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A Research Annual

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FINANCIAL PLANNING FOR INTERNATIONAL LONG-TERM DEBT FINANCING

Rosita P. Chang, Peter E. Koveos, and S. Ghon Rhee

INTRODUCTION

A recent trend indicates that a growing number of U.S. firms have raised a large portion of required funds in the Eurocurrency and Eurobond markets. This new trend has been, in no small part, triggered by two important developments in the U.S. domestic and international capital markets: the adoption of the Statement of Financial Accounting Standards No. 52 by the Financial Accounting Standards Board (FASB) and the evolution of swap markets in the 1980s. Before December 1982, FASB No. 8 required that translation gains (losses) be passed through quarterly as well as annual income statements, thus causing unduly large fluctuations in reported earnings. By abolishing the "flow through" requirement under FASB No. 8, the provisions of FASB No. 52 permit unrealized foreign exchange gains (losses) to be reported in a separate

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reserve account under consolidated stockholders' equity. Although the long-term impact of FASB No. 52 on financing activities of the U.S. multinational firms has yet to be evaluated carefully, its adoption certainly helped multinational firms increase their foreign currency debt financing. The continued success of the swap market has been largely due to the creative cross-currency swap engineered by the World Bank and International Business Machines in August 1981.[1] Although long-term currency swaps have been in existence for years as a device to avoid foreign exchange controls, the general perception of swap transactions had been changed by the publicity surrounding the World Bank /IBM transaction. Once swap transactions were recognized as a convenient vehicle to achieve long-term hedging and risk-sharing between two parties in different risk classes, the swap market took off on its phenomenal evolution. More importantly, swap transactions have been used to take advantage of capital market imperfections related to interest rate differentials and limited availability of funds in different currency markets.

As the scope of financing activities becomes more global, U.S. firms pay more attention to overall strategic planning for international debt financing. Three important features are involved with long-term debt financing in the international capital market: (1) the choice of currency, (2) the choice of coupon rate, and (3) the choice of maturity. The past literature focused mainly on the theory of currency-of-denomination, leaving the optimal coupon and maturity strategies unexplored [5, 6, 9, 10, 11, 17, 19, 20]. Traditional decision rules for the choice of currency dictate that multinational firms hold assets denominated in strong currencies and have liabilities denominated in weak currencies. These rules have guided many firms in their long-term as well as short-term hedging against the foreign exchange risk.

While generally true, the traditional decision rules may be misleading: In the absence of market imperfections, interest arbitrage ensures that the interest rate parity theorem holds. Thus, any firm should be indifferent to the choice between local currency and foreign currency for its debt financing because interest rate differentials in two countries simply reflect market expectations of changes in exchange rates. A classic study by Aliber and Stickney [1] presented empirical evidence supporting the validity of the interest rate parity theorem. At the theoretical level, many studies provided rigorous proof to this effect [5, 6, 21]. More recent studies have explored the reasons for deviations from interest parity in the presence of various market imperfections such as taxes, foreign exchange transaction costs, bond flotation costs, etc. [3, 7, 12, 17, 19, 20]. Whereas most of the cited studies examined the observed deviations from the viewpoint of the efficient market hypothesis, Shapiro [19] evaluated managerial implications of these deviations. He developed a set of decision rules for currency denomination in relation to long-term debt financing based upon the distortions introduced by corporate income taxes and flotation costs: (1) In the presence of corporate income taxes but in the absence of flotation costs, the traditional decision rules hold such that borrow (lend) in the weaker (stronger) currency and (2) with the introduction of flotation costs but in the absence of corporate income taxes, borrow (lend) in the stronger (weaker) currency. In corroboration with Shapiro [19], Rhee et al. [17] further demonstrated that the traditional decision rules still hold even with the introduction of both taxes and flotation costs. The underlying reasoning is that the "tax effect" dominates the "flotation cost effect" in determining the effective cost of long-term borrowing.

Two aspects of the currency-of-denomination decision for long-term debt that have been largely overlooked are the choice of optimal coupon rate and maturity strategies. Since only *par* bonds were considered for the denomination decision, neither Shapiro [19] nor Rhee, et al. [17] incorporated the coupon rate strategy into their analyses. In addition, the maturity strategy was not considered in the presence of the term structure of exchange rate expectations. Recognition of (1) the current U.S. tax treatment of the original issue of discount and premium bonds and (2) the term structure of foreign exchange rate expectations lends an added dimension dealing with both optimal coupon rate and maturity strategies to the currency denomination decision.

This paper integrates the optimal coupon rate and maturity strategies into the currency-of-denomination decision to formulate an overall financial plan for international long-term financing. The second section lays the groundwork for the analysis by modeling the valuation formulas of long-term bonds denominated in foreign as well as local currency. The tax treatment of three types of bonds, i.e., par, discount, and premium bonds, is built into the models and, additionally, the term structure of exchange rate expectations is introduced into the valuation of foreign currency debt. The third section estimates the effective cost of borrowing in order to develop simple decision rules for the choice of currency, coupon rate, and maturity. Several important results emerge from the analysis. First, the decision rule for the currency-of-denomination is unambiguously consistent. Regardless of the types of bonds issued or the types of term structure of exchange rate expectations, the firm should denominate the bond issue in the weaker currency. Thus, when a devaluation (appreciation) of the foreign currency is expected, foreign (local) currency debt should be issued. Second, a set of decision rules is developed for the choice of the coupon rate. When local currency debt is issued due to the expected appreciation of the foreign currency, the smaller the coupon rate the lower the effective cost of debt. When foreign currency debt is issued in anticipation of the devaluation of the foreign currency, the optimal coupon rate strategy depends on the magnitude of the devaluation expected. If the expected rate of devaluation is large (small), the firm is better off by issuing foreign currency premium (discount) bonds. Third, the optimal maturity strategy for local currency discount bonds is straightforward; the lower the coupon rate, the longer the optimal maturity. In determining the optimal maturity of foreign currency debt, however, both the type of term structure of exchange expectations and the magnitude of expected devaluation (of foreign currency) play a crucial role. When the expected rate of devaluation is small and the future spot rates converge to a new level, the longer the maturity, the lower the cost of debt. In contrast, when the expected rate of devaluation is large and the future spot rates decrease exponentially, the shorter the maturity, the lower the cost of debt. The last section summarizes the results nd discusses future directions of related research.

MODEL DEVELOPMENT

Suppose a U.S. firm evaluates simultaneously the choice of currency in which to denominate a long-term bond issue and the choice of the optimal coupon rate and maturity: It can borrow either in the foreign currency or in the local currency.[2] In addition, the bond can be issued either at par, at a discount, or at a premium. The firm's decision will be based on the effective cost of borrowing under various alternatives.

Foreign Currency Bond

Suppose the firm plans to borrow foreign currency debt in an amount equivalent to one dollar. If the selected coupon rate, w, is the same as the market interest rate, r_F, applicable to corporate debt in the same risk class, the bonds will be sold at par and the maturity (face) value will be $\lambda = 1$. Alternatively, discount bonds with a coupon rate $w < r_F$ will have the maturity value of $\lambda > 1$ for the firm to raise one dollar, whereas premium bonds carrying a coupon rate $w > r_F$ will have the maturity value of $\lambda < 1$.[3] The total amount of discount $(\lambda - 1)$ or premiun $(1 - \lambda)$ will be amortized over the life of the bond. Under the current U.S. tax laws, the prorated discount is treated as a tax-deductible expense while the prorated premium is treated as income to the firm and is subject to taxation.[4] In addition, the issue costs are also amortized over the life of the bond. The costs include the flotation costs (management fee, underwriting fee, and selling concession) and front-end expenses (printing fee, legal fee, tombstone advertising fee, stock exchange listing fee, underwriters' expense reimbursement, etc.). Assuming that (1) the corporate income tax rate is applicable to exchange gains and losses on the dollar equivalent of principal and (2) the tax treatment of exchange gains and losses is symmetrical, the after-tax bond valuation model is developed. To provide a convenient focus for the model development, the cash flow data summarized in Table 1 are used.

Given the current spot exchange rate, x_0 (\$/F), the first row of Table 1 presents interest expenses and principal to be paid back in foreign currency when n-year discount bonds are issued to raise an amount equivalent to one dollar, or $1/x_0$ in foreign currency. The figures in the first row are converted into U.S. dollar equivalent by multiplying appropriate spot exchange rates as shown on the second row. Note that the maturity (face) value of bonds may be

$$\gtreqless 1$$ depending on the magnitude of coupon rate relative to the

market interest rate, $w \lesseqgtr r_F$.

To complete the cash flow series in the second row, the term structure of exchange rate expectations has to be admitted for all n periods into the future. If active forward markets exist for all

Table 1. Cash Flows for Foreign Currency Bonds[a]

	$i = 0$	$i = 1$	$i = 2$	$i = 3$	. . .	$i = n$
1. In foreign currency	$1/x_0(\$/F)$	$w\lambda/x_0$	$w\lambda/x_0$	$w\lambda/x_0$	. . .	$w\lambda/x_0 + \lambda/x_0$
2. In U.S. dollar	1	$w\lambda x_1/x_0$	$w\lambda x_2/x_0$	$w\lambda x_3/x_0$	. . .	$w\lambda x_n/x_0 + \lambda x_n/x_0$
3. Given various term structures of exchange rate expectations[b]						
a. Case 1 where $x_i/x_0 = 1$	1	$w\lambda$	$w\lambda$	$w\lambda$	. . .	$w\lambda + \lambda$
b. Case 2 where $x_i/x_0 = \exp(s)$	1	$w\lambda \exp(s)$	$w\lambda \exp(s)$	$w\lambda \exp(s)$	. . .	$w\lambda \exp(s) + \lambda \exp(s)$
c. Case 3 where $x_i/x_0 = (1 + s)^i$	1	$w\lambda(1 + s)$	$w\lambda(1 + s)^2$	$w\lambda(1 + s)^3$	. . .	$w\lambda(1 + s)^n + \lambda(1 + s)^n$
d. Case 4 where $x_i/x_0 = \exp[s(1 - 1/(1 + i))]$	1	$w\lambda \exp[s(1 - 1/2)]$	$w\lambda \exp[s(1 - 1/3)]$	$w\lambda \exp[s(1 - 1/4)]$	. . .	$w\lambda \exp[s(1 - 1/(n + 1))] + \lambda \exp[s(1 - 1/(n + 1))]$

[a] $x_0(\$/F)$ = the current spot exchange rate;
x_i = the spot exchange rate at the end of year i ($i = 1, \ldots, n$);
w = the coupon rate;
λ = the maturity (face) value of bonds, where $\lambda \gtrless 1$ if the bonds are issued at a discount ($w < r_F$), par ($w = r_F$), or a premium ($w > r_F$).

[b] Case 1: The future spot exchange rates remain at its current level.
Case 2: The spot exchange rate in the next period moves to a new level and the future spot rates remain at this new level.
Case 3: The future spot exchange rates increase (decrease) exponentially.
Case 4: The future spot exchange rates asymtotically converge to a new level.

maturities, the term structure of exchange rate expectations may be observed from the series of forward rates. Unfortunately, long-term forward markets are not available or are too thin to provide reliable forward rates. An alternative approach is to deduce the term structure of exchange rate expectations from the term structure of interest rates in two countries. A pioneering study by Porter [15] examined the relationship between the term structure of interest rates and that of exchange rate expectations. Following Porter [15], four different types of the term structure of exchange rate expectations are considered: in Case 1 interest rates in two countries are identical for all maturities, such that $x_i/x_0 = 1$ for all $i = 1, \ldots, n$. Thus, the rate of change in spot exchange rates is zero over the next n years. In Case 2 the interest rate differentials diminish as the maturity increases and they converge to unity. Thus, it follows that $(1 + r_{\$,i})/(1 + r_{F,i}) = \exp(s/i)$, where $r_\$$ = the market interest rate in the U.S. capital market, r_F = the market interest rate in the foreign capital market, and $i = 1, \ldots, n$. A revaluation (devaluation) of the foreign currency relative to U.S. dollar is indicated by $s > 0$ ($s < 0$). Given the interest rate differentials described above, the next period's spot exchange rate will move up (down) to a new level, $\exp(s)x_0$, depending on $s > 0$ ($s < 0$) and the future spot rate will remain at this level for all n periods such that $x_i/x_0 = \exp(s)$ for $i = 1, \ldots, n$. Case 3 is characterized by constant interest rate differentials, i.e., $(1 + r_{\$,i})/(1 + r_{F,i}) = (1 + s)$, which implies that the future spot exchange rate either increases or decreases exponentially depending upon $s > 0$ or $s < 0$, such that $x_i/x_0 = (1 + s)^i$ where $i = 1, \ldots, n$. In Case 4 the interest rate differentials have either a concave or convex shape over time, i.e., $(1 + r_{\$,i})/(1 + r_{F,i}) = \exp[(s/i)(1 - 1/(1 + i))]$. This implies that $x_i/x_0 = \exp[s(1 - 1/(1 + i))]$ for $i = 1, \ldots, n$. Thus, the future spot exchange rate asymtotically converges to a new level, $\exp(s)x_0$ as the maturity goes to infinity.[5] Note that Case 1 emerges as a special example of all three other cases when $s = 0$. Given the various shapes of the term structure of exchange rate expectations, the cash flows for each case are presented in the bottom half of Table 1. Note that all the cash flows in Table 1 represent before-tax figures. With the introduction of corporate income taxes and transaction costs, the foreign currency bond valuation can be developed as shown below.

$$1 - c\left[1 - \frac{t}{n}\,\mathrm{PV}(1)\right] = (1 - t)w\lambda\,\mathrm{PV}(1) + \frac{\lambda}{(1 + k_F)^n} - \frac{t(\lambda - 1)}{n}\,\mathrm{PV}(1) \tag{1}$$

$$1 - c[1 - \frac{t}{n}\mathrm{PV}(2)] = (1-t)w\lambda\mathrm{PV}(2) + \frac{\lambda e^{s} - t\lambda(e^{s} - 1)}{(1+k_{\mathrm{F}})^{n}} - \frac{t(\lambda - 1)}{n}\mathrm{PV}(2) \tag{2}$$

$$1 - c[1 - \frac{t}{n}\mathrm{PV}(3)] = (1-t)w\lambda\mathrm{PV}(3) + \frac{\lambda(1+s)^{n} - t\lambda[(1+s)^{n} - 1]}{(1+k_{\mathrm{F}})^{n}} - \frac{t(\lambda - 1)}{n}\mathrm{PV}(3) \tag{3}$$

$$1 - c[1 - \frac{t}{n}\mathrm{PV}(4)] = (1-t)w\lambda\mathrm{PV}(4) + \frac{\lambda e^{s[1-1/(1+i)]} - t\lambda\{e^{s[1-1/1+i)]} - 1\}}{(1+k_{\mathrm{F}})^{n}} - \frac{t(\lambda - 1)}{n}\mathrm{PV}(4) \tag{4}$$

where k_{F} = the effective cost of foreign currency debt,
t = the corporate income tax rate,
s = the rate of change in spot exchange rate,
c = the issue cost per dollar of funds raised,

$$\mathrm{PV}(1) = \sum_{i=1}^{n}\left(\frac{1}{1+k_{\mathrm{F}}}\right)^{i},$$

$$\mathrm{PV}(2) = e^{s}\sum_{i=1}^{n}\left(\frac{1}{1+k_{\mathrm{F}}}\right)^{i},$$

$$\mathrm{PV}(3) = \sum_{i=1}^{n}\left(\frac{1+s}{1+k_{\mathrm{F}}}\right)^{i},$$

$$\mathrm{PV}(4) = \sum_{i=1}^{n}\left\{\frac{e^{s[1-1/(1+i)]}}{1+k_{\mathrm{F}}}\right\},$$

$$\lambda \gtreqless 1 \qquad \text{if } w \lesseqgtr r_{\mathrm{F}}.$$

Equations (1) through (4) represent foreign currency bond valuation formulas appropriate for various shapes of the term structure of exchange rate expectations. Equation (1) is for Case 1 in which the rate of change is dropped from the formula. The left-hand side of (1) represents the amount of funds raised net of the after-tax issue cost, where c denotes the total issue cost per dollar of funds raised. The issue costs are not deductible in their entirety in the year of issue but are to be written off over the term of the bonds. The present value of the tax subsidies on the annual amortized issue costs is $c(t/n)\mathrm{PV}(k_{\mathrm{F}})$ where $\mathrm{PV}(k_{\mathrm{F}}) = \Sigma_{i=1}^{n} 1/(1+k_{\mathrm{F}})^{i}$ and k_{F} is the effective cost of foreign currency bonds. The first term on the right-hand side of (1) is the present value of the after-tax interest expenses, where $w\lambda$ denotes the annual interest expense per dollar of funds raised. The second term is the present value of the face value λ payable in year n. The last term represents the present value of the tax subsidies on the prorated discount (premium) over the life of the bonds, where $(\lambda - 1)$ is the discount (premium) per dollar of funds raised. Note that discount bonds will have $\lambda - 1 > 0$, which implies that the tax subsidies on the prorated discount will reduce the effective cost of debt. In contrast, premium bonds will have $\lambda - 1 < 0$, which means that the firm pays additional taxes on the amortized premium and the effective cost of debt will be increased as indicated by the last term. Further note that the last term will drop for par bonds because $\lambda = 1$.

Equation (2) expresses the bond valuation for Case 2 in which the next period spot exchange rate moves up (down) to a new level and the future spot rates stay at this level for the remaining $n - 1$ periods into the future. Present values of the tax subsidies on the amortized issue costs, the prorated discount, and of the after-tax interest expenses are affected by the future spot exchange rates. One important variation from (1) is found in the second term of the right-hand side of (2). The entire numerator of the second term is the after-tax cost of repaying λ dollars in year n. Because of exchange gains (losses) on the principal, the tax effect has to be considered. If the foreign currency appreciates (devalues) relative to the U.S. dollar, the firm will have exchange losses (gains) of $\lambda[\exp(s) - 1]$. As a result, the firm will receive tax subsidies on exchange losses or pay additional taxes on exchange gains depending upon whether $\exp(s) > 1$ or $\exp(s) < 1$.

Equation (3) is for Case 3 in which the future spot exchange rates increase or decrease exponentially over time. This implies that the rate of change in spot exchange rates is constant. Because the assumption of a constant rate of change simplifies the mathematical derivations, Case 3 has been frequently analyzed in the past studies [9, 17, 19]. The interpretation of each term in (3) is identical to that of (2).

Equation (4) is applicable to Case 4 in which the future spot exchange rates converge gradually to a new level. Hence, x_i/x_0 is replaced by $\exp[s(1 - 1/(1 + i))]$ where $i = 1, \ldots, n$. Again, the interpretation of each term in (4) is identical to that of either (2) or (3).

Local Currency Bond

When the firm issues dollar denominated bonds in the domestic capital market, no foreign exchange risk is involved; hence, the local currency bond valuation is straightforward.

The effective cost of local currency discount bonds is measured by $k_\$$ in (5):

$$1 - c[1 - \frac{t}{n}\mathrm{PV}(5)] = (1-t)w\lambda\mathrm{PV}(5) + \frac{\lambda}{(1+k_\$)^n} - \frac{t(\lambda - 1)}{n}\mathrm{PV}(5) \qquad (5)$$

where $k_\$ =$ the effective cost of local currency debt and $\mathrm{PV}(5) = \Sigma_{i=1}^{n}[1/(1+k_\$)]^i$. Depending on the magnitude of coupon rate, w, relative to the local market interest rate, $r_\$$, the face (maturity) value of bond will be $\lambda \gtreqless 1$ as $w \lesseqgtr r_\$$. Therefore, Eq. (5) can be used to determine the effective cost of local currency discount (par, or premium) bonds.

The following section estimates the effective cost of borrowing under various financing alternatives to examine the currency-of-denomination decision and the coupon rate and maturity strategies. The analysis is limited to a multiperiod framework with bond maturities greater than 1 year. In a single period framework, the coupon rate strategy loses theoretical merits because the distinction between discount, par, and premium bonds becomes meaningless.

THE EFFECTIVE COST OF LONG-TERM DEBT

The currency-of-denomination decision and the optimal coupon rate and maturity strategies will be evaluated based on the effective cost of debt. Unfortunately, in the multiperiod framework, the effective cost of debt cannot be expressed in a closed form solution, which is typical of the internal rate of return estimation. Therefore, the currency-of-denomination decision, the coupon rate, and maturity strategies will be examined by means of numerical analysis. Given the bond valuation formulas as expressed by (1) through (5), numerical analysis will estimate the effective cost of debt that satisfies the equality conditions. This section begins with a discussion justifying the numerical values of key variables used for the simulation. Based on the simulation results, the choice of currency, coupon rate, and maturity will be discussed.

Selection of Numerical Values

The annual rate of change in spot exchange rates is allowed to vary from −10% to +10%. This range was chosen based on the past experiences with six major currencies: Canadian dollar, French franc, German mark, Swiss franc, Japanese yen, and British pound. During the 12-year period, March 1973 through January 1985, the Canadian dollar devalued relative to the U.S. dollar at an annual rate of 2.38%, the French franc at 6.33%, the German mark at 1.02%, and the British pound at 6.49%. Only two major currencies appreciated during the same period; the Swiss franc increased its value at an annual rate of 1.57% and the Japanese yen at 0.23%. (The month of March 1973 marked the advent of floating exchange rates.) The selected range of the s-value is wide enough to include the recent fluctuations in foreign exchange rates of the major currencies.

It is assumed that the coupon rate of foreign currency par bonds is 15% while the range of coupon rates varies from 1 to 25% to introduce premium and discount bonds.

Total transaction costs (including flotation costs and front-end expenses) are assumed to be 5% per dollar of funds raised. Recent studies by Mendelson [13] and van Agtmael [22] reported that the total costs range from 3 to 4% of the amount of the issue in the Eurobond market. While total costs in the U.S. market are lower than observed in the Eurobond market due to smaller flotation costs, a slightly higher level of $c = 5\%$ is chosen to reflect other related expenses such as the issuer's own expenses for accountants, travel, and communications.

The typical maturity of Eurobonds has been 5–8 years in the past; this is relatively shorter than U.S. maturities for domestic issue. Recent trends in the Eurobond market indicate that long-term maturities have become more popular. For example, in October 1984, Exxon Capital Corporation issued 20-year bonds, Union Bank of Finland floated 50-year bonds, and General Electric Credit Corporation issued 15-year bonds.[6] A maturity of $n = 10$ years is chosen for the numerical analysis.[7] Finally, a corporate income tax rate of $t = 50\%$ is used.

The Currency-of-Denomination Decision

Table 2 presents the effective cost of both foreign currency debt and U.S. dollar debt. Space limitations permit presentation of

Table 2. Estimation of the Effective Cost of Debt

Classification	Coupon Rate	s	The effective Cost of Foreign Currency Debt, k_F: Case 2	Case 3	Case 4	The Effective Cost of U.S. Dollar Debt, $k_\$$	Difference, k_F-$k_\$$: Case 2	Case 3	Case 4
Discount Bonds		−.10	.0705	.0346	.0710		−.0051	−.0410	−.0046
		−.06	.0725	.0481	.0728		−.0031	−.0275	−.0028
		−.02	.0746	.0655	.0747		−.0010	−.0101	−.0009
	.05	.00	.0756	.0756	.0756	.0756	.0000	.0000	.0000
		.02	.0767	.0868	.0766		.0010	.0112	.0010
		.06	.0788	.1118	.0785		.0032	.0362	.0029
		.10	.0809	.1401	.0805		.0053	.0645	.0049
		−.10	.0698	.0253	.0711		−.0084	−.0529	−.0071
		−.06	.0731	.0436	.0739		−.0051	−.0346	−.0043
		−.02	.0765	.0657	.0768		−.0017	−.0125	−.0014
	.10	.00	.0782	.0782	.0782	.0782	.0000	.0000	.0000
		.02	.0800	.0916	.0797		.0018	.0134	.0015
		.06	.0835	.1207	.0827		.0053	.0425	.0045
Par Bonds		.10	.0872	.1527	.0857		.0090	.0745	.0075
		−.10	.0692	.0188	.0711		−.0107	−.0611	−.0088
		−.06	.0734	.0405	.0746		−.0065	−.0349	−.0053
		−.02	.0777	.0659	.0781		−.0022	−.0140	−.0018
	.15	.00	.0799	.0799	.0799	.0799	.0000	.0000	.0000
		.02	.0822	.0948	.0818		.0023	.0149	.0019
		.06	.0867	.1266	.0855		.0068	.0467	.0056
		.10	.0913	.1608	.0892		.0114	.0809	.0093

Premium Bonds		−.10	.0689	.0140	.0712		−.0123	−.0672	−.0100
		−.06	.0737	.0382	.0751		−.0075	−.0430	−.0061
		−.02	.0787	.0660	.0791		−.0025	−.0152	−.0021
	.20	.00	.0812	.0812	.0812	.0812	.0000	.0000	.0000
		.02	.0838	.0971	.0833		.0026	.0159	.0021
		.06	.0890	.1308	.0874		.0078	.0496	.0062
		.10	.0943	.1666	.0917		.0131	.0854	.0105
		−.10	.0686	.0103	.0712		−.0135	−.0718	−.0109
		−.06	.0739	.0365	.0755		−.0082	−.0456	−.0066
		−.02	.0793	.0661	.0799		−.0028	−.0160	−.0022
	.25	.00	.0821	.0821	.0821	.0821	.0000	.0000	.0000
		.02	.0849	.0988	.0844		.0028	.0167	.0023
		.06	.0907	.1338	.0889		.0086	.0517	.0068
		.10	.0966	.1708	.0936		.0145	.0887	.0115

results for only a few selected coupon rates: discount bonds carrying the coupon rates of 5 and 10%, par bonds with a 15% coupon rate, and premium bonds with coupon rates of 20 and 25%. Of the four different shapes of the term structure of exchange rate expectations, the simulation results under Case 1 are not reported in Table 2 because Case 1 is a special example of the other three cases when the rate of change in spot exchange rates is zero.[8] Thus, the effective cost of foreign currency debt is reported only for Cases 2, 3, and 4. The estimation of the effective cost of U.S. dollar debt is based on Eq. (5). It should be noted from Eq. (5) that the effective cost of U.S. dollar debt is independent of the rate of change in spot exchange rates. Therefore, the estimated effective cost of U.S. dollar debt remains unchanged as the s-value varies.

The last column reports the difference between the effective cost of foreign currency debt and that of U.S. dollar debt given the three types of term structure of exchange rate expectations. A simple rule for the currency-of-denomination decision emerges from the reported results. Notice that the reported difference is always negative (positive) if $s < 0$ ($s > 0$) regardless of the shape of the term structure of exchange rate expectations and of the types of bonds issued. When a devaluation (appreciation) of the foreign currency is anticipated, foreign currency debt is less (more) expensive than U.S. dollar debt. Thus, the choice of currency in which to borrow or to lend is dependent on the sign of the rate of change in spot exchange rates. This result is consistent with Shapiro [19] and Rhee et al. [17], which examined the denomination decision on the basis of par bonds. Whether or not the firm issues par bonds or nonpar bonds, the decision rule indicated by the simulation results is consistent with the conventional prescriptions: Borrow in the weaker currency and lend in the stronger currency.

Further notice that the largest magnitude (in terms of absolute value) of $k_F - k_\$$ is reported for Case 3 in which future spot exchange rates increase (decrease) exponentially. In contrast, the smallest magnitude is observed for Case 4 in which future spot exchange rates asymptotically converge to a new level while the absolute values of $k_F - k_\$$ for Case 2 always fall between Case 3 figures and Case 4 figures. This result is not unexpected because exponentially changing spot exchange rates (Case 3) will have a larger impact on the effective cost of foreign currency debt than those converging to a new level either gradually (Case 4) or drastically (Case 2). The effective cost of foreign currency debt ranges from

3.46 to 14.01% under Case 3 as the rate of change in spot exchange rates varies from −10 to +10% given the coupon rate of 5%, whereas, the comparable ranges for Cases 4 and 2 are between 7.10 and 8.05% and between 7.05 and 8.09%, respectively. As the coupon rate increases, the ranges of the effective cost increase for all three cases. At a coupon rate of 25%, the effective cost of foreign currency debt ranges from 1.03 to 17.08% for Case 3, from 7.12 to 9.36% for Case 4, and from 6.86 to 9.66% for Case 2. This is caused by changes in the relative importance of three components that play critical roles in the valuation of foreign currency-denominated bonds. As indicated by Eqs. (1) through (4), there are four components that determine the market value of foreign currency debt: (1) the after-tax interest expenses, (2) the after-tax principal, (3) the tax effects on discount (premium), and (4) the after-tax transaction costs. As the coupon rate goes up, the relative importance of the after-tax interest expenses also increases while that of the principal drastically decreases. Additionally, the tax subsidies on discount, which lower the effective cost of debt for discount bonds carrying low coupon rates, change into additional tax burden on premium to raise the effective cost of debt as the coupon rate increases. In contrast, the relative importance of the after-tax transaction costs shows a minimal sensitivity to the increase in the coupon rate. The combined effect of the changes in the first three components causes the range of the effective cost of debt to increase as the coupon rate goes up.

The Coupon Rate Strategy

Suppose that the foreign currency is expected to appreciate relative to the U.S. dollar. Hence, the U.S. firm denominates the new issue of bonds in the local currency. The next critical question concerns the choice of the coupon rate for this dollar issue. This question can be easily answered by examining the relationship between the effective cost of U.S. dollar debt and the coupon rate. As shown in Table 2, the effective cost of U.S. dollar debt is an increasing function of the coupon rate: As the coupon rate increases, the effective cost also increases. The effective cost of U.S. dollar debt is only 7.56% when the coupon rate is 5% while it increases to 8.21% at a coupon rate of 25%. The graphic illustration of this relationship between the effective cost of U.S. dollar debt and the coupon rate can be found in Figures 1, 2, and 3 when

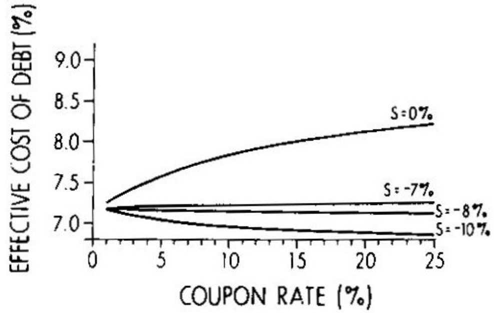

Figure 1. The Relationship between the Effective Cost of Debt and the Coupon Rate (Case 2).

the rate of change in spot exchange rates is equal to zero. Although these figures are presented to show the relationship between the effective cost of foreign currency debt and the coupon rate given three types of term structure of exchange rate expectations and the various levels of devaluation (revaluation) of the foreign currency, we know that the effective cost of foreign currency debt is the same as that of local currency debt when $s = 0$. As depicted in Figure 1, it is observed that the effective cost of U.S. dollar debt increases at a diminishing rate as the coupon rate increases. (Due to the difference in scales on the vertical axes, the shapes of the effective cost curves in the three figures look different.) Thus, discount bonds with the lowest coupon rate are preferred as a borrowing vehicle when local currency debt is issued.

This result is due to the peculiar tax treatment of bond discounts (premiums) under the U.S. tax code. Firms must pay additional taxes when premium bonds are issued because the prorated premium is treated as taxable income, whereas they pay less taxes when discount bonds are issued because the prorated discount is treated as a tax deductible expense. The consequences of this peculiar tax treatment for stockholders' wealth have been carefully analyzed by Racette and Lewellen [16]. They demonstrated that firms can take advantage of the added tax savings from amortizing bond discounts to increase the market value of common equity. The additional tax savings in turn lowers the effective cost of debt as the firm issues bonds carrying low coupon rates.[9]

Suppose that the foreign currency is expected to devalue relative to the U.S. dollar. The firm, therefore, will prefer foreign currency debt to U.S. dollar debt. For the coupon rate strategy, consider

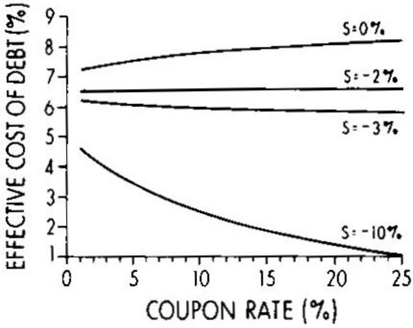

Figure 2. The Relationship between the Effective Cost of Debt and the Coupon Rate (Case 3).

Figures 1, 2, and 3, which illustrate the relationship between the effective cost of foreign currency debt and the coupon rate. Figure 1 shows the relationship under Case 2 in which future spot exchange rates move up (down) to a new level at the next period and remain at this level for all future periods. Note that the effective cost of foreign currency debt is consistently lower than that of U.S. dollar debt (indicated by the curve with $s = 0\%$) as long as $s < 0$. Depending on the magnitude of the rate of devaluation, however, the effective cost of foreign currency debt is either an increasing or decreasing function of the coupon rate. Specifically, the effective cost of debt increases when the rate of devaluation is $s = -7\%$ but it becomes a decreasing function of the coupon rate when the rate of devaluation is $s = -8\%$ or lower. Hence, when $0\% > s \geqslant -7\%$, the lowest coupon rate is optimal one while at a high rate of devaluation, $s < -8\%$, the higher the coupon rate, the lower the effective cost of foreign currency debt.

Figure 2 presents the effective cost curves of foreign currency debt for Case 3 in which future spot rates increase (decrease) exponentially. The optimal coupon rate strategy is similar to that observed in Figure 1. The effective cost is an increasing function of the coupon rate at relatively low rates of devaluation (less than 2%) but it becomes a decreasing function at higher rates of devaluation (greater than 3%). Therefore, the smaller the coupon rate the lower the effective cost of foreign currency debt if $0\% > s \geqslant -2\%$ whereas the higher the coupon rate the lower the effective cost if $s < -3\%$. When compared with Figure 1 (Case 2), it is noted that the effective cost of debt becomes a decreasing function when the rate of devaluation is small under Case 3, i.e., $s = -8\%$ under Case

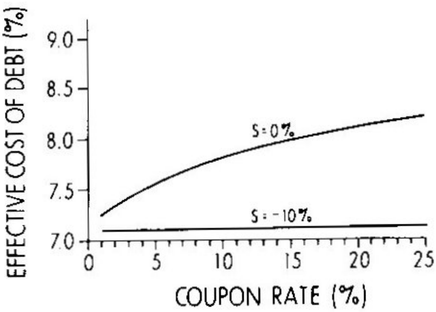

Figure 3. The Relationship between the Effective Cost of Debt and the Coupon Rate (Case 4).

2 vs. $s = -3\%$ under Case 3. With an exponentially decreasing exchange rate, its impact will be large enough to make the effective cost curve decrease at a relatively small rate of devaluation.

Figure 3 illustrates the effective cost curves of foreign currency debt when future spot exchange rates asymptotically converge to a new level (Case 4). Because this term structure of exchange rate expectations will have the smallest impact on the effective cost of debt, we observe that the effective cost curve is increasing even at a 10% rate of devaluation.

Hence, the optimal coupon rate should be the lowest one. However, as the rate of devaluation is increased above 10%, the effective cost curve should slope downward, which will change the optimal coupon rate from the lowest to the highest.

The optimal coupon rate strategies can be summarized as follows: When local currency debt is preferred due to the expected revaluation of the foreign currency, the lower the coupon rate, the lower the effective cost of debt. Thus, the firm gains from issuing the local currency discount bonds. When foreign currency debt is preferred due to the expected devaluation of the foreign currency, the optimal coupon rate strategy is dependent on the magnitude of the expected devaluation and the term structure of exchange rate expectations. In general, the simulation results suggest that the firm should issue foreign currency premium (discount) bonds if the expected rate of devaluation is large (small).

The Maturity Strategy

When the foreign currency is expected to revalue relative to the U.S. dollar, the firm prefers the bond issue denominated in the local

Table 3. The Optimal Maturity of U.S. Dollar Debt

	Coupon Rate		
Maturity	*5%*	*10%*	*15%*
2	.0901	.0906	.0910
10	.0756	.0782	.0799
20	.0695	.0755	.0788
30	.0658	.0744	.0786
32	.0653	.0743	.07853
34	.0649	.0743	.07852
36	.0646	.0742	.07851
38	.0643	.0742	.078503
39	.0642	.074190	.0785010
40	.0641	.074189[a]	.0785007[a]
41	.0640	.074192	.0785008
42	.0640	.0742	.078501
43	.0639	.0742	.078502
44	.0639	.0742	.078503
45	.0638	.0742	.078505
46	.0638	.0743	.078507
47	.063792	.0743	.078509
48	.063789[a]	.0743	.078512
49	.063794	.0743	.078515
50	.0638	.0744	.078518
60	.0643	.0747	.07855
70	.0652	.0751	.0786

[a]Optimal maturity.

currency. Additionally, the firm gains more by issuing discount bonds than premium bonds because the smaller the coupon rate the lower the effective cost of U.S. dollar debt. To consider the maturity strategy of the new issue, the effective cost of local currency debt is estimated at various maturity lengths. For the numerical simulation, the maturity is allowed to vary from 2 to 70 years. Three coupon rates are selected: 5, 10, and 15%. At the first two coupon rates, the bonds are selling at a discount, whereas, the coupon rate of 15% for par bonds is included for the purpose of comparison with discount bonds. Table 3 presents the estimated effective cost of U.S. dollar debt at various maturities.

Note that the effective cost of U.S. dollar debt is a convex function of the maturity for all three coupon rates selected. Hence, it reaches a minimum point at a finite maturity and then slopes upward as the maturity increases. The minimum effective cost of debt is attained at $n = 48$ given the coupon rate of 5% while for the 10% bonds the lowest effective cost of debt is reached at $n = 40$. Par bonds with the 15% coupon rate show the lowest cost also at $n = 40$. The observed general pattern in connection with the relationship between the effective cost of debt and maturity is that the optimum maturity increases as the coupon rate declines.

When a devaluation of the foreign currency is expected, the firm wants to issue foreign currency debt. The coupon rate strategy is dependent on the magnitude of expected devaluation and the types of the term structure of exchange rate expectations. In general, the firm benefits from issuing premium (discount) bonds if the expected rate of devaluation is large (small). The relationship between the effective cost of foreign currency debt and its maturity is summarized in Table 4. For the reported simulation results, the maturity is allowed to vary from 2 to 70 years. Two different rates of devaluation are introduced; $s = -2\%$ and $s = -10\%$. Corresponding to a 2% rate of devaluation, the coupon rates of 5, 10, and 15% are selected to introduce discount bonds (including par bonds), whereas, given $s = -10\%$, the larger coupon rates of 15, 20, and 25% are chosen to introduce premium bonds (including par bonds) for all three types of the term structure of exchange rate expectations.

It is observed from Table 4 that the three types of term structure of exchange rate expectations have a significant impact upon the optimal maturities. In Case 2, with the introduction of a small rate of devaluation ($s = -2\%$), the optimal maturities are $n = 49$, 40, and 35 given the coupon rates of 5, 10, and 15%, respectively. This result is similar to that reported for the optimal maturities of local currency debt. Given the small rate of devaluation, the impact of foreign exchange risk must be small. Hence, it is not surprising to observe results similar to those for local currency debt. However, at the large rate of devaluation ($s = -10\%$), the shortest maturity is optimal for the firm.

In Case 3, the optimal maturities turn out to be the longest regardless of the magnitude of the rate of devaluation. As reported in the second column, the effective cost of debt decreases monotonically as the maturity increases. With exponentially decreasing spot exchange rates, the optimal maturity strategy is "the longer the better."

In Case 4 wherein the future spot exchange rate decreases asymtotically to a new level, the maturity strategy is similar to that

Table 4. The Optimal Maturity of Foreign Currency Debt

	Case 2						Case 3						Case 4					
	$s = -2\%$			$s = -10\%$			$s = -2\%$			$s = -10\%$			$s = -2\%$			$s = -10\%$		
	Coupon Rate			Coupon Rate			Coupon Rate			Coupon Rate			Coupon Rate			Coupon Rate		
Maturity	5%	10%	15%	15%	20%	25%	5%	10%	15%	15%	20%	25%	5%	10%	15%	15%	20%	25%
2	.0851	.0849	.0847	.0608[a]	.0587[a]	.0569[a]	.0797	.0794	.0791	.0330	.0304	.0280	.0867	.0868	.0869	.0711	.0701	.0693
3	.0818	.0818	.0818	.0643	.0624	.0608	.0748	.0744	.0742	.0280	.0249	.0221	.0825	.0828	.0831	.0704[a]	.0695[a]	.0687[a]
4	.0799	.0801	.0803	.0661	.0644	.0630	.0721	.0718	.0716	.0253	.0217	.0187	.0803	.0808	.0812	.0704	.0696	.0689
10	.0746	.0765	.0777	.0692	.0689	.0686	.0655	.0657	.0659	.0188	.0140	.0103	.0747	.0768	.0781	.0711	.0712	.0712
20	.0687	.0741	.0770	.0703	.0713	.0721	.0584	.0610	.0625	.0143	.0096	.0062	.0688	.0743	.0773	.0716	.0728	.0737
30	.0650	.0731	.07692	.0707	.0723	.0734	.0532	.0581	.0606	.0115	.0074	.0044	.0650	.0733	.0772	.0718	.0736	.0740
34	.0640	.0729	.07691	.0708	.0725	.0737	.0517	.0573	.0600	.0107	.0068	.0039	.0641	.0731	.077143	.0718	.0737	.0741
35	.0639	.0729	.07690[a]	.0708	.0726	.0737	.0514	.0571	.0599	.0105	.0067	.0038	.0640	.0731	.077142[a]	.0718	.0738	.0741
36	.0637	.0729	.07691	.0708	.0726	.0738	.0511	.0570	.0598	.0103	.0065	.0037	.0638	.0730	.077142	.0718	.0738	.0741
37	.0636	.0728	.07691	.0708	.0726	.0738	.0508	.0568	.0597	.0101	.0064	.0036	.0637	.0730	.077142	.0719	.0738	.0741
38	.0634	.0728	.07691	.0708	.0727	.0739	.0505	.0567	.0595	.0100	.0063	.0035	.0635	.0730	.077142	.0719	.0738	.0741
39	.0633	.07279	.07691	.0708	.0727	.0739	.0502	.0565	.0594	.0098	.0062	.0034	.0634	.0730	.077143	.0719	.0738	.0741
40	.0632	.07279[a]	.07692	.0709	.0727	.0739	.0500	.0564	.0593	.0096	.0060	.0033	.0633	.07298[a]	.0772	.0719	.0738	.0741
41	.0631	.07279	.07692	.0709	.0727	.0739	.0497	.0563	.0592	.0095	.0059	.0033	.0632	.07298	.0772	.0719	.0739	.0741
42	.0630	.0728	.07692	.0709	.0728	.0739	.0495	.0561	.0591	.0093	.0058	.0032	.0631	.0730	.0772	.0719	.0739	.0741
43	.0630	.0728	.07692	.0709	.0728	.0739	.0493	.0560	.0590	.0092	.0057	.0031	.0631	.0730	.0772	.0719	.0739	.0741
44	.0629	.0728	.07693	.0709	.0728	.0739	.0491	.0559	.0590	.0090	.0056	.0030	.0630	.0730	.0772	.0719	.0739	.0741
45	.0629	.0728	.07693	.0709	.0728	.0739	.0489	.0558	.0589	.0089	.0055	.0030	.0630	.0730	.0772	.0719	.0739	.0741
46	.0628	.0728	.07693	.0709	.0728	.0740	.0487	.0557	.0588	.0088	.0054	.0029	.0630	.0730	.10772	.0719	.0739	.0741
47	.0628	.0729	.07694	.0709	.0728	.0740	.0486	.0556	.0587	.0086	.0053	.0028	.06293	.0731	.0772	.0720	.0739	.0741
48	.06279	.0729	.07694	.0709	.0728	.0739	.0484	.0555	.0586	.0085	.0052	.0028	.06292	.0731	.0772	.0720	.0739	.0742
49	.06279[a]	.0729	.0770	.0710	.0728	.0739	.0483	.0555	.0586	.0084	.0051	.0027	.06292[a]	.0731	.0772	.0720	.0739	.0742
50	.0628	.0729	.0770	.0710	.0728	.0739	.0481	.0554	.0585	.0083	.0051	.0026	.06292	.0731	.0772	.0720	.0739	.0742
51	.0628	.0730	.0770	.0710	.0728	.0739	.0480	.0553	.0584	.0082	.0050	.0026	.06294	.0732	.0772	.0720	.0739	.0742
60	.0632	.0732	.0770	.0710	.0728	.0738	.0472	.0549	.0580	.0072	.0043	.0021	.0634	.0734	.0772	.0722	.0738	.0743
70	.0641	.0736	.0770	.0711	.0727	.0736	.0469[a]	.0547[a]	.0576[a]	.0064[a]	.0038[a]	.0018[a]	.0639	.0738	.0773	.0723	.0738	.0743

[a]Optimal maturity.

observed in Case 2. At the lower rate of devaluation ($s = -2\%$) the optimal maturities are $n = 49$, 40, and 35 given coupon rates of 5, 10, and 15%, respectively. These results are identical to those reported for Case 2. At the higher rate of devaluation ($s = -10\%$), the optimal maturities are $n = 3$ for all three coupon rates of 15, 20, and 25%. These maturities are slightly longer than the Case 2 results.

In summary, the simulation suggests that the optimal maturity for local currency debt (which has to be issued at discount) has an inverse relationship with the coupon rate; the lower the coupon rate, the longer the optimal maturity. On the other hand, the firm should issue foreign currency debt at premium (discount) when the expected rate of devaluation is large (small). The maturity strategy for foreign currency debt varies depending on the term structure of exchange rate expectations. For Cases 2 and 4 wherein future spot rates converge to a new lower level either drastically (Case 2) or gradually (Case 4), it is observed that the same strategy as developed for the local currency debt applies to the foreign currency discount bonds, i.e., the lower the coupon rate, the longer the optimal maturity. In contrast, when the foreign currency debt is issued at a premium, a short maturity is optimal regardless of the magnitude of the coupon rate. For Case 3 in which future spot rates decrease exponentially, however, the simulation suggests that the longer the maturity, the lower the cost of debt. This result remains unchanged regardless of whether the firm issues foreign currency debt at a premium or discount.

SUMMARY AND FUTURE DIRECTIONS OF RESEARCH

This paper has integrated the optimal coupon and maturity strategies into the currency-of-denomination decision. To this end, different types of the term structure of exchange rate expectations are introduced and the firm is allowed to issue not only par bonds but also premium (discount) bonds.

Several important decision rules have emerged from the analysis as summarized in Table 5.

First, the decision rule for the currency denomination is unambiguously consistent. Regardless of the types of bonds issued or the types of term structure of exchange rate expectations, the firm should denominate the issue of bonds in the weaker currency. Thus,

Table 5. Decision Rules for Long-Term Debt Financing

Decision	*A Devaluation of Foreign Currency is Expected*	*An Appreciation of Foreign Currency Is Expected*
1. Denomination	Issue foreign currency debt	Issue local currency debt
2. Coupon rate	Issue discount bonds if the rate of devaluation is small Issue premium bonds if the rate of devaluation is large	Issue discount bonds
3. Maturity	Cases 2 and 4 The lower the coupon rate, the longer the maturity for discount bonds Regardless of the coupon rate, a short maturity is optimal for premium bonds Case 3 For both discount and premium bonds, the longer the maturity, the lower the cost of debt	The lower the coupon rate, the longer the maturity for the local currency discount bonds

when a devaluation (appreciation) of foreign currency is expected, foreign (local) currency debt has to be issued.

Second, the decision rules for the optimal coupon rate can be summarized as follows: When U.S. dollar debt is issued due to the expected appreciation of the foreign currency, the smaller the coupon rate the lower the effective cost of debt. When foreign currency debt is issued due to the expected devaluation of the foreign currency, the optimal coupon rate strategy depends on the magnitude of its expected devaluation. The general rule is that when the expected rate of devaluation is large (small), the firm should issue foreign currency premium (discount) bonds.

Third, the optimal maturity strategy for U.S. dollar discount bonds is straightforward: The lower the coupon rate, the longer the optimal maturity. The optimal maturity strategy for foreign currency debt depends on the type of the term structure of exchange rate expectations; For the foreign currency discount bonds, it is observed that the lower the coupon rate, the longer the optimal maturity in Cases 2 and 4 wherein future spot rates converge to a new level either drastically (Case 2) or gradually (Case 4). A short maturity is optimal for the foreign currency premium bonds regardless of the coupon rate in both Case 2 and Case 4. In contrast, with the introduction of exponentially decreasing future spot rates (Case 4), the longer the maturity, the lower the effective cost of debt for both discount and premium bonds.

The analysis in this paper has been built on the presumption that the firm minimizes the effective cost of debt for the choice of currency, coupon rate, and maturity for its long-term debt financing. Although this presumption can be justified in that foreign exchange risks are unsystematic or largely diversifiable (see Cornell [4] and Aliber and Stickney [1]), it constitutes the limitation of this study and warrants further investigation of the issues addressed in this paper as the implicit risk neutrality assumption is relaxed. Recent studies by Jacque and Lang [10] and Jucker and deFaro [11] suggest a promising direction in the portfolio context in resolving the risk neutrality assumption. Another important limitation to be recognized is the partial equilibrium nature of the analysis that examined the supply side of corporate debt, or equivalently, strictly from the firms' standpoint. From the viewpoint of individual investors, two additional variables become crucial, personal taxes and differential price volatility of low coupon and high coupon bonds. A full equilibrium approach should consider the supply side as well as demand side of the corporate bond pricing, which promises an important area for future research. Nevertheless, we believe the reported results are useful in their own right in terms of providing a set of decision rules for long-term debt financing in the global context.

NOTES

1. For an excellent review of the World Bank/IBM swap transaction, see Bock [2] and Park [14].
2. The local currency and the U.S. dollar will be used interchangeably throughout the paper.
3. The following equality condition holds for three types of bonds; par, discount bonds, and premium bonds:

$$1 = w\lambda \mathrm{PV}(r_F) + \lambda/(1 + r_F)^n \tag{2a}$$

where r_F = the market interest rate,

w = the coupon rate,
λ = the terminal (face) value,
$PV(r_F) = [1 - (1 + r_F)^{-n}]/r_F$, and
n = the maturity of bonds.

Note that par bonds will have $w = r_F$ and $\lambda = 1$, discount bonds $w < r_F$ and $\lambda > 1$, and premium bonds $w > r_F$ and $\lambda < 1$.

4. Section 61–12 of the Federal Revenue Code as described in the Standard Federal Tax Reporter (1984) Volume 1, Commerce Clearing House, Inc.

5. The original expression for x_i/x_0 developed by Porter [15] was $x_i/x_0 = \exp[s(1 - 1/i)]$. To accommodate the condition that the maturity of bond $n \geqslant 2$, a slight modification was made such that $x_i/x_0 = \exp[s(1 - 1/(1 + i))]$.

6. See the 1984 November and December issues of *Euromoney*.

7. "Euroyen Bonds" published by Daiwa Securities Co., Ltd. (1984) reports that a 10-year maturity is the most common for Euroyen bonds.

8. Given a zero rate of change in spot exchange rates, the effective cost of foreign currency debt should be the same as that of local currency debt.

9. Racette and Lewellen [16] used the straight line method in amortizing discounts (premiums) as stipulated by Section 61–12 of the Federal Revenue Code. In contrast, Paragraph 15 of the Accounting Principles Board (APB) Opinion No. 21, "Interest on Receivables and Payables" (August 1971), recommended that the effective interest method be used when a material difference exists between the amortized discounts (premiums) under the two methods. A recent study by Rhee and Chang [18] demonstrates that the tax-induced bias against par or premium bonds does not disappear even when the effective interest method is used. Thus, the firm can reduce the effective cost of debt by issuing low coupon bonds regardless of the amortization method employed. Furthermore, the analytical results of this paper remain the same regardless of the amortization method used.

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