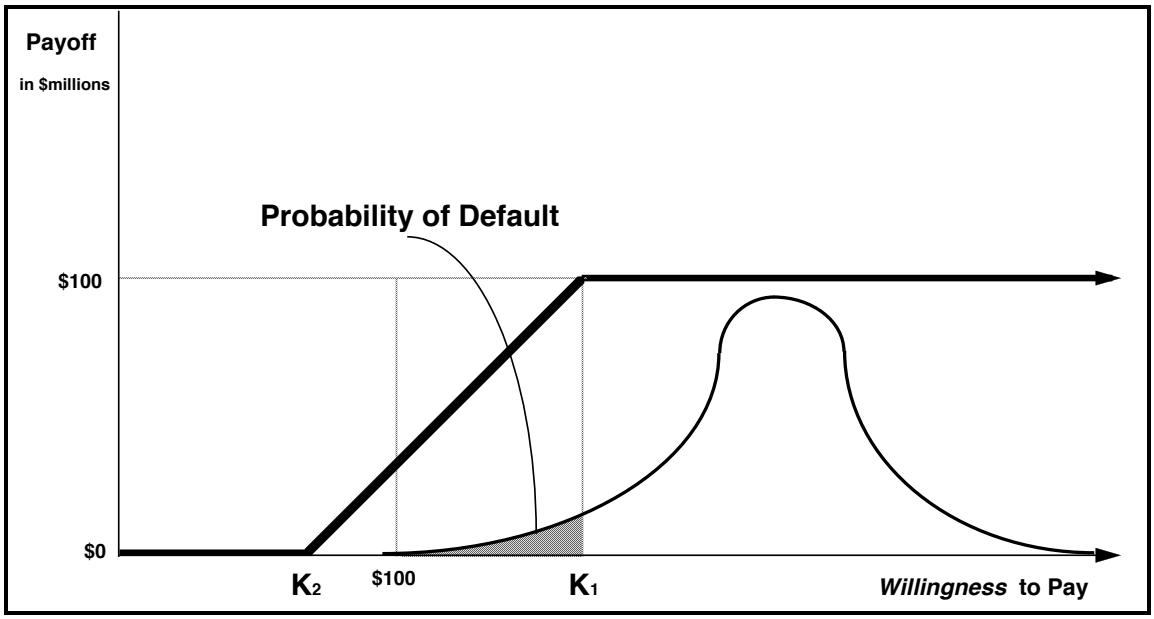
As will be shown later, for insurability purposes it is not at all necessary that the diagonal line segment of the payoff profile extending between K_1 and K_2 be 45º. Indeed, it

[6]Other useful extensions have been made to this basic framework. For example, Longstaff and Schwartz [1995] have relaxed the implicit assumption in Merton, and also Black and Cox, that interest rates remain constant throughout the period of the loan. The Longstaff and Schwartz model allows for interest rates to follow any stochastic process.

is not even necessary for it to be a straight line. A line segment of any non-zero slope, a series of connected line segments, or even a curve will do just fine. The new technology of insurability will accommodate any of these patterns. What is important for the technology to succeed is that the trigger points K_1 and K_2 be approximately known, and that the shape of the payoff profile between these points be approximately known. I use advisedly the word "approximately," because through the pooling concept, errors in one direction or another are likely to be offset by errors in other similar risk exposures.

The usual way for pricing sovereign debt is to take a profile of the payoffs under various economic states, and then weigh them by the probabilities of the underlying states. The expected future payoff is then discounted to reflect the time value of money and an adjustment of some sort for risk aversion can be applied to get the economic value of the debt. This process is depicted heuristically in Exhibit 5, where a density function is displayed under the payoff profile. As depicted, there is approximately a 10% chance of default, with partial payments of various levels occurring in the default states.

Exhibit 5: Pricing Sovereign Debt in the Usual Way



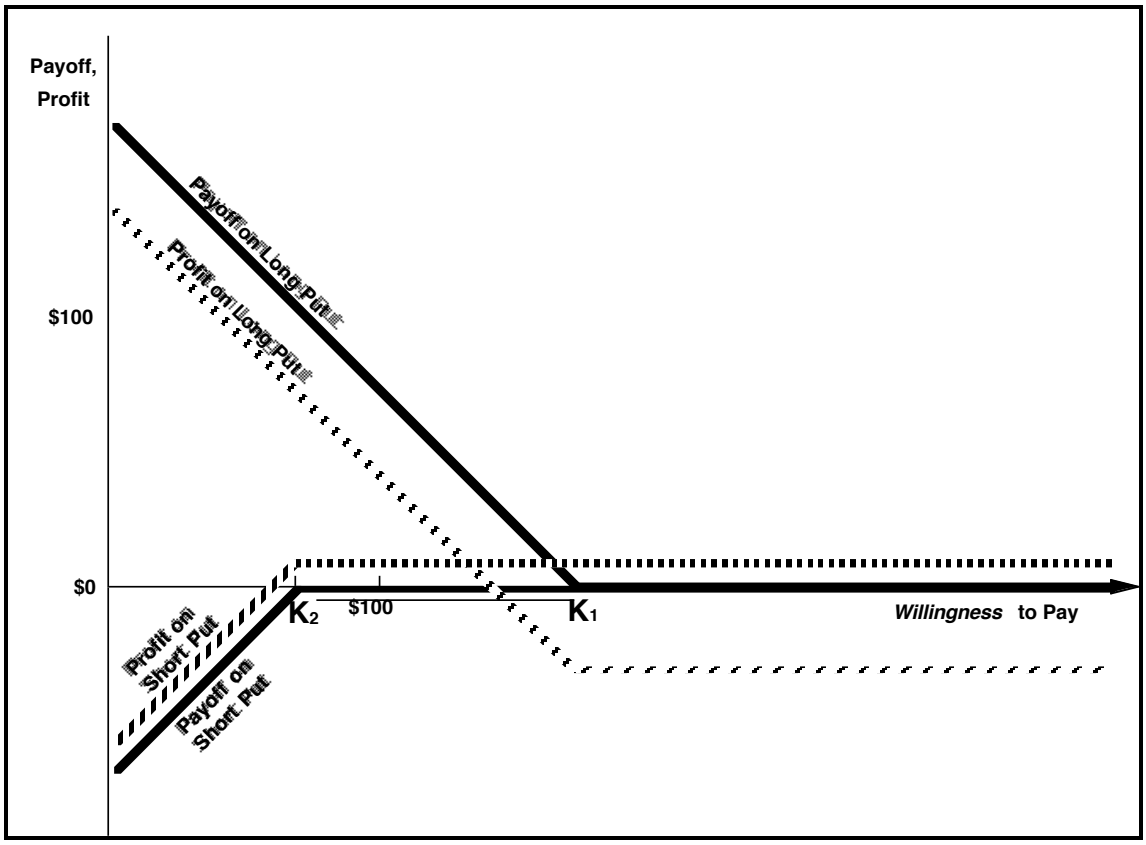
IV. The Hedging Mechanism for Insuring Sovereign Debt

In the new approach to insuring sovereign debt against default, use of put options will be important. Exhibit 6 depicts the payoff and profit profiles on a put option held long and another put held short. Consider first the owner of a put option ("long put") written on the willingness to pay, with a strike price of K_1. Never mind for now how such a put option can be acquired. (It will be discussed in Section V.) Note, however, that its strike price at which the debtor *chooses* to default is well above the $100 million level of economic ability to pay, below which the country would be *obliged* to default. The size of this offset is related to the political realities that face those who preside. Plotted below the payoff profile is shown a profit profile of similar shape. The vertical spread between the payoff profile and (net) profit profile is the up-front cost of the put

option. This cost could be a range of values, of course, but I have drawn the figure assuming a particular cost only for illustrative purposes.

Next, consider the payoff profile to the writer of a put option ("short put") written on the willingness to pay, with a strike price of K_2. Note that this strike price is well below the strike level of the previous put option; in this case, because of the 45º line segment in Exhibit 5, it is set at a level that falls $100 million below K_1. Above the payoff profile is shown a profit profile of similar shape. The vertical spread between the payoff profile and (net) profit profile is the up-front premium received by the writer of the put option. This premium could be a range of values, of course, but I have drawn the figure assuming a particular premium only for illustrative purposes. Note also that the premium for writing a put with a strike price of K_2 is far less than the cost of buying a put with a strike price of K_1. As will be shown, the difference between the cost of buying the put with a K_1 strike price and the revenue from selling a put with a K_2 strike price will be the cost of converting the risky sovereign debt into secure insured debt.

Exhibit 6: Payoff and Profit Profiles of Long and Short Put Options



In Exhibit 7, I have juxtaposed the net profit profiles for long and short positions in put options on the country's willingness to pay. As before, the long put option has a strike price of K_1, while the short put option has a strike price of K_2. If the vertical distances of the risky loan and the two put options are summed, they result in a straight horizontal line, denoted "riskless loan." This loan is riskless because its net payoff is independent of the debtor's willingness to repay the loan. The riskless loan promises only $77 million, which is $23 million less than the $100 million promise of the risky

loan, but it delivers upon its promise. In this example, $23 million would be the cost of insuring the risky loan. It is equal to the difference between what it would cost to buy a put option on willingness to pay with an exercise price at K_1, and the proceeds garnered by selling a put option with an exercise price at K_2.

There is, of course, no reason that a risky sovereign loan must be converted to risk-less debt. By reducing the strike price of the long put option, it can be partially insured. In fact, if an error is made in setting the strike level too low or too high, a risky loan may wind up being partially insured or over insured. Exhibit 8 depicts a partially insured loan, with a "stop loss" level below what would be the promised payoff on the riskless loan. However, the cost of partially insuring a loan is less than the cost of full insurance. In this illustration, the cost is only about half as much. This is apparent by comparing the reduced cost of the long put option with the cost of the long put option of Exhibit 7. (The short put options in Exhibits 7 and 8, which carry the same strike price, return the same premium.)

Exhibit 7: Net Payoff Profiles on Riskless Debt, Risky Debt and Put Options

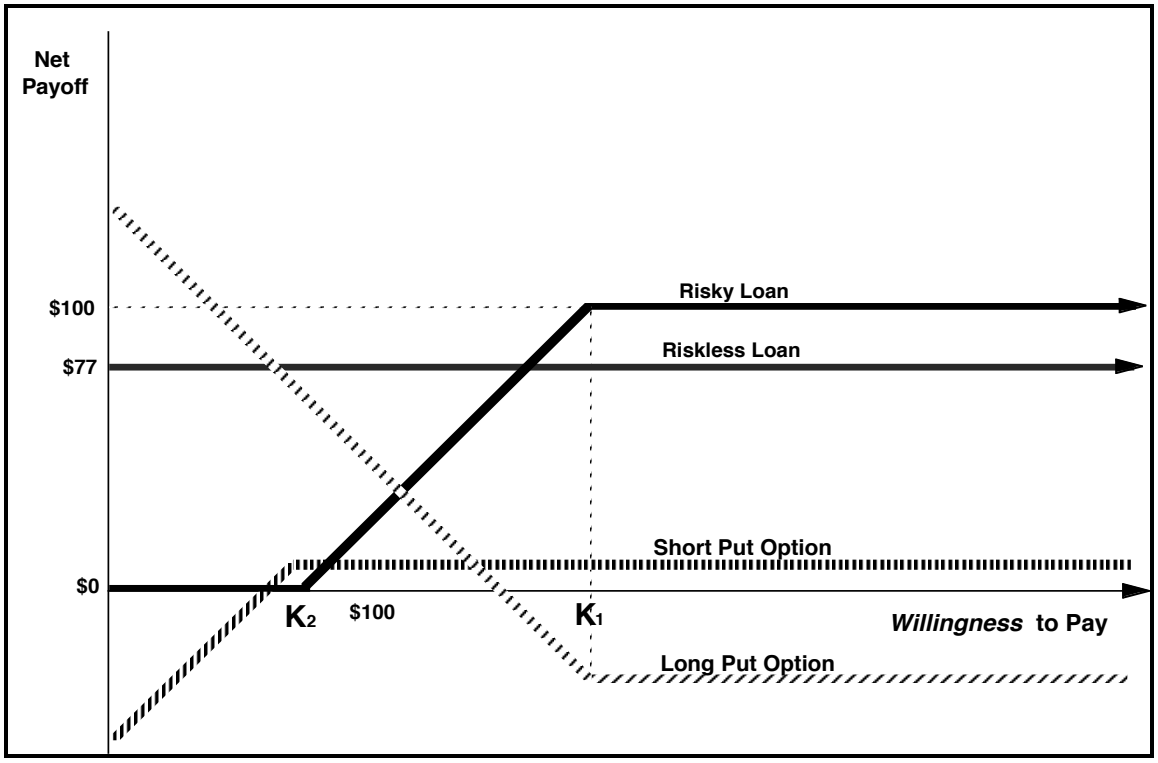
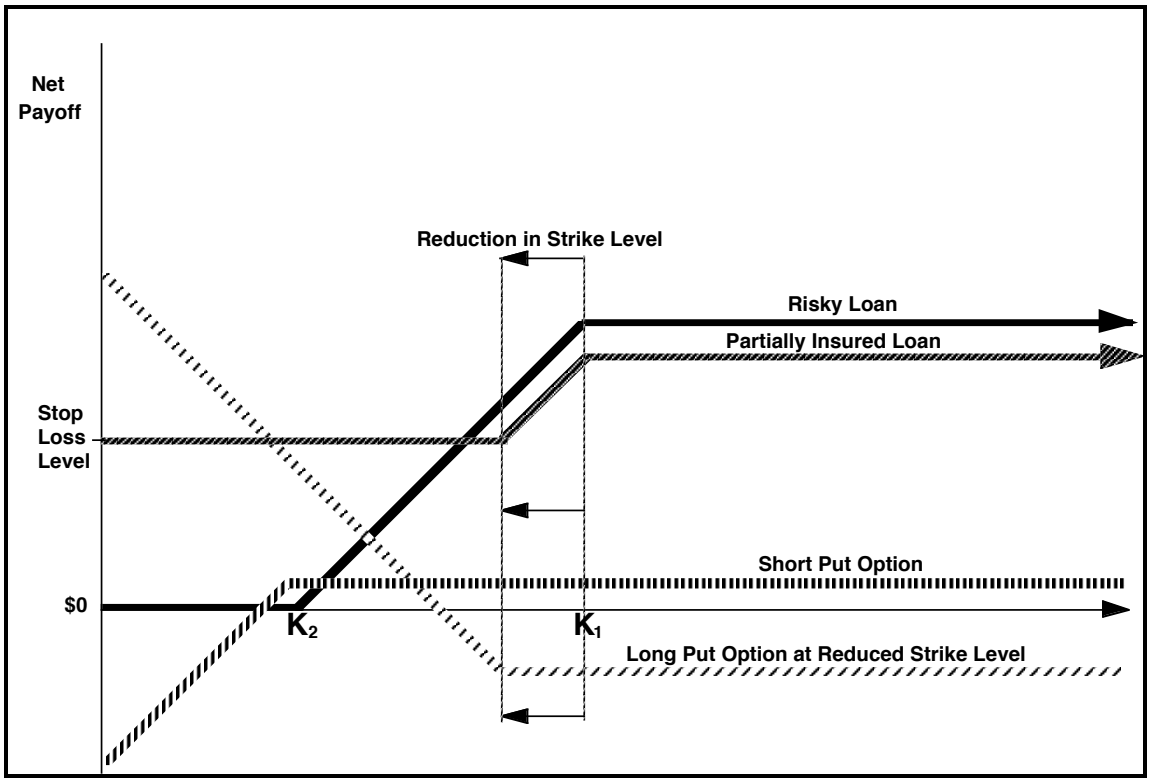


Exhibit 8: Partially Insured Debt



V. Applying the Risk-Hedging Mechanism to Sovereign Debt

Pricing sovereign debt under the new approach simply involves computing the value of the promised payments, assuming they are default-free, and then subtracting the cost of full insurance. But pricing the insurance is not easy. There are five steps necessary to price this insurance on sovereign debt, where the hedging approach underlies the guaranty. Three of these steps would also be necessary under the traditional approach to pricing sovereign debt. In addition to these six steps, two other steps are necessary if the economic value of the debt is not only to be priced, but the insurance is actually going to be offered on an economically viable basis.

Step I: Determine the current status of a country's economic health.

This step is not unique to the risk-hedging approach for pricing sovereign debt, of course. It is a traditional starting point for lenders considering any sovereign guaranty on public or private debt. Because an assessment of the economic health of the borrower is already familiar, I will not elaborate further on this step.

Step 2: Map the external debt profile of the debtor nation.

This profile would reflect the interest, maturity, call and sinking fund provisions, the priority status of the lender (e.g., preferred creditor and super-preferred creditor tranches), and so forth. While it is a tedious task to accumulate the necessary data and perform the analysis, this step is a familiar one to lenders in traditional credit appraisals. Therefore, no more will be said about it here other than that there is a need to portray the information in a manner that is useful and consistent with the contingent claims approach to debt pricing.

Step 3: Establish the linkage between "willingness to pay" and economic health.

This is an important step from an operational perspective, because it is more natural to hedge against deteriorating economic health than it is to hedge against psychological predilections (i.e., willingness to pay). Fortunately, much of the groundwork has already been laid for it to be done. Under the traditional approach to pricing sovereign debt, typically some subjective judgments are made about states of the world, and subjective probabilities are assigned to these states. Of course, a more quantitative approach could be substituted and probabilities of default could be obtained from such an analysis. In either case, however, forecasts need to be made about the future states of the world and their probabilities of occurrence. However, if the economic literature on sovereign debt defaults is any indication, it is easier to explain default than predict it. Nonetheless, contained in this literature is much of the information needed to be able to implement the new approach.

In the References Section, I have provided citations to most of the major and many of the minor studies on sovereign debt risk that have appeared in the economic literature during the past 25 years. A companion study, by Stefano Bertozzi [1995], which contains an annotated bibliography of these references, provides an excellent road map for navigating through this literature. Empirical studies contained in these references attempt to predict future defaults by studying the characteristics of past defaults. Suffice

it to say that the studies were largely unsuccessful in this regard. Even those studies which appeared to have some predictive power were illusory, upon closer inspection. The problem stems from the supposed "leading economic indicators of default." These indicators, in some studies, were shown to provide six to eighteen months of "advance warning" of impending defaults. However, in many developing countries, these leading indicators are published only after a delay as long as two years beyond the reporting period. Thus, in terms of publicly available data to commercial lenders, these data would be of little help to them in attempting to reduce their exposure to impending defaults.

A helpful byproduct of the many failed attempts to predict sovereign defaults reliably is that the factors linked to default have been identified. While it is not necessary to be able to estimate the probabilities of default under the alternative approach, the risk-hedging mechanism does depend on an ability to specify the economic factors associated with a country's willingness to repay its debt. History has often shown that even though a country chooses to default long before it must default, that choice to default is closely related to its economic health. In other words, willingness to pay is a function of ability to pay, but with an offset equal to the economic cushion a regime feels it needs for maintaining political power.

Among the articles predicting sovereign debt defaults, I have selected 25 of the most important studies since 1971. These studies are identified in Exhibit 9, which provides an authors legend. This legend will be used in Exhibit 11 to identify which articles employed which variables in their empirical tests.

Exhibit 9: Predicting Sovereign Debt Defaults, Authors Legend of Major Studies, 1971-1994

FC:	Frank and Cline [1971]	C:	William Cline [1983]
D:	Dhonte [1975]	E:	Sebastian Edwards [1984]
FJ:	Feder and Just [1976]	M:	Morgan [1986]
G:	Grinols [1976]	PK:	Paul Krugman [1987]
S:	G.W. Smith [1977]	KL:	Kharas and Levinsohn [1988]
Sa:	Sargen [1977]	F:	Kenneth Froot [1989]
MB:	Mayo and Barrett [1977]	BR:	Bulow and Rogoff [1989]
SB:	Saini and Bates [1978]	BRi:	Brewer and Rivoli [1990]
P:	Porzecanski [1980]	A:	Atkeson [1991]
FJR:	Feder, Just, and Ross [1981]	DR:	Diwan and Rodrik [1992]
EG:	Eaton and Gersovitz [1981]	DK:	Dooley and Kletzer [1994]
AT:	Abassi and Taffler [1982]	Sp:	Mark Spiegel [1994]
SC:	Sachs and Cohen [1982]		

The economic theories and empirical techniques employed in these studies for testing the factors that precede defaults range widely, and are discussed in Bertozzi [1995]. The variables examined are listed in Exhibit 10. Exhibit 11 shows the chronology of testing for significance of each of these variables, identified according to the study that tested them. Some of these studies were successful in identifying variables whose changing values were indicative of impending default. However, I believe that it is fair to say that the studies were mostly unsuccessful in predicting default with any regularity or with a leadtime sufficient to allow a lender to "undo" a loan. Some of the studies appear to show a six to eighteen month lead

Exhibit 10: Explanatory Variables for Sovereign Debt Defaults

1. **Debt service ratio**
2. Rollover ratio
3. **Import Cover**
4. **Debt disbursement ÷ imports**
5. Debt outstanding ÷ GNP
6. **Debt outstanding ÷ exports**
7. **Net transfers ÷ imports**
8. **Debt service ÷ debt outstanding**
9. Debt service ÷ debt disbursements
10. Debt service ÷ reserves
11. **Debt service ÷ imports**
12. **External debt ÷ exports**
13. Export growth rate
14. Per capita income
15. Capital inflows ÷ debt service
16. CPI growth rate
17. Gross fixed capital formation ÷ GDP
18. **Imports ÷ GDP**
19. **IMF Reserves ÷ imports**
20. **5-year current account balance - (+) the increase (decrease) in reserves ÷ exports**
21. Money supply growth rate
22. Growth of international reserves
23. Current account deficit plus amortization ÷ GDP
24. Current account deficit plus amortization minus net direct investment flows, non-compensatory official and multilateral loans and "excess" (greater than two months import cover) foreign exchange reserves ÷ GDP
25. The percent variability of exports
26. **Imports ÷ GNP**
27. GNP growth rate
28. Total real GNP
29. Total population
30. Real level of debt to public institutions
31. New loan commitments per capita
32. Domestic credit ÷ GDP
33. **The percent of variable interest rate loans ÷ total medium- and long-term debt**
34. Decline in international lending
35. Real GDP growth
36. **Reserve ÷ imports**
37. Political risk
38. **Exports ÷ GNP**
39. Net noncommercial foreign exchange inflows ÷ debt service payments
40. Commercial foreign exchange inflows ÷ debt service payments
41. Real per capita GNP ÷ U.S. per capita GNP
42. Growth of per capita real GDP
43. **Exports ÷ imports**
44. **Current debt service ratio**
45. **Short-term debt ÷ imports**
46. International Reserves ÷ GNP
47. Average propensity to import
48. Private, public, and total consumption
49. Government net revenue
50. Foreign inflows
51. Domestic saving
52. Foreign aid
53. Debtor's future income
54. Debtor's current endowment
55. Marginal value of debt
56. Average value of debt
57. Governmental regime stability
58. Democratic political process
59. Moral hazard
60. Risk of repudiation
61. The stock of capital flight
62. Loan duration
63. Loan volume
64. Rate of devaluation
65. Variability in international reserves
66. Government expenditure ÷ GNP
67. GNP per capita
68. Propensity to invest
69. Debt overhang

Note: Variables in boldface type are deemed to be directly hedgeable.

time between the deterioration of a key variable and a sovereign default. However, when closer inspection is done of the data, it has been found that the data were published with a delay that, more often than not, exceeded the purported "lead time" — in other words, the leading economic indicators of default were not leading at all, for practical business purposes.

Fortunately, this poses no problem for insuring sovereign debt. The hedging technique does not require that defaults be predicted, or that any "lead time" be established. Rather, it simply requires that the factors related to sovereign defaults are identifiable, and that their correlation with the overall economic health of the debtor nation is understood. While this may seem like a daunting task, if the attempts to predict default that were published in the economic literature over the past 25 years are any indication, it is less daunting to uncover variables which were coincidental with default. Moreover, there appear to be sufficient data to allow the analyst to estimate the amount of offset between willingness and ability to pay that triggers the default event.

This step is the most crucial of all in the new approach, and is unique to it. Because public and private entities do not issue options on a country's willingness to repay its debt, it will be necessary to synthetically create the equivalent of such an option. Existing economic literature on sovereign defaults has identified the factors associated with a country's choice to default. Earlier I introduced Exhibit 10, which lists the variables that have been tested to date. Shown in boldface type are variables whose numerators or denominators, and in some cases both, appear to be amenable to risk-hedging techniques. For example, variable #43 is a ratio of exports-to-imports. Many of the exports and imports of a country have their counterpart in traded commodity options and futures. Even if there are currently no options or futures on a given commodity, there may be traded securities on commodities whose prices are highly correlated with the ones of concern, or it may be possible to synthetically create such futures and options.

Step 4: Establish the linkage between economic health and hedgeable components.

The new approach toward insuring against default requires that a notional portfolio of hedgeable components be constructed. This portfolio must track the economic health of the debtor country. A pair of put options (long and short) on this portfolio must then be synthesized using available financial instruments and levered purchase or sale contracts.[7] Hedging techniques employed can be similar to those set forth in the portfolio insurance literature. (See Chance [1989, Chapter 11] for a review of this literature. Because an option on a portfolio is much less expensive than a portfolio of options, the cost of creating insurance is not prohibitive. Because the cost of portfolio insurance is related to the volatility of the underlying portfolio, a diversified economy such as Brazil should be cheaper to insure than an economy that depends on two or three exports, such as Zaire, other things equal. Of course, the closer a country is to the default trigger level in its economic health, the higher will be the cost of insurance.

[7]The technique for synthesizing such an option is described at length in Babbel [1989].

Exhibit 11: A Chronology of Explanatory Variables and Authors

Reference No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	**FC**		**FJ**	**S;Sa**			**FJR**		**C**	**E**								**FJR**
2	FC		FJ	S														
3	**FC**		**FJ**	**S;MB**	**SB**													
4		**D**																
5		D	G							E								E
6		**D**																
7		**D**																
8		**D**	**G**															
9		D							C		M				BRi	A		C
10			G															
11			**G**															
12			**G**	**MB**				**AT**	**C**		**M**							**AT**
13			FJ	S					C									C
14			FJ	S														
15			FJ	S														
16				MB;Sa	SB			AT		E								
17				MB														
18				**MB**														
19				**MB**														
20					**SB**													
21					SB													
22					SB													
23						P				E								P
24						P												P
25							EG											EG
26							**EG**											**EG**
27							EG											EG
28							EG											EG
29							EG											EG
30							EG											EG
31								AT										AT
32								AT										AT
33								**SC**										**SC**
34								SC										SC
35								SC			M							SC
36							**FJR**		**C**		**M**							**FJR**
37																		**Sp**
38							**FJR**											**FJR**
39							FJR											FJR
40							FJR											FJR
41							FJR											FJR
42									C	E								C
43											**M**							**M**
44											**M**							**M**
45											**M**							**M**
46										E								E
47										E								E
48													KL					KL
49													KL					KL
50													KL					**Sp**
51													KL		BRi	A		KL
52														F				F
53														F				F
54														F				F
55														BR				BR
56														BR				BR
57															BRi			BRi
58															BRi			BRi
59																A		A
60																A		A
61																		**DK**
62										E								E
63										E								E
64										E								E
65										E								E
66										E								E
67										E								E
68										E							DR	E
69												PK					DR	PK

The characteristics of the options to be synthesized can be quite flexible, owing to the technology of portfolio insurance. For instance, it is not necessary for there to be an expiration date; the profile of the payoff function may be of virtually any shape; the exercise prices may be set at any level; the options on the portfolio may be set to payoff based on the minimum or maximum of two or more indices.

Step 5: Estimate the shape of the debt payoff function under debt relief arrangements.

The purpose of this step is to aid the analyst in designing and fine-tuning the portfolio insurance. Although portfolio insurance techniques are quite accommodating, they must be tailored to the situation of each country. Fortunately, if this step is misspecified, it is likely that for a lender to many emerging market countries, there will be offsetting errors to some extent. Indeed, there are likely to be some defaults that are

not explained by the economic factors considered. For example, Feder and Just [1977] found that six variables were able to explain 94 percent of sovereign defaults, but that six percent were due to factors not captured in their model. In these cases, the risk pooling principle provides a complementary mechanism to insure against default. Thus, to arrive at the fair cost of insurance, an amount must be added to the cost of portfolio insurance to account for the actuarial cost of non hedgeable defaults.

The five steps listed above are sufficient to compute the theoretical cost of a loan guaranty, and therefore, to price sovereign debt at the margin. However, if a lender actually wishes to implement an insurance program, some additional items must be considered and one more step must be taken. For example, the hedging mechanism is built on an implicit assumption that the size of a given insurance program is not so large that implementing it will not distort prices and disrupt financial markets. This assumption is strained for large debtor nations with substantial sovereign debt. Another consideration to keep in mind when insuring the sovereign debt of many nations is that there are likely to be a number of offsets. For example, one country (e.g., Venezuela) might be hurt if oil prices decline, whereas another (e.g., Uruguay) might be helped. Thus, the options positions taken to insure these two countries would be opposite. This does not mean that the insurer nets the two exposures and ignores the exposure to oil prices. If oil prices decline, it is likely to hurt Venezuela more than it helps Uruguay, because of the asymmetric loan payoff profiles. In other words, the slight added security of Uruguayan debt will not offset the severe credit deterioration of Venezuelan debt. Accordingly, the insurer must construct a "long straddle" position in the synthetic options — one that has payoffs if oil prices move in either direction.

Step 6: Monitor the hedges and dynamically adjust them to take into account changing market conditions.

In this any form of portfolio insurance, what is sought is a self-financing hedge. The hedge is adjusted frequently to track economic conditions. This frequent rebalancing incurs substantial transactions costs, so they must be taken into account in pricing the loan guaranty.

VI. The Complications

Thus far a rosy picture has been painted—in fact, far too rosy. While describing the new approach, I have glossed over a number of items. In this section, I will briefly discuss them, although I will leave much to be resolved.

One of the first considerations is whether the existence of an insurance program will somehow alter the behavior of the debtor. If it does, then the program will be ineffective. (This is the Heisenberg Principle applied to sovereign debt!)

An advantage of the new program is that the hedges necessary to create the insurance can be undertaken outside the control of the debtor country. Many of them can be done in Chicago, Rotterdam, London, New York, and other international financial centers.

One problem that arises in using a hedging approach is that it is easier to hedge price risk than quantity risk. For example, Argentina gains foreign exchange through the export of wheat. If world wheat prices decline, Argentina's economic health is hurt. Thus, a hedge against falling wheat prices would seem to be appropriate. But what if something happens to the production or stock of wheat in Argentina. For example, a few years ago, the major loading docks in Argentina suffered a massive grain dust explosion, eliminating much of the export stock. World wheat prices actually rose when this occurred. Obviously, a price hedge would not be effective in insuring against this sort of misfortune to Argentina's economy.[8] Recently developed techniques have provided options that adjust for changes in quantity,[9] but these techniques have limited applicability and would not address situations such as a drought or freeze in a country whose market share of the ruined commodities is too small to affect world price levels.

Another complication is that the analyst needs to continually monitor the components of a country's economy that give rise to its economic health. Over time, changes in the key components of an economy arise, and need to be taken into account in modifying the hedge portfolio. There is always the possibility that a debtor nation itself has undertaken the desired hedges. If this is so, outside hedges would be redundant and costly.

Finally, there is an ultimate constraining factor on the degree to which this technology can be applied. In the broadest macroeconomic view, clearly there are limits beyond which risk cannot be fully hedged. Much sovereign risk arises from the transfer of wealth between countries, as relative prices and economic productivity change. In an ultimate sense, this kind of risk is globally hedgeable. In other words, if everyone tried to hedge the risk, there would be zero net supply of hedging instruments. The risk positions of all hedgers would "zero out." This kind of risk is analogous to the "idiosyncratic risk" or "unsystematic risk" discussed in the financial economics literature. On the other hand, some sovereign risk arises from global systematic risk. The global economy waxes and wanes over time, and all countries are affected to one degree or another. While this kind of risk is hedgeable, it is only up to some point. If everyone tried to hedge this risk, there would be an excess demand for hedging instruments and a negative net supply. The

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[8]See "Grain Prices Rise; Argentina Explosion Will Disrupt Shipping," *Wall Street Journal,* March 14, 1985. Sen and Chattopadhyay [1995] suggest three modifications to a simple domestic lending rule that address the risks of sovereign loans, which are typically uncollateralized and lack recourse. A simple domestic lending rule would be to make sure that the loan rate exceeds the bank's cost of capital and the expected values of both the borrower's cashflows and the collateral exceed the terminal value of the loan. Because a sovereign loan is uncollateralized and lacks recourse, the domestic lending rule is inadequate for sovereign lending situations. Three modifications are suggested. First, the sovereign borrower's expected earnings after discounting by its rate of time preference for consumption has to exceed the loan value. Second, the domestic borrower's decision to voluntarily default is made after observing the value of the collateral whereas the sovereign borrower's decision is made after observing its earnings. The sovereign borrower upgrades its expectation of future earnings in a Bayesian manner. Thus it is the upgraded expected value of earnings that has to exceed the loan value. Although no lending rule would completely prevent a default, each probability of default (voluntary, involuntary and total) can be managed. This provides a third modification.

[9]See Babbel and Eisenberg [1993].

wealth to cover such risks must come from somewhere, but in a macroeconomic sense, there is a global decrease in wealth and there is nowhere on the planet to turn for full recompense.

VII. Epilogue

In this paper I have set forth a new approach to insuring sovereign debt against default. The approach is not as new now as it was when I first proposed it in 1984. Nonetheless, the application is new. Moreover, some of the concerns that were raised when the program was first proposed have been overcome with the passage of time. For example, new kinds of options and portfolio insurance techniques have evolved to such an extent that they are now able to accommodate many of the specialized demands of an insurance program for sovereign debt. Moreover, there are now active markets for emerging market debt that can be utilized as reference points and for cross-hedging purposes. There are also ten years of additional studies that have been performed on the factors that accompany sovereign defaults.

All of these developments have taken an idea that was clearly in the realm of the absurd and made it a little less so. I believe that the idea is now at the stage where some serious discussions should be held to determine whether this is a direction that merits further consideration.

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