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Chapter 10 - Measuring Exposure to FX Changes

Last Lecture

Three areas of exposure:
- TE: associated with specific transactions (imports, exports).
- EE: associated with futures cash flows –this is the measure stakeholders care about.
- Translation exposure: associated with a firm's consolidated statements.

• Review from Chapter 10 – Parts 1 & 2:
- TE is easy to calculate: Value in USD of specific transaction or portfolio of transactions.
  - ◊ Correlations are very important.

- EE more difficult to measure. More subjective.
  - ◊ Accounting-based measures need to simulate EAT under different S_t.
  - ◊ Finance-based measures need ΔCF_t & $e_{f,t}$. Use returns, not ΔCF_t. Run a regression.

- Testing for EE: Use a linear regression model.
  - ◊ Stock Returns$_t$ = $\alpha + \beta\, e_{f,t} + \xi_t$

    H_0 (No EE): $\beta = 0$

    H_1 (EE): $\beta \neq 0$.

Evidence: For large companies (MNCs, Fortune 500), on average, β is small and not significantly different than zero. We cannot reject H_o: No EE.

This Lecture

In this class, we will cover the last FX exposure: Translation exposure.

3. Translation exposure

Translation exposure: Risk from consolidating assets and liabilities measured in foreign currencies with those in the reporting currency.

Assets and liabilities in a FC must be restated in terms of a DC. This translation follows rules set up by a parent firm's government or an accounting association –in the U.S., FASB.

Problem: The translation involves complex rules that sometimes reflect a compromise between historical and current exchange rates.

- Historical rates may be used for some equity accounts, fixed assets, inventories.
- Current exchange rates are used for current assets, liabilities, expenses and income.

Every item translated at historical rates is not exposed to changes in S_t.
Note: Different exchange rates are used, imbalances will occur.

Key issue: what to do with the resulting imbalance? It is taken to either current income or equity reserves.

Measuring Translation Exposure

There are several methods to translate foreign currency accounts into the reporting currency. Two methods that predominate:

- ◊ Temporal method (monetary/nonmonetary method)
- ◊ Current rate method

Terminology:
Monetary: there is a date attached to the asset or liability.
Three exchange rates can be used:

S_0: Historical exchange rate.
S_t: Current exchange rate at the date of balance.
$S_{AVERAGE}$: Average exchange rate for the period.

FASB #8 - *Temporal Method* (1976-1982)
- Translate nonmonetary assets at S_0, assets and liabilities use S_t
- Translate most income statements items at the $S_{AVERAGE}$
- Translate shareholder equity at S_0
- Bookkeeping exchange gains or losses are passed to the Income statement

FASB #52 - *Current Rate Method* (since 12/15/1982)
- Translate most amounts at S_t
- Income statement items are translated at S_0 or $S_{AVERAGE}$
- Translate shareholder equity at S_0
- Exchange gains or losses are not reflected in income statement rather accumulate in an adjustment account in stockholders' equity: C*umulative translation adjustment* (CTA).
- Distinguished between functional currency (usually local currency) and reporting currency (currency the parent firm uses to prepare own financial statements)

- Exceptions to FASB #52
1. Subsidiaries who mostly deal with parent, functional currency: USD => translate using temporal method.
2. Subsidiaries in hyperinflationary countries (100%+ over 3 years), functional currency: USD => translate using temporal method.

Example: IBM Hong Kong has the following balance sheet.

IBM Hong Kong Balance Sheet in millions of HKD

	Balance accounts	CR exposure	Temporal exposure
Assets			
Cash	300	300	300
Accounts receivable	850	850	850
Inventory	400	400	N.ex.
Net fixed plant and equip.	1,000	1,000	N.ex.
Total assets	2,550		
Total exposed assets		2,550	1,150
Liabilities and Capital			
Accounts payable	200	200	200
Notes payable	300	300	300
Long-term debt	900	900	900
Shareholder's equity	1,150	N.ex.	N.ex.
Total liabilities and capital	2,550		
Total exposed liabilities		1,400	1,400
Net exposed assets		1,150	-250

At S_t = .128 USD/HKD, IBM's exposure (in USD):
Current rate method: HKD 1,150,000,000 x .128 USD/HKD = USD 147,200,000
Temporal method: HKD -250,000,000 x .128 USD/HKD = USD -32,000,000 ¶

Real World Example: Translation Exposure - The Case of Ericsson
Ericsson has many subsidiaries outside Sweden.

For most of the subsidiaries, the local currency is the currency in which the companies operate
Financial statements are translated to SEK using the current rate method.
For some subsidiaries ("integrated companies"), having very close relations with the Swedish operations
=> SEK is the functional currency
Financial statements are translated using the temporal method.

Translation exposure in foreign subsidiaries is hedged:
- Monetary net in companies translated using the temporal method (translation effects in investment affecting the income statement) is hedged to 100%.
- Equity in companies translated using the current rate method (translation effects reported directly in stockholders' equity in the balance sheet) is hedged selectively up to 20% of the total equity.

The translation differences reported in equity, during the year 2000, were SEK 2.0 billion, mainly due to a weaker SEK. **Source**: Ericsson Annual Report 2000.

Chapter 11 - Managing TE

We have two ways to manage TE (to hedge FX exposure):

- Using Internal Methods (special contracts/organization/restructure)
- Using External Methods (market tools)
  - ◊ Forwards/Futures
  - ◊ Options
  - ◊ Money Market (same as IRP)

1. Internal Methods

◊ Risk Shifting: Pricing in DC (no FX risk, but no flexibility to accommodate clients).

Example: Boeing exports planes to TAM Airlines, a Brazilian company. The transaction is priced (& settled) in USD. Boeing faces no FX risk from this transaction; TAM takes all the FX risk. ¶

◊ Risk Sharing: Two parties can agree -using a customized hedge contract- to share the FX risk involved in the transaction.

Example: Levi's buys cotton for USD 1 million from Nakatami Cotton (NC). Payment in JPY.
Risk sharing agreement:
• If $S_t \in$ [98 JPY/USD, 140 JPY/USD] $\Rightarrow$ transaction unchanged. (Levi's pays USD 1M to NC)
The range where the transaction is unchanged is called *neutral zone*.
• If $S_t < 98$ JPY/USD or $S_t > 140$ JPY/USD $\Rightarrow$ both companies share the risk equally, by setting a different exchange rate to settle the transaction.

Suppose that when Levi's has to pay NC, $S_t = 180$ JPY/USD.
The S_t used in settling the transaction is 160 JPY/USD (=180 - 40/2).
$\Rightarrow$ Levi's's final cost = JPY 160 million = **USD 888,889** < **USD 1M**. ¶

◊ Leading and Lagging (L&L): Accelerating or decelerating the timing of FC payments:
$\Rightarrow$ *leading* or *lagging* the movement of funds.

L&L is done between the parent company and its subsidiaries or between two subsidiaries.

Example: Managing TE with L&L.
Parent company: IBM (US company).
Subsidiaries: Mexico, Brazil, and Hong Kong. (IBM Mexico and IBM owe payables to IBM HK.)
Situation: IBM Hong Kong's exposure, due to payables in FC, is too large.

IBM orders IBM Mexico and IBM Brazil to accelerate (lead) its payments to IBM HK. ¶

◊ Natural hedging: Natural hedges are created by payment obligations and/or receivables that have, at least, partially offsetting foreign currency risk.

Example: A U.S. company imports machine parts from Germany priced in euros. This transaction exposure is partially offset by sales of machines to Spain, also priced in euros. ¶

In situations where natural hedges exist, companies should only consider hedging the net transaction exposure, not the individual transaction.

2. External Methods

Use market instruments to hedge TE exposure:

- ◊ Forwards/Futures
- ◊ Options
- ◊ Money Market (same as IRP, without covering step)

We will go over two cases: (1) Receivables in FC
(2) Payables in FC

Example: Receivables in FC
MSFT exports Windows to Switzerland for CHF 3M Payment due in 90 days.
S_t = 0.60 USD/CHF
TE(in USD) = CHF 3M * 0.60 USD/CHF = USD 1.8M

Hedging Tools- Futures/Forwards/Options/Money Market Hedge/Nothing

Interest USD = 4.25%-5%
Interest CHF = 4%-4.25%
$F_{t,90\text{-day}}$ = .65 USD/CHF
Put(X=0.64 USD/CHF; P = USD .06)
Call(X=0.63 USD/CHF; P = USD .02)
T = 90 days

1. Forward Hedge – Sell Forward CHF
   Sell CHF forward at $F_{t,90\text{-day}}$= 0.65 USD/CHF
   Amount to be received in 90 days = CHF 3M * 0.65 USD/CHF = USD 1.95M

Note: No uncertainty related to CHF CF

2. MMH (Replication of IRP) – borrow FC, convert to DC, deposit in domestic bank
   Borrow CHF at 4.25
   Convert to USD at 0.60
   Deposit in US Bank at 5%

In 90 days, MSFT will receive the deposit from the US bank. MSFT will use the CHF receivable to repay the CHF loan. That is, by using the MMH, MSFT faces no uncertainty related to the USD value of CHF CF. ¶

CHAPTER 10 – BRIEF ASSESMENT

1. It is March 3, 2017. Malone, a U.S. company, exports mining equipment to South Africa. Malone expects to receive a payment of ZAR 500 million in August 3, 2017 (ZAR=South African Rand).

(A) Calculate TE
(B) Use the information given in the attached Excel output (based on 15 years of 5-mo changes) to calculate:
i) The VaR associated with Malone's open position (use a 97.5% C.I.).
ii) The VaR-mean (97.5%). Interpret this number.
iii) The worst case scenario for Malone.

The information below is based on monthly percentage changes from 2001:9 to 2016:12.

5-mo % change ZAR/USD	
Mean	3.117%
Standard Error	0.854%
Median	1.803%
Mode	#N/A
Standard Deviation	9.355%
Sample Variance	0.875
Kurtosis	143.329
Skewness	48.399
Range	61.127%
Minimum	-22.970%
Maximum	38.157%
Sum	374.077
Count	183

2. You work for Vandelay Industries, U.S. MNC. Vandelay gives you the following projections for next year:

Currency	Total inflows	Total outflows	Current Exchange rate
GBP	GBP 25,000	GBP 40,000	1.40 USD/GBP
KUD	KUD 600,000	KUD 400,000	0.40 USD/KUD (KUD=Kuwaiti Dinar)

(A) What is Vandelay's net transaction exposure (NTE)?
(B) Suppose the GBP and the KUD are perfectly and positively correlated ($\rho=1$). The USD/GBP exchange rate increases to 1.68 USD/GBP. What is the **change** in net transaction exposure for Vandelay?
(C) Suppose the GBP and the KUD have zero correlation ($\rho=0$). The USD/GBP exchange rate increases to 1.68 USD/GBP. What is the **change** in (expected) net transaction exposure for Vandelay?

3. HM Sweden provides the following info:
Sales and cost of goods are dependent on S_t (SEK/USD, SEK=Swedish Kroner). All numbers are in millon kroners.

	S_t = 7 SEK/USD	S_t = 6.3 SEK/USD
Sales (in SEK)	400	550
Cost of goods (in SEK)	150	200
Gross profits (in SEK)	250	350
Depreciation (in SEK)	50	50
Interest expense (in SEK)	20	20
Taxes (in SEK)	70	110

A. Calculate the elasticity of free CF (measured as EAT+Depreciation) to changes in S_t.
B. Interpret the elasticity.

4. You want to test if MSFT faces EE. You collect data from January, 1990 to April 2017, for a total of 328 observations. You run two regressions, using monthly data:

$$returns_t = \alpha + ß\, e_{f,t} + \xi_t,$$

and

$$returns_t = \alpha + ß\, e_{f,t} + \delta_1 (R_{market,t}-R_f) + \delta_2 HML_t + \delta_3 SMB_t + \varepsilon_t.$$

Using the excel output (shown below) test if MSFT has faced EE during your sample.

R Square 0.011907

	Coefficients	*SE*	*t Stat*
Intercept	0.018569	0.005069	3.662978
$e_{f,t}$	0.499677	0.2521	1.982063

R Square 0.327083

	Coefficients	*SE*	*t Stat*
Intercept	0.011673	0.004262	2.739086
$R_{market,t}-R_f$	1.250846	0.105388	11.86891
HML	-0.16682	0.134013	-1.24478
SMB	-1.53667	0.593604	-2.58871
$e_{f,t}$	-0.28523	0.2186	-1.30478