FX Exposure

2. Measuring Exposure

Economic Exposure

Economic exposure (EE): EE measures how an *unexpected* change in S_t affect the future cash flows of the firm.

• Economic exposure is: Subjective.
Difficult to measure.

• Measuring CFs.

We can use accounting data (changes in EAT) or financial/economic data (stock returns) to measure EE. Economists tend to like more non-accounting data measures.

Note: Since S_t is very difficult to forecast, the actual change in S_t ($e_{f,t}$) can be considered "*unexpected*."

Measuring Economic Exposure

A Measure Based on Accounting Data

It requires to estimate the net cash flows of the firm (EAT or EBT) under several FX scenarios. (Easy with an excel spreadsheet.)

Example: IBM HK provides the following info:

Sales and cost of goods are dependent on S_t

	S_t = 7 HKD/USD	**S_t = 7.70 HKD/USD**
Sales (in HKD)	300M	400M
Cost of goods (in HKD)	150M	200M
Gross profits (in HKD)	150M	200M
Interest expense (in HKD)	20M	20M
EBT (in HKD)	**130M**	**180M**

Example (continuation):

A 10% depreciation of the HKD, increases the HKD cash flows from HKD 130M to HKD 180M, and the USD cash flows from USD 18.57M to USD 23.38.

Q: Is EE significant?

A: We can calculate the elasticity of CF to changes in S_t:

CF elasticity = % change in earnings / % change in S_t = .259/.10 = 2.59

Interpretation: We say, a 1% depreciation of the HKD produces a change of 2.59% in EBT. Quite significant. But you should note that the change in exposure is USD 4.81M. This amount might not be significant for IBM! (Judgment call needed.) ¶

Note: Obviously, firms will simulate many scenarios to gauge the sensitivity of EBT to changes in exchange rates.

A Regression based Measure and a Test

The CF elasticity gives us a measure, but it is not a test of EE. We still need a judgement call.

We know it is easy to test regression coefficients (t-tests or F-tests). We use a use a regression to test for EE.

• Simple steps:

(1) Collect data on CF and S_t (available from the firm's past)

(2) Estimate the regression: $\Delta CF_t = \alpha + ß\ \Delta S_t + \xi_t$,

$\Rightarrow$ ß measures the sensitivity of ΔCF to changes in ΔS_t.

$\Rightarrow$ the higher ß, the greater the impact of ΔS_t on CF.

(3) Test for EE $\Rightarrow$ H_0 (no EE): $\beta = 0$

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

(4) Evaluation of this regression: t-statistic of ß and R^2.

Rule: $|t_\beta = ß/SE(ß)| > 1.96$ $\Rightarrow$ ß is significant at the 5% level.

• We know that other variables also affect stock returns, for example, the market portfolio, or the Fama-French factors.

One way to "control" for the changes in other variables that affect cash flows is to use a multivariate regression:

$$\Delta CF_t = \alpha + ß\ \Delta S_t + \delta_1 X_{1,t} + \delta_2 X_{2,t} + \ldots + \delta_k X_{k,t} + \varepsilon_t,$$

where $X_{i,t}$ represent one of the k*th* variable that affects CFs.

Note: Sometimes the impact of ΔS_t is not felt immediately by a firm.

$\Rightarrow$ contracts and short-run costs (short-term adjustment difficult).

Example: For an exporting U.S. company a sudden appreciation of the USD increases CF in the short term. Solution: use a modified regression:

$$\Delta CF_t = \alpha + ß_0\ \Delta S_t + ß_1\ \Delta S_{t-1} + ß_2\ \Delta S_{t-2} + ß_3\ \Delta S_{t-3} + \delta_1 X_{1,t} + \ldots + \xi_t.$$

The sum of the ßs measures the sensitivity of CF to ΔS_t.

An Easy Measure of EE Based on Financial Data

Accounting data can be manipulated. Moreover, international comparisons may be difficult. We can use financial data –stock prices!

We can easily measure how returns and ΔS_t move together: correlation.

Example: Kellogg's and Walt Disney's EE.

Using monthly stock returns for Kellogg's ($Kret_t$) and monthly changes in S_t (USD/EUR) from 1/1990-7/2018, we estimate $\rho_{K,e}$ (correlation between $Kret_t$ and $e_{f,t}$) = 0.223.

It looks small, but away from zero. We do the same exercise for Walt Disney, obtaining $\rho_{DIS,e}$= 0.076, small and close to zero. ¶

• Better measure: 1) Run a regression on ΔCF against (unexpected) ΔS_t.
2) Check statistical significance of regression coeff's.

Example: IBM's EE.

Now, using the IBM data, we run the regression:

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

R^2 = 0.003102

Standard Error = 0.09462

Observations = 169

	Coefficients	*Standard Error*	*t-Stat*	*P-value*
Intercept (α)	0.016283	0.007297	2.231439	0.026983
Changes in S_t (β)	-0.20322	0.2819	**-0.72089**	0.471986

Analysis:

We cannot reject H_0, since $|t_\beta$ = **-0.72**| < 1.96 (not significantly different than zero).

Again, the R^2 is very low. (The variability of s_t explains less than 0.3% of the variability of IBM's returns.) ¶

Example: Kellogg's EE.

Now, using the data from the previous example, we run the regression:

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

$R^2 = 0.0275$

Standard Error = 0.05645

Observations = 343

	Coefficients	*Standard Error*	*t-Stat*	*P-value*
Intercept (α)	0.005684	0.003051	1.863278	0.063283
$e_{f,t}$ (β)	0.474442	0.152735	**3.106302**	0.002053

Analysis:

We reject H_0, since $|t_\beta = 3.10| > 1.96$ (significantly different than zero).

Note, however, that the R^2 is very low! (The variability of s_t explains less than 2.4% of the variability of Kellogg's returns.) ¶

• Returns are not only influenced $e_{f,t}$. We run a multivariate regression to test for EE; including not only $e_{USD/TWC,t}$, but, say, also the FF factors: excess market returns over T-bill rates, $(R_m\text{-}R_f)_t$, Size (SMB) and Book-to-Market (HML):

Example (continuation): Kellogg's EE.

$R^2 = 0.0761$

Standard Error = 0.05539

Observations = 342

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.003628	0.003047	1.190654	0.234627
Market (R_m-R_f)	0.320746	0.076858	**4.173255**	3.83E-05
Size (SMB)	-0.1135	0.098942	-1.14718	0.252121
B-M (HML)	0.086802	0.105397	0.823569	0.410767
$e_{f,t}$ (β)	**0.285396**	0.156486	**1.823781**	0.069071

$R^2 = .0903$ (a higher value driven mainly by the market factor). But, looking at EE, the t-stat is now **1.82**, (not significant at 5% level). Cannot eject the H_0: No EE economic exposure. ¶

• Using this multivariate regression we cannot eject the H_0: No EE economic exposure. ¶

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

EE: Evidence

The above regression (done for Kellogg) has been done repeatedly for firms around the world.

Recent paper by Ivanova (2014):

- Mean β equal to 0.57 (a 1% USD depreciation increases returns by 0.57%).
- But, only 40% of the EE are statistically significant at the 5% level.
- For large firms (MNCs), EE is small –an average β=0.063– and not significant at the 5% level.
- 52% of the EEs come from U.S. firms that have no international transactions (a higher S_t "protects" these domestic firms).

Summary: On average, large companies (MNCs, Fortune 500) are not EE. EE is a problem of small and medium, undiversified firms.