INTERNATIONAL DIVERSIFICATION

Some Underlying Relationships

1. Effects of Exchange Risk

Time	Cost of 1 Mark	Value of German Bond	Value in Dollars
0	.50	920 DM	.50 X 920 = 460
1	.40	1000 DM	.4 X 1000 = 400

$$(1 + R_H) = \frac{1000}{920} \text{ or } R_H = 8.70\%$$

$$(1 + R_{us}) = \frac{400}{460} \text{ or } R_{us} = -13.04\%$$

$$(1 + R_{us}) = \frac{.40 * 1000}{.50 * 920} = \frac{40}{46}$$

$$= \left(\frac{.40}{.50}\right)\left(\frac{1000}{920}\right)$$

$$(1+R_x)=\frac{.40}{.50}$$

$$R_x=-.20\%$$

$$(1+R_{us})=(1+R_x)(1+R_H)$$

$$1+R_{us}=1+R_x+R_H+R_xR_H$$

$$1+R_{us}=1-.20+.0870+(-.20)(.0870)$$

Normally drop $R_x\ R_H$ term arguing it's small

$$\overline{R}_{us}\cong\overline{R}_x+\overline{R}_H$$

$$\overline{R}_{us}\cong-11.30\%$$

$$Var(R_{us}) \cong Var(R_x + R_H)$$

$$\text{var}(R_{us}) = \text{var}(R_x) + \text{var}(R_H) + 2\text{cov}(R_x R_H)$$

Normally drop covariance arguing its small

$$Var(R_{us}) \cong Var(R_x) + Var(R_H)$$

$$[Var(R_{us})]1/2 \cong [Var(R_x) + Var(R_H)]1/2$$

$$Var(R_x) = .25 \qquad Std.\ Dev.(R_x) = .5$$

$$Var(R_H) = .16 \qquad Std.Dev.(R_H) = .4$$

$$Std.Dev(R_{us}) = [.25 + .16]1/2$$

$$Std.Dev.(R_{us}) = .64$$

2. Covered Interest Rate Parity

define

1. R_{us} **return in U.S. dollars.**

2. R_H **return in home currency**

3. F_t **Futures price of one unity of foreign currency at time t**

4. S_t **Spot price of one unit of foreign currency at time t**

Strategy A

Buy U.S. 90 day T bill for $100

Ending wealth 100X(1+R_{US}**)**

Strategy B

1. **Buy German 90 day government bill and enter into futures contract.**

Marks invested

$$1/S_o \times 100$$

Ending wealth in Marks

$$[1/S_o \times 100](1 + R_H)$$

Ending wealth in Dollars

$$[1/S_o \times 100](1 + R_H) \times F_o$$

Since both riskless, law of one price holds

$$(1 + R_{us}) = \frac{F_o}{S_o}(1 + R_H)$$

3. Uncovered interest rate parity

Strategy A

Buy U.S. 90 day T bill for $100

**Ending wealth = $100(1+**$R_{us}$)

Strategy B

Buy 90 day T bill

Marks invested $1/S_o \times 100$

Ending wealth in Marks
$(1/S_o \times 100)(1 + R_u)$

Ending wealth in Dollars
$\{1/S_o \times 100\}(1 + R_H) \times S_1$

Where S_1 **is spot rate in 90 days**

Uncovered interest rate parity says they have same return. Rate not application of law of one price since different risk.

$$(1+R_{us}) = (1+R_H)\frac{S_1}{S_o}$$

Putting this relationship together with covered interest rate parety implies

$$F_o = E(S_1)$$

Also note that

$$\frac{(1+R_{us})}{(1+R_H)} = \frac{S_1}{S_o}$$

Example $R_{US} = 6\%$

$R_{can} = 12\%$

Current exchange rate .80

$$\frac{1.06}{1.12} = \frac{E(S_1)}{.80}$$

$E\left(S_1\right) = .757$

or Canadian dollar is expected to depreciate

4. Purchasing Power Parety

define

1. I_S = **inflation in U.S.**
2. I_H = **inflation in foreign Country**

$$\frac{S_1}{S_o} = \frac{(1+I_H)}{(1+I_S)}$$

Evidence

1. Uncovered interest rate parity is

$$\frac{(1+R_{us})}{(1+R_H)}=\frac{S_1}{S_o}$$

Consider the following regression

$$\frac{(1+R_{us})}{(1+R_H)}=\frac{S_1}{S_o}$$

We should find a = 0 b = 1

regressions find b ≤ 0 evidence against uncovered interest rate parety. One possible explanation is "peso problem"

2. Purchasing Power Parety

Very poorly supported especially in short run

TABLE 10.2 Size of Major Bond Markets at Year-End, 1988*

Bond Market	Total Publicly Issued	As percent of Public Issues in Major Markets
U.S. dollar	$4,517.0	46.3%
Japanese yen	2,161.0	
Deutsche mark	753.5	
Italian lira	534.3	
U.K. sterling	344.4	[illegible]
French franc	332.4	
Canadian dollar	245.3	
Belgian franc	187.8	
Danish krone	159.7	1.6
Swedish krona	157.0	1.6
Swiss franc	156.3	1.6
Dutch guilder	133.5	1.4
Australian dollar	81.6	.8
Total	$9,763.8	100.0%

*Data from Salomon Brothers.

*Nominal value outstanding, billions of U.S. dollars equivalent.

TABLE 10.4

	Canada	France	Germany	Japan	Netherlands	Switzerland	U.K.
Canada							
France	.447						
Germany	.469	.917					
Japan	.475	.704	.721				
Netherlands	.480	.920	.976	.730			
Switzerland	.479	.834	.917	.736	.925		
U.K.	.515	.572	.612	.575	.608	.585	
U.S.	.677	.386	.475	.434	.444	.491	.415

Correlations among Bond Indexes measured in U.S. dollars

TABLE 10.5

	Canada	France	Germany	Japan	Netherlands	Switzerland	U.K
Canada							
France	.321						
Germany	.311	.952					
Japan	.223	.662	.637				
Netherlands	.320	.955	.991	.643			
Switzerland	.321	.883	.929	.676	.933		
	.392	.626	633	.520	.666	.639	
	.164	-.254	-.220	-.164	-.228	-.180	-.19

Correlations for 3 month Bond Indexes measured in U.S. dollars

Table 10.6 (continued)

	Domestic Risk	Exchange Risk	Total Risk
Bonds			
Canada	7.28	4.71	9.51
France	5.17	12.37	14.19
Germany	6.95	12.76	16.43
Japan	8.91	13.02	17.16
Netherlands	4.91	12.51	14.58
Swiss	5.37	13.94	16.70
United Kingdom	8.51	12.18	16.39
U.S.	8.27	-----	8.27
Value weighted index (non US)			14.05
Equal weighted index (non US)	5.0	9.98	12.92
3 Month Securities			
Canada	1.96	4.71	4.75
France	2.31	12.37	12.39
Germany	4.06	12.76	12.72
Japan	4.68	13.02	12.96
Netherlands	1.90	12.51	12.59
Swiss	2.30	13.94	14.18
United Kingdom	3.54	12.18	12.27
US	1.04	-----	1.04
Value weighted index (non US)			9.82
Equal weighted index (non US)	1.52	9.98	10.10

Table 10.7

Risk from placing X percent in a world index

excluding U.S. securities and the rest in

U.S. index

<u>Value weighted index</u>

X Proportion in World Index (%)	Stocks	Long Term Bonds	T-Bills
0	17.30	8.27	1.04
10	16.52	8.23	1.20
	15.90	8.38	1.96
30	15.46	8.69	2.88
40	15.22	9.16	3.84
50	15.18	9.76	4.82
60	15.36	10.48	5.81
70	15.73	11.28	6.81
80	16.29	12.15	7.81
	17.03	13.07	8.81
100	17.91	14.05	9.82

Table 10.8 (Continued)

Bonds

	Own Country	Exchange Gain	To U.S. Investors
Canada	12.32	-1.14	11.18
France	12.69	-2.84	9.85
Germany	7.44	+3.47	10.91
Japan	9.56	9.55	19.11
Netherlands	10.20	1.69	11.89
Swiss	5.75	3.93	9.68
United Kingdom	14.13	-1.35	12.78
U. S.	12.05	----	12.05
Value weighted index (non US)			15.19
Equal weighted index (non US)	10.30	+1.90	12.20

3 mo Securities

	Own Country	Exchange Gain	To U.S. Investors
Canada	11.73	-1.23	10.50
France	13.69	-2.98	10.71
Germany	5.84	3.10	
Japan	7.04	9.21	16.25
Netherlands	7.75	1.54	9.29
Swiss	5.36	+3.67	
United Kingdom	12.26	-1.62	10.64
U. S.	10.93	----	10.93
Value weighted index (non US)			10.46
Equal weighted index (Non US)	9.10	[illegible]	[illegible]

Investment Strategies

1. **Betting on uncovered interest rate parity not holding**

   Buy high R_H

2. **Betting on uncovered interest rate parity not holding partial hedge**

Buy	**High**	R_H
Hedge	**Low**	R_H

3. Active bet on currency movement

<u>BELIEF</u> **SPREAD BETWEEN CANADIAN AND U.S. DOLLAR WILL WIDEN**

<u>DESIRE</u> **GAIN FROM WIDENING OF SPREAD WITHOUT TAKING RISK OF SHIFT IN YIELD CURVE**

DEFINE

1. W = **WEALTH IN DOLLARS**
2. Q_1 = **QUANTITY OF U.S. BONDS**
3. Q_2 = **QUANTITY OF CANADIAN BONDS**
4. Q_C = **QUANTITY OF CANADIAN DOLLARS**
5. P_1 = **PRICE OF 1 MILLION FACE VALUE U.S. BONDS**
6. P_2 = **PRICE OF 1 MILLION CANADIAN BOND**
7. P_C = **PRICE OF CANADIAN $ IN U.S.**

$$W = P_1Q_1 + P_C P_2 Q_2 + P_C Q_C$$

$$W = P_1'Q_1 + P_C' P_2' Q_2 + P_C' Q_C$$

DEFINE Δ AS CHANGE

$$\Delta W = \Delta P_1 Q_1 + \left(P'_C P'_2 - P_C P_2\right) Q_2 + \Delta P_C Q_C$$

$$\Delta P_C = P'_C - P_C$$

$$\textbf{x} \quad \Delta P_2 = P'_2 - P_2$$

$$P'_C P'_2 + P_C P_2 - P_C P'_2 - P'_C P_2 + P_C P_2 - P_C P_2$$

$$\Delta P_C \Delta P_2 = P'_C P'_2 - P_C \Delta P_2 - P_2 \Delta P_C - P_C P_2$$

$$\therefore P'_C P'_2 - P_C P_2 = P_C \Delta P_2 + P_2 \Delta P_C + \Delta P_C \Delta P_2$$

$$\Delta W = \Delta P_1 Q_1 + P_C \Delta P_2 Q_2 + \left(Q_C + Q_C \cdot P_2\right) \Delta P_C + Q_2 \Delta P_C \Delta P_2$$

Assume $Q_2 \Delta P_C \Delta P_2 \cong 0$

$$\Delta W = \Delta P_1 Q_1 + P_C \Delta P_2 Q_2 + \left(Q_C + Q_2 \cdot P_2\right) \Delta P_C$$

Desire

(1) Bet on spread change

(2) Neutral

a. parallel shifts

b. currency changes

$$\frac{\Delta P}{P} = -D\frac{\Delta r}{1+r}$$

$$\Delta P = -\frac{D \cdot P}{(1+r)}\Delta r = v\Delta r$$

$$\Delta W = -Q_1 V_1 \Delta r_1 - Q_2 V_2 \Delta r_2 P_C + (Q_C + Q_2 P_2)\Delta P_C$$

(1) $Q_1 V_1 + Q_2 V_2 P_C = 0$

(2) $Q_C + Q_2 P_2 = 0$

Assume Canadian interest rate will fall (relatively)

(1) Long Canadian

(2) Short U.S.

(3) Short Currency

4. Term Structure Differences