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THE CURRENCY-OF-DENOMINATION DECISION FOR DEBT FINANCING

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Abstract. This paper examines the currency-of-denomination decision for long-term debt financing in the presence of corporate income taxes and flotation costs. The numerical analysis provides convincing evidence that the "tax effect" dominates the "flotation cost effect" unless the firm operates in tax haven countries. Hence, the conventional decision rule still applies to the choice of currency in which to borrow or to lend: Borrow in the weakest currency and lend in the strongest.

INTRODUCTION

In the 1984 Spring-Summer issue of this Journal, Shapiro [7] made a significant contribution to the understanding of the currency denomination decision for long-term debt financing. His study represents an important addition to the theory of currency-of-denomination which has been the subject of several past studies. (See deFaro and Jucker [1], Eaker [2], Giddy [4] and Shapiro [9].) He demonstrated that the presence of two market imperfections, corporate income taxes and flotation costs, distorts the interest rate parity theorem which would have held in their absence. This distortion, however, yields a set of important decision rules for the choice of currency in which to borrow or to lend. The decision rules developed by Shapiro are summarized as follows:

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(a) In the presence of corporate income taxes but in the absence of flotation costs, borrow [lend] in the weaker [stronger] currency.

(b) With the introduction of flotation costs but in the absence of corporate income taxes, borrow [lend] in the stronger [weaker] currency.

(c) When both corporate income taxes and flotation costs are introduced, no clear-cut decision rule exists.

Given the opposing impacts of corporate income taxes and flotation costs on the effective cost of long-term borrowing, the indeterminancy regarding the third case is not surprising; however, it is unfortunate that this case is the one that is faced most frequently by multinational corporations. On the basis of a numerical simulation, this study will provide convincing evidence that with the introduction of taxes and flotation costs, the conventional prescription still holds: Borrow in the weaker currency and lend in the stronger one. The underlying reasoning is that the "tax effect" dominates the "flotation cost effect".

A BRIEF REVIEW OF THE "TAX EFFECT" AND THE "FLOTATION COST EFFECT"

Shapiro developed his currency-of-denomination decision rules by analyzing the effective cost of borrowing for a U.S. firm operating an overseas subsidiary using the U.S. dollar as the base currency. The parent firm evaluates the following currency-of-denomination choice for its subsidiary's debt financing: Borrow in the local currency at an interest rate r_f or in Eurodollars at r_{US}.

Assuming that (a) flotation costs are written off immediately, (b) the corporate income tax rate is applicable to exchange gains and losses of the dollar equivalent of principal, and (c) the tax treatment on exchange gains and losses is symmetrical, the effective cost of issuing debt with an n-year maturity in the local currency is measured by k in equation (1):[1,2]

$$1-(1-t)c=(1-t)r_f\sum_{i=1}^{n}\left(\frac{1-d}{1+k}\right)^i+\left(\frac{1-d}{1+k}\right)^n, \qquad (1)$$

where t denotes the local corporate income tax rate, c is flotation costs per dollar of funds raised, and d is the (constant) rate of change in the spot exchange rate. The local currency devaluation [revaluation] relative to the dollar is indicated by $d > 0$ [$d < 0$].

Likewise, the effective cost of Eurodollar debt is measured by r in equation (2):

$$1-(1-t)c=(1-t)r_{US}\sum_{i=1}^{n}\left(\frac{1}{1+r}\right)^i+\frac{1-t[1-(1-d)^n]}{(1+r)^n}. \qquad (2)$$

Solving Equations (1) and (2) for k and r, respectively, yields:

$$k = (1-t)[r_f(1-d)-d] - td + (1-t)c\,\frac{(1-d)}{PV(k^*)}\text{, and} \tag{3}$$

$$r = (1-t)r_{US} - td\alpha + (1-t)c\,\frac{1}{PV(r)}, \tag{4}$$

where,

$$\alpha = \left[\frac{(1-d)^n - 1}{-d}\right] / \left[\frac{(1+r)^n - 1}{r}\right],$$

$$PV(r) = \sum_{i=1}^{n} \left(\frac{1}{1+r}\right)^i = \left[1 - \frac{1}{(1+r)^n}\right] / r,$$

$$PV(k^*) = \sum_{i=1}^{n} \left(\frac{1}{1+k^*}\right)^i = \left[1 - \frac{1}{(1+k^*)^n}\right] / k^*\text{, and}$$

$$k^* = \frac{k+d}{1-d} \quad \text{or} \quad \frac{1}{1+k^*} = \frac{1-d}{1+k}.$$

If the interest rate parity theorem holds in the absence of taxes and flotation costs, then $r_{US} = r_f(1-d) - d$. Equation (4) is subtracted from equation (3) in order to examine which currency-of-denomination minimizes the expected financing costs:

$$k - r = -td(1-\alpha) + \frac{(1-t)c}{PV(k^*)}\left[(1-d) - \frac{PV(k^*)}{PV(r)}\right]. \tag{5}$$

The first term on the right-hand side of equation (5) represents the "tax effect" while the second term denotes the "flotation cost effect." In the absence of corporate income taxes and flotation costs, i.e., $t = 0$ and $c = 0$, $k - r = 0$. Thus, the firm should be indifferent between borrowing in Eurodollar and local currency.

In a world with taxes but with no flotation costs, i.e., $t > 0$ and $c = 0$, equation (5) reduces to the "tax effect," and Shapiro's simple decision rule, "borrow in the weaker currency and lend in the stronger one," can easily be shown to follow from this "tax effect":

$$k - r = -td(1-\alpha) \lesseqgtr 0 \text{ if } d \gtreqless 0. \tag{6}$$

In the absence of corporate taxes but with the introduction of flotation costs, i.e., $t = 0$ and $c > 0$, equation (5) is simplified to the "flotation cost effect," and Shapiro's decision rule, "borrowing in the stronger currency and lending in the weaker one," can likewise be shown to follow from this "flotation cost effect":

$$k - r = \frac{(1-t)c}{PV(k^*)}\left[(1-d) - \frac{PV(k^*)}{PV(r)}\right] \gtrless 0 \quad \text{if} \quad d \gtrless 0. \tag{7}$$

DOMINANCE OF THE "TAX EFFECT" OVER THE "FLOTATION COST EFFECT"

The unresolved issue is what should be the decision rule in the presence of these two opposing effects. In order to evaluate the potential magnitude of the "tax effect" and the "flotation cost effect" respectively, a numerical analysis is undertaken. The rate of change in the spot exchange rate is allowed to vary from +.40 to −.40 while the size of flotation costs ranges from .01 to .10.[3] It is assumed that $r_f = .16$, $t = .50$, and $n = 5$.[4] The simulation results obtained using representative numerical values provide convincing evidence that the "flotation cost effect" is swamped by the "tax effect" when both corporate income taxes and flotation costs are introduced. Hence, the difference between the effective costs of local currency debt and of Eurodollar debt is negative [positive] when the local currency devalues [revalues] relative to the U.S. dollar. Therefore, the conventional decision rule still applies to the currency-of-denomination in a world in which both corporate income taxes and flotation costs are present.

The simulation results are presented in Table 1. Note that the "tax effect" is negative [positive] while the "flotation cost effect" is positive [negative] when the local currency devalues [revalues] relative to the U.S. dollar. The most important result is that for the combined effect reported in the fifth column. Observe that the sign of the combined effect is the same as that of the "tax effect" simply because the absolute value of the "tax effect" is greater than that of the "flotation cost effect." Thus, the simulation suggests that the "tax effect" dominates the "flotation cost effect."

The effective costs of local currency debt and of Eurodollar debt are reported in the last two columns.[5] From equation (5), we know that the difference between k and r is equal to the combined effect. Because the combined effect is negative when $d > 0$ while it is positive when $d < 0$, the effective cost of local currency debt is lower [higher] than that of dollar-denominated debt when a devaluation [revaluation] of the local currency is expected. As a result, the conventional decision rule is recommended for the choice of currency in the presence of corporate income taxes and flotation costs: Borrow in the weakest currency and lend in the strongest.

It is obvious that the magnitude of the "tax effect" is dependent upon the applicable corporate income tax rate. To examine the impact of varying tax rates on the denomination decision, the break-even tax rate at which the "tax effect" is completely offset by the "flotation cost effect" is estimated.

TABLE 1

The "Tax Effect," the "Flotation Cost Effect," and the Combined Effect

d[1]	c[2]	Tax Effect	Flotation Cost Effect	Combined Effect[5]	k[3]	r[4]
	.01	−.0252	.0005	−.0247	−.3512	−.3265
	.04	−.0256	.0020	−.0236	−.3490	−.3253
.40	.07	−.0260	.0035	−.0225	−.3466	−.3241
	.10	−.0264	.0051	−.0213	−.3442	−.3229
	.01	−.0045	.0001	−.0044	.0164	.0207
	.04	−.0046	.0005	−.0041	.0200	.0241
.06	.07	−.0048	.0009	−.0039	.0236	.0276
	.10	−.0050	.0012	−.0038	.0274	.0312
	.01	−.0022	.0001	−.0021	.0488	.0510
	.04	−.0023	.0003	−.0020	.0525	.0546
.03	.07	−.0024	.0004	−.0020	.0563	.0583
	.10	−.0025	.0006	−.0019	.0602	.0621
	.01	.0000	.0000	.0000	.0813	.0813
	.04	.0000	.0000	.0000	.0851	.0851
.00	.07	.0000	.0000	.0000	.0890	.0890
	.10	.0000	.0000	.0000	.0930	.0930
	.10	.0023	−.0001	.0022	.1137	.1115
	.04	.0024	−.0003	.0021	.1176	.1155
−.03	.07	.0025	−.0005	.0020	.1216	.1197
	.10	.0026	−.0007	.0019	.1257	.1238
	.01	.0045	−.0001	.0044	.1461	.1418
	.04	.0047	−.0005	.0042	.1502	.1460
−.06	.07	.0049	−.0009	.0040	.1543	.1503
	.10	.0052	−.0014	.0038	.1585	.1547
	.01	.0295	−.0011	.0284	.5138	.4854
	.04	.0315	−.0043	.0272	.5191	.4919
−.40	.07	.0336	−.0076	.0260	.5246	.4986
	.10	.0356	−.0109	.0247	.5301	.5054

Notes:
1. d = rate of change in the spot exchange rates.
2. c = flotation costs per dollar of funds raised.
3. k = the effective cost of local currency debt.
4. r = the effective cost of foreign currency debt.
5. Because of rounding errors, the combined effect is not always the same as the difference between k and r.

At this tax rate, the firm will be indifferent between local currency debt and Eurodollar debt. As reported in Table 2, the estimated break-even tax rates are extremely small, ranging from 2 percent to 16 percent. This implies that the "tax effect" dominates the "flotation cost effect" unless the firm operates in tax-haven countries.[6] Not surprisingly, the break-even tax rates are sensitive to the size of flotation costs but they are insensitive to

TABLE 2

The Break-Even Tax Rates

Flotation Cost	Break-even Tax Rates*
.01	2%
.04	7%
.07	12%
.10	16%

Note: The break-even tax rates remain unchanged as the rates of change in the spot exchange rate vary from +40 percent to −40 percent.

the rates of change in the spot exchange rate. The break-even tax rates remain unchanged as the d value changes from \$.40 to −.40.

Additionally, the local interest rate is allowed to vary from the initial level of $r_f = .16$ to examine the sensitivity of the analytical results. The absolute value of the "tax effect" increases [decreases] as the local interest rate increases [decreases] but the "flotation cost effect" is not sensitive to the change in the local interest rate. Thus, the conclusions reached on the basis of the numerical analysis remain unchanged.

Finally, the consequences of relaxing two simplifying assumptions imposed on the effective cost formulas, equations (1) and (2), are examined. With the amortization of flotation costs over the life of debt, the present value of the tax subsidy on amortization becomes smaller than that obtained with the immediate write-off.[7] Subsequently, the effective cost of local currency debt, as well as Eurodollar debt, becomes larger. Nevertheless, the sign of the combined effect remains unchanged and, therefore, the decision rule for the currency denomination is the same.

When the ordinary income tax rate is replaced by the capital gains tax rate, the magnitude of taxes on exchange gains or of the tax subsidy on exchange losses of the Eurodollar loan principal becomes smaller. As a result, the "tax effect" becomes larger (in terms of its absolute value) whereas the "flotation cost effect" remains the same.[8] Naturally, the dominance of the "tax effect" over the "flotation cost effect" should be more pronounced than observed in Table 1.

CONCLUSION

In corroboration of Shapiro [7], this paper examined the currency denomination for long-term financing in the presence of corporate income taxes and flotation costs. The simulation results suggest that the "tax effect" dominates the "flotation cost effect" unless the firm operates in tax-haven countries. Hence, even with the introduction of taxes and flotation costs, the conventional decision rule still applies to the currency-of-denomination: Borrow in the weakest currency and lend in the strongest one.

NOTES

1. Throughout the analysis, the same notations used by Shapiro [7] are adopted.

2. The implications of relaxing the first two assumptions are discussed in the following section. Levi [5] and Shapiro [7, 8] discussed asymmetric tax treatment on exchange gains and losses for countries such as Canada, England, Sweden, etc.

3. For the selection of the numerical values, special care is taken to ensure that their ranges are wide enough to include realistic values. The selected range of flotation costs, for example, is sufficiently large to accommodate the size of the actual costs observed in the Eurobond market and the domestic capital market. Recent studies by Mendelson [6] and van Agtmael [10] report that the total costs in the Eurobond market range from 3% to 4% of the amount of the issue. These costs include the flotation costs (management fee, underwriting fee, and selling concession) in the range of 2% to 2.5% and front-end expenses (printing fee, legal fee, tombstone advertising fee, etc.) ranging from 0.8% to 1.42%. In contrast, the total costs in the U.S. market is substantially lower mainly due to the smaller flotation costs, typically 0.875% of the amount of the issue.

4. The typical maturity of Eurodollar bond is 5-8 years which is relatively shorter than the U.S. domestic bond issue. For the numerical simulation, the shortest maturity of five years is chosen. Nevertheless, the sensitivity analysis is done to ascertain that the reported analytical results, as well as the conclusions, are not affected by the increase in the maturity.

5. When the rate of devaluation is large, the effective cost of debt (denominated in the local currency or Eurodollar) may be negative. See Giddy [4] for his discussion of the negative effective cost of debt.

6. Ernst and Whinney [3] compiled corporate income tax rates of 71 countries which were effective as of December 31, 1983. The corporate tax rates of various countries are distributed as follows:

Corporate Income Tax Rate	Number of Countries
50 % or higher	17
40% – 49%	26
30% – 39%	16
20% – 29%	3
19% or less	9
Total	71

In interpreting the above information, the following caveat is in order as an anonymous referee pointed out: (a) The marginal effective tax rates could be lower than the reported nominal rates and (b) tax havens do not represent the only source of tax avoidance by multinational corporations.

7. When flotation costs are amortized over the life of debt, the left-hand side of equation (1) becomes

$$c\left[1 - \frac{t}{n}\sum_{i=1}^{n}\left(\frac{1-d}{1+k}\right)^{i}\right].$$

Equation (2) is replaced by

$$c\left[1 - \frac{t}{n}\sum_{i=1}^{n}\left(\frac{1}{1+r}\right)^{i}\right].$$

8. With the introduction of the capital gains tax rate, τ, applicable to exchange gains and losses of the principal, only the effective cost of Eurodollar debt is affected as shown below:

$$1-(1-t)c = (1-t)r_{US}\sum_{i=1}^{n}\left(\frac{1}{1+r}\right)^{i} + \frac{1-\tau[1-(1-d)^{n}]}{(1+r)^{n}}. \tag{9a}$$

Solving equation (9a) for r yields

$$r = (1-t)r_{US} - \tau d\alpha + (1-c)\frac{1}{PV(r)}. \tag{9b}$$

The difference between k as defined by equation (3) and r as defined by (9b) becomes

$$k - r = - td(1 - \frac{\tau}{t}\alpha) + \frac{(1-t)c}{PV(k^*)}[(1-d) - \frac{PV(k^*)}{PV(r)}]. \qquad (9c)$$

Since $\tau < t$, it is obvious from equation (9c) that the absolute value of "tax effect" is larger than before.

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