A note on the
"Note on Foreign Currency Swaps", HBS No. 292-043

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Abstract

This note describes the design of a hypothetical swap transaction, i.e. the swap discussed in the "Note on Foreign Currency Swaps", HBS No. 292-043. The HBS note is background reading for a number of HBS cases, such as HBS No. 287-058 ("The Walt Disney Companys Yen Financing"), HBS No. 287-057 ("R.J. Reynolds International Financing"), and HBS No. 288-042 ("Elders IXL Limited – 1986"). The current document provides a much more intuitive and transparent description of the swap in HBS No. 292-043. It can be assigned instead of the HBS note or as supplementary material.

1 Introduction

The World Bank (WB) and a company (C) would like to issue bonds with a maturity of 5 years and fixed annual coupon payments. The World Bank wants to borrow SFr 100m, and the company would like to borrow US$ 50m. Can they benefit from a swap agreement if their borrowing costs are given by the following table?

	World Bank	Company
All-in SFr borrowing cost	$8.38\%^a$	$7.98\%^c$
All-in US$ borrowing cost	$16.58\%^b$	$17.59\%^d$

Table 1: Borrowing costs of the parties to the swap

a: 7.75% coupon and front-end fees of 2.5%. b: 16% coupon and front-end fees of 1.875%. c: 7.35% coupon and front-end fees of 2.5%. d: 17% coupon and front-end fees of 1.875%.

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[1] *This note is an extended version of "the abridged version of 'Foreign Currency Swaps' (No. 286-073) originally prepared by doctoral student William B. Allen, Jr. under the supervision of Professor Scott P. Mason, abridged by Professor W. Carl Kester." The quote is from the Professionally abridged version.*

2 Basic Analysis

For a swap to create value, it must reduce the parties' combined interest expense by enabling them to benefit from their comparative advantages as bond issuers. To see that this is possible in our example, notice that the difference between the World Bank's US$ and SFr borrowing costs is smaller than that between the Company's borrowing costs.

To save borrowing costs, the two parties must first borrow in each other's preferred currency: the World Bank must issue a US$ bond, and the Company must issue a SFr bond. Then, a swap is set up in order to arrange for the following exchange of cash flows:

- The World Bank receives US$ cash inflows that cover its payments to its US$ bondholders. In exchange, the World Bank pays for the Company's SFr debt service.

- The Company covers the World Bank's US$ debt service in exchange for receiving SFr cash inflows that it can pass on to its SFr bondholders.

Given the basic structure of the swap, we can now specify the exchange of payments between the parties. The parties' debt service obligations determine any future cash flows that they will exchange under the swap agreement. Table 2 lists those cash flows.

Year	WB-inflow[a]	WB-outflow[b]	C-inflow[c]	C-outflow[d]
	US$	SFr	SFr	US$
1	+8.000	-7.350	+7.350	-8.000
2	+8.000	-7.350	+7.350	-8.000
3	+8.000	-7.350	+7.350	-8.000
4	+8.000	-7.350	+7.350	-8.000
5	+58.000	-107.350	+107.350	-58.000

Table 2: Future swap cash flows (millions)

a, d: 16% coupon and principal repayment of the US$ 50m bond issued by the World Bank (WB). b, c: 7.35% coupon and principal repayment of the SFr 100m bond issued by the Company (C).

In addition, the parties will exchange up-front payments. These payments depend on the pricing of the above-stated sequences of future cash flows, as discussed in Section 3.

3 Pricing the Swap

3.1 The World Bank's Perspective

From the World Bank's perspective, the swap results in a future US$ inflow and a future SFr outflow. The World Bank receives these future cash in- and outflows in exchange for an up-front SFr inflow and a US$ outflow. Each of these up-front payments can be seen as the price of a future cash flow.

In swap markets, the prices of future cash flows in a certain currency are quoted in terms of interest rates. We will now discuss how these quotes translate into prices. Suppose that the swap between the World Bank and the Company is based on the following quotes:

	Spot exchange rates
SFr/US$	1.9995-2.0005

	Swap rates against 6-month US$ LIBOR
US$	16.25-16.35%
SFr	7.7-7.8%

Table 3: Quotes

These quotes show that the World Bank can earn a fixed 16.25% US$ rate in exchange for paying US$ LIBOR, and that it can finance this payment (receive US$ LIBOR) by borrowing at a fixed SFr 7.8% rate. To translate these quotes into prices, we interpret the World Bank's future US$ inflow (stated in Table 2) as proceeds of a US$ investment that yields a return of 16.25%. Moreover, the World Bank's SFr outflow is interpreted as a financial obligation resulting from a SFr loan at an interest rate of 7.8%.

We start with the World Bank's US$ inflow stated in column 2 of Table 2. This inflow represents a 16.25% return on investment if it is tied to the following US$ up-front payment of the World Bank to the swap dealer:

$$\text{US\$ m} \sum_{t=1}^{5} \frac{8}{1.1625^t} + \frac{50}{1.1625^5} = \text{US\$ m } 49.593. \tag{1}$$

Next, we determine the SFr up-front payment that the World Bank receives under the swap. This up-front payment is equal to the face value of a 7.8%

loan that leads to the future SFr outflows stated in column 3 of Table 2:

$$\text{SFr m} \sum_{t=1}^{5} \frac{7.35}{1.078^t} + \frac{100}{1.078^5} = \text{SFr m } 98.194. \tag{2}$$

Upshot: The swap agreement entitles the World Bank to an up-front inflow of SFr 98.194m, in exchange for a payment of US\$ 49.593m.[2] This US\$ payment is slightly higher than the proceeds of the World Bank's US\$ bond issue. Net of the front-end fee of 1.875%, the bond issue yields US\$ 50m (1-1.875%)=US\$ 49.063m, i.e. proceeds short of US\$ 49.593m by US\$ 0.531m. To spare the World Bank a US\$ funding need, the difference can be deducted from the SFr up-front payment that the World Bank receives. The deduction equals US\$ 0.531m × SFr/US\$ 2.0005= SFr 1.061m. Net of this deduction, the World Bank is entitled to an up-front inflow of SFr 97.133m, in exchange for the entire proceeds of its US\$ bond issue.[2]

3.2   The Company's Perspective

The above-stated quotes imply that the company can earn a fixed 7.7% SFr return in exchange for paying a fixed 16.35% US\$ interest rate. Given the structure of its future US\$ outflow and future SFr inflow, the Company is entitled to an up-front inflow of

$$\text{US\$ m} \sum_{t=1}^{5} \frac{8}{1.1635^t} + \frac{50}{1.1635^5} = \text{US\$ m } 49.432, \tag{3}$$

in exchange for an up-front payment of

$$\text{SFr m} \sum_{t=1}^{5} \frac{7.35}{1.077^t} + \frac{100}{1.077^5} = \text{SFr m } 98.591. \tag{4}$$

Upshot: The swap agreement entitles the Company to an up-front inflow of US\$ 49.432m, in exchange for a payment of SFr 98.591m. This SFr payment is slightly higher than the proceeds of the Company's SFr bond issue. Net of the front-end fee of 2.5%, the bond issue yields SFr 100m (1-2.5%)=SFr 97.500m,

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[2]It is a bit misleading to say that the up-front SFr inflow occurs "in exchange for" the US\$ outflow. As discussed above, these up-front cash flows are really in exchange for future cash flows in the two currencies.

i.e. proceeds short of SFr 98.591m by SFr 1.091m. To spare the Company a SFr funding need, the difference can be deducted from the US\$ up-front payment that the Company receives. The deduction equals SFr 1.091m / (SFr/US\$ 1.9995)= US\$ 0.546m. Net of this deduction, the Company is entitled to an up-front inflow of US\$ 48.886m, in exchange for the entire proceeds of its SFr bond issue.

4   The Profitability of the Swap

We conclude by analyzing the profits of the parties to the swap. The following table summarizes the cash flows of the World Bank (WB), the Company (C), and the swap dealer (D):

Year	WB US\$	WB SFr	C SFr	C US\$	D US\$	D SFr
0	-49.063	+97.133	-97.500	+ 48.886	+0.177	+0.367
1	+8.000	-7.350	+7.350	-8.000	0.000	0.000
2	+8.000	-7.350	+7.350	-8.000	0.000	0.000
3	+8.000	-7.350	+7.350	-8.000	0.000	0.000
4	+8.000	-7.350	+7.350	-8.000	0.000	0.000
5	+58.000	-107.350	+107.350	-58.000	0.000	0.000

Table 4: Swap cash flows (millions)

The above table shows the cash flows of the parties to the swap agreement, i.e. the World Bank (WB), the Company (C), and the swap dealer (D). The table does not contain the cash flows associated with the bond issues of the World Bank and the Company. The World Bank's US\$ bond issue results in a sequence of cash flows that is exactly the opposite of that stated in the second column. The Company's SFr bond issue results in a sequence of cash flows that is exactly the opposite of that stated in the fourth column. The net cash flows of the World Bank and the Company are therefore equal to those stated in the third and fifth column of Table 4.

It is common to evaluate the profitability of the swap by comparing the parties' borrowing costs to the borrowing costs that they would incur without the swap.

- Upon swapping its US$ coupon payments into SFr, the World Bank's borrowing costs are SFr 8.07% , i.e. the internal rate of return of the cash flow stated in the third column of Table 4. If the World Bank borrowed directly in SFr, its borrowing costs would be 8.38%.

- Upon swapping its SFr coupon payments into US$, the Company's borrowing costs are US$ 16.69%, i.e. the internal rate of return of the cash flow stated in the fifth column of Table 4. If the Company borrowed directly in US$, its borrowing costs would be 17.59%.