Chapter 12
Managing & Measuring Economic Exposure

- **Last Class**
- **Three types of FX Exposure**
  (1) *Transaction exposure* (TE): Short-term

  (2) *Economic exposure* (EE): Long-term

  (3) *Translation exposure*: Book values vs Market values. (Not covered)

- **Managing TE - Tools:**
  - Forwards/Futures
  - MMH
  - Option Hedge

Q: Best Tool? Need to consider S_{t+T} distribution (scenarios).

- **Economic exposure (EE)**

Risk associated with a change in the NPV of a firm's expected cash flows, due to (*unexpected*) changes in S_t ($e_{f,t}$).

- **This Class**
- **Measuring EE:**
  - Accounting data (EAT, EBT, Operating Income, EPS changes)
    - CF elasticity = $\frac{\text{\% change in EBT}}{e_{f,t}}$
    - Financial/economic data (returns)
    - Regression
- **Managing EE**
  - Main Tool: Operational Hedging (Matching Inflows and Outflows)
- **Review Project**

Economic Exposure

Economic exposure (**EE**): Risk associated with a change in the NPV of a firm's expected cash flows, due to an *unexpected* change in S_t.

Note: S_t is very difficult to forecast. Actual change in S_t can be considered "unexpected."

• General definition. It can be applied to any firm (domestic, MNC, exporting, importing, purely domestic, etc.).

• The degree of EE **depends on**:
- Type & structure of the firm: Importing, exporting, or purely domestic.
- Industry structure in which the firm operates: Monopolistic, oligopolistic, competitive.

• In general:

- **Importing** & **exporting** firms face higher EE than purely domestic firms
- **Monopolistic** firms face lower EE than firms that operate in competitive markets.

Example: A U.S. firm face almost no competition in domestic market. Then, it can transfer to prices almost any increase of its costs due to changes in S_t. Thus, this firm faces no/low EE. ¶

• The degree of EE for a firm is an empirical question.

• Economic exposure is difficult to measure.

• We can use *accounting data* (EAT changes) or *financial/economic data* (returns) to measure EE. Economists like economic-based measures.

Measuring Economic Exposure

A Measure Based on Accounting Data

We use cash flows to estimate FX exposure. For example, we simulate a firm's **CFs** (EBT, Operating Income, etc.) **under several FX scenarios**.

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** HKD CFs from **HKD 130M** (=**USD 18.57M**) to **HKD 180M** (=**USD 23.38M**): A **25.92%** change in CFs measured in USD.

Q: Is EE **significant**?

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

$$\textbf{CF elasticity} = \frac{\text{\% change in EBT}}{e_{f,t}} = \frac{.2592}{.10} = \mathbf{2.59}$$

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

IBM HK behaves like a net exporter: Weaker DC, Higher CFs. ¶

Note: Firms will simulate many scenarios & produce an expected value.

We can use historical accounting CFs to calculate economic exposure.

Example: Kellogg's cash flow elasticity in **2020-2019**.

From 2019 to 2020 (end-of-year to end-of-year), K's operating income ("*adjusted operating profit*") increased **2.6%**. The USD depreciated against basket of major currencies (Nominal Broad USD Index) by **2.98%**. Then,

$$\textbf{CF elasticity} = \frac{\text{\% change in OI}}{e_{f,t}} = \frac{.026}{.0298} = \mathbf{0.8724}$$

Interpretation: We say, a 1% depreciation of the USD produces a positive change of **0.87%** in operating income. K's behaves like a **net exporter**.

Update: **2022-2021**.

From 2022 to 2021, K's operating profit increased **3.9%**. The USD appreciated against basket of major currencies by **5.30%**. Then,

$$\textbf{CF elasticity} = \frac{.039}{-.0530} = \mathbf{-0.7358}.$$

(Results reversed!) ¶

A Regression based Measure and a Test

CF elasticity gives us a measure, but it is not a test of EE. A judgment call is needed.

It is easy to **test** regression coefficients (t-tests or F-tests).

• Simple steps:

(1) Get data: CF_t & S_t (available from the firm's past)

(2) Estimate regression:

$$\Delta CF_t = \alpha + \beta \, \Delta S_t + \varepsilon_t,$$

⇒ β: Sensitivity of ΔCF_t to ΔS_t.

⇒ The higher β, the greater the impact of ΔS_t on CF_t.

(3) Test for EE ⇒ 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: $|t_\beta = \beta/SE(\beta)| > \mathbf{1.96}$ ⇒ β is significant at the 5% level.

A Regression based Measure and a Test

In general, regressions are done in terms of % changes:

$$cf_t = \alpha + \beta \, \boldsymbol{e_{f,t}} + \xi_t,$$

cf_t: % change in CF from t-1 to t.

Interpretation of β: A 1% change in S_t changes the CF_t by β%.

• Expected Signs

We estimate the regression from a Domestic (say, U.S.) firm's point of view: CF measured in DC (say, USD & S_t is USD/FC). Then, from the regression, we can derive the Expected sign (β):

Type of company	**Expected sign for β**
U.S. Importer	Negative
U.S. Exporter	Positive
Purely Domestic	Depends on industry

• Other variables also affect CFs: Investments, acquisitions, growth of the economy, etc.

We "*control*" for the other variables that affect CFs with a multivariate regression, say with k other variables:

$$cf_t = \alpha + \beta\, e_{f,t} + \delta_1 X_{1,t} + \delta_2 X_{2,t} + \ldots + \delta_k X_{k,t} + \varepsilon_t,$$

where $X_{k,t}$ represent one of the k^{th} other variables that affects CFs.

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

$\Rightarrow$ contracts and short-run costs matter.

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

$$cf_t = \alpha + \beta_0\, e_{f,t} + \beta_1 e_{f,t-1} + \beta_2 e_{f,t-2} + \ldots + \beta_q e_{f,t-q} + \delta_1 X_{1,t} + \ldots + \varepsilon_t.$$

Sum of ß's: Total sensitivity of cf_t to $e_{f,t}$ ($= \beta_0 + \beta_1 + \beta_2 + \beta_3 + \ldots$)

A Measure Based on Financial Data

Accounting data can be manipulated. Moreover, international comparisons are difficult. Instead, use financial data: Stock prices!

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

Example: Kellogg's and IBM's EE.

Using monthly stock returns for Kellogg's ($r_{K,t}$) and monthly changes in S_t (USD/EUR) from **33 years** (**1988:Jan** – **2022:Jan**), we estimate $\boldsymbol{\rho}_{\mathbf{K,s}}$ (correlation between $r_{K,t}$ & $e_{f,t}$) = **0.150**. It looks small.

We do the same exercise for IBM, measuring the correlation between $r_{IBM,t}$ & $e_{f,t}$, obtaining $\boldsymbol{\rho}_{\mathbf{IBM,s}}$ = **0.089**, small and, likely, close to zero.

But, if we use USD/TWC, based on the major currencies, things change a bit: $\boldsymbol{\rho}_{\mathbf{K,s}}$ = **0.1263** (similar to USD/EUR) & $\boldsymbol{\rho}_{\mathbf{IBM,s}}$ = **0.1795** (different). ¶

An Easy Measure of EE Based on Financial Data

• Better measure: A regression-based measure that can be used as a test.

Steps:

1) Regress, r_t, returns against (unexpected) ΔS_t.

$$r_t = \alpha + \beta\, e_{f,t} + \varepsilon_t$$

2) Check statistical significance of regression coefficient for s_t:

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

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

$\Rightarrow$ A simple t-test can be used to test H_0.

(Rule: $|t_\beta| > \mathbf{1.96} \Rightarrow$ Reject H_0 at 5% level –i.e., β significantly $\neq 0$!)

Interpretation: A 1% change in S_t changes the Value of the firm by β%.

Example: Kellogg's EE.

Using **1988-2022** data (see previous example), we run the regression:

$$r_{K,t} = \alpha + \beta\, e_{f,t}(\text{USD/TWC}) + \varepsilon_t$$

$R^2 = 0.01596$

Standard Error = 5.56447

Observations = 409

	Coefficients	*Standard Error*	*t-stat*	*P-value*
Intercept (α)	0.38592	0.27515	1.4026	0.1615
$e_{f,t}$ (β)	**0.43775**	**0.17041**	**2.5688**	0.0106

Analysis: Reject H_0, $|t_\beta = \mathbf{2.57}| > \mathbf{1.96}$ (significantly $\neq 0$) $\Rightarrow$ EE!

β > 0, K behaves likes an exporter.

Interpretation of **β**: A 1% increase in exchange rates, increases K's returns by **0.44%**.

Note: R^2 is very low! ¶

Example: IBM's EE.

Now, using the IBM data (**1988-2022**), we run the regression:

$$r_{IBM,t} = \alpha + \beta\, e_{f,t}(\text{USD/TWC}) + \varepsilon_t$$

$R^2 = 0.03221$

Standard Error = 7.4465

Observations = 409

	Coefficients	*Standard Error*	*t-stat*	*P-value*
Intercept (α)	0.38896	0.36821	1.0563	0.2914
$e_{f,t}$ (β)	**0.83941**	0.22805	**3.6809**	0.0003

Analysis: Reject H_0, $|t_\beta = \mathbf{3.68}| > \mathbf{1.96}$ (β significantly $\neq 0$) $\Rightarrow$ EE!

$\beta > 0$, IBM behaves likes an exporter.

Interpretation of β: A 1% increase in exchange rates, increases IBM's returns by **0.84%**.

Again, the R^2 is low! ¶

• Returns are not only influenced $e_{f,t}$. In investments, it is common to use the 3 factors from the **Fama-French model**:

- **Market** $(r_M - r_f)$
- **SMB** (size)
- **HML** (value).

In Kellogg's case:

$$r_{K,t} = \alpha + \gamma_1 (r_M - r_f)_t + \gamma_2\, SMB_t + \gamma_3\, HML_t + \varepsilon_t$$

A momentum can be added to accommodate Carhart's (1997) model.

Note: In general, we find γ_1 & γ_3 significant. R^2 is not very high.

• Now, we test if Kellogg's faces EE, *conditioning* on the other drivers of K's returns. That is, we do a t-test on β on the following regression:

$$r_{K,t} = \alpha + \gamma_1 (r_M - r_f)_t + \gamma_2\, SMB_t + \gamma_3\, HML_t + \beta\, e_{f,t} + \varepsilon_t$$

Example (continuation): Kellogg's EE (with 3 FF factors):

	Coefficients	Std Error	t-stat
Intercept	0.0798	0.2691	0.2967
Market $(r_M - r_f)_t$	0.3893	0.0647	6.0204
Size (SMB)	-0.1144	0.0898	-1.2738
B-M (HML)	0.1546	0.0851	1.8157
$e_{f,t}$ **(β)**	**0.2601**	0.1664	**1.5633**

R^2 = 0.0995 (a higher value driven mainly by the market factor).

Now, t-stat = **1.56** (*p-value* = .119). We say:

"After controlling for other factors that affect Kellogg's excess returns, we do not find evidence of EE at the 5% significance level."

⇒ Usual interpretation: No EE for K.

We also see a lower sensitivity, β: **0.2601**. ¶

Example (continuation): IBM's EE (with 3 FF factors):

	Coefficients	Std Error	t-stat
Intercept	-0.2894	0.3180	-0.9102
$e_{f,t}$ **(β)**	**0.3963**	0.1966	**2.0157**
Market $(r_M - r_f)_t$	0.9506	0.0764	**12.4363**
Size (SMB)	-0.2557	0.1062	**-2.4085**
B-M (HML)	-0.1154	0.1006	-1.1471

R^2 = 0.3092.

The t-stat = **2.01** (*p-value* = .045).

⇒ Usual interpretation: IBM faces EE.

Again, we see a big reduction in lower sensitivity, β: **0.3963**. ¶

EE: Evidence

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

Results from work by Ivanova (2014):

- Mean β = **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 –average β = **0.063**– & **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) face no EE.
- EE is a problem of small and medium, undiversified firms.

EE: Evidence

• Check Ivanova's results for big firms, using the **S&P 100**.

We regress SP100 returns from past **38 years** (**1984:Apr** – **2022:Jan**) against $e_{f,t}$ (USD/TWC) & the 3 FF factors:

R^2 = 0.9664

Standard Error = 0.8136

Observations = 454

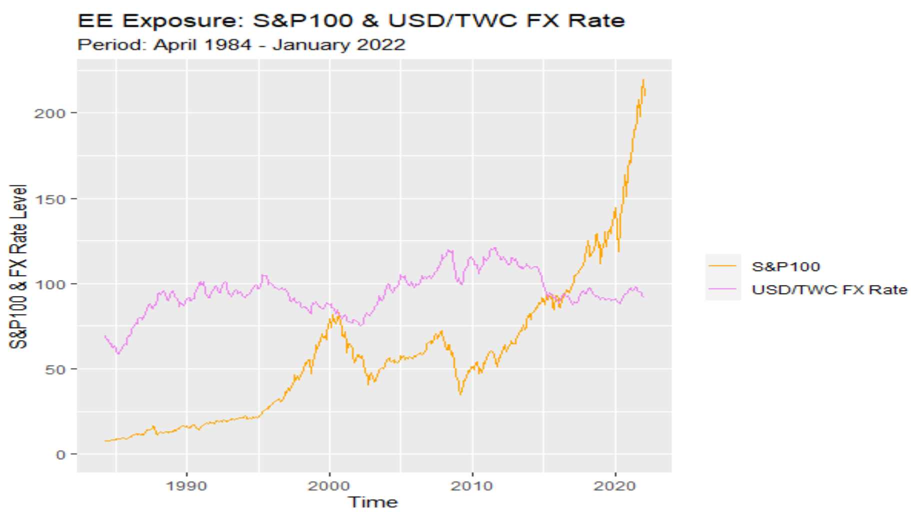
	Coefficients	Std Error	t-stat	P-value
Intercept	-0.0247	0.0389	-0.6357	0.5253
$e_{f,t}$	**-0.0225**	0.0231	**-0.9756**	0.3298
Market $(r_M - r_f)_t$	0.9988	0.0090	110.5233	>.00001
SMB	-0.2459	0.0133	-18.4659	>.00001
HML	0.0068	0.0126	0.5381	0.5907

Since $|t_\beta = -0.98| < 1.96$ ⇒ No evidence of EE for big U.S. firms.

EE: Evidence

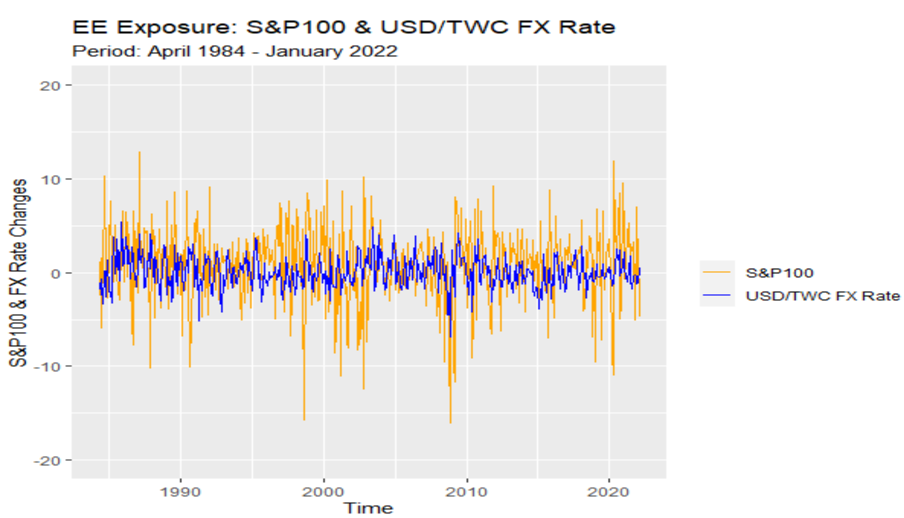
Data mining may find periods of a positive and negative relation between both **S&P100** & USD/TWC FX Rate series. Overall, not clear.

Note: S&P100 is adjusted (divided by 10).



EE: Evidence

Difficult to see a well-defined relation between **S&P 100 returns** and changes in FX rates.



Managing Economic Exposure

Definition: EE measures how changes in FX rates affect CFs.

Understanding EE: Cash flows from subsidiary (a price taker)

Revenue: **Price in FC** * Quantity * S_t = PQ

Cost: Variable (α PQ) + Fixed Cost (0<α< 1, with $\alpha=\alpha_{FC}+\alpha_{DC}$)

Gross profits: (1 – α) PQ – Fixed Cost

EBT = [(1 – α) PQ – Fixed Cost] – IE (IE: Interest Expense)

EAT = [(1 – α) PQ – Fixed Cost – IE] * (1 – t) (t: tax rate)

Costs & IE have two components: a FC & a DC.

- For example: Variable Cost (VC): α_{FC} & α_{DC}
  Interest Expense (IE): IE_{FC} & IE_{DC}.

• Q: How can a company reduce EE?

- A company can play with α_{FC}: The better the match, between Revenue and Costs in FC, the smaller the EE.
- A company can play with IE_{FC}.

• **Matching Inflows and Outflows**

To get a manageable EE, firms tend to play with α_{FC}.

When a firm restructures operations (say, by shifting expenses to FC, by increasing α_{FC}) to reduce EE, we say a firm is doing *operational hedging*.

General rules:

- If $S_t\uparrow$ (DC depreciates) & CF ↑ (typical, **net exporter**), operational hedges tend to shift expenses abroad (α_{FC} & $IE_{FC}\uparrow$) & revenues home.
- If $S_t\downarrow$ (DC appreciates) & CF ↑ (typical, **net importer**), operational hedges tend to shift expenses home (α_{FC} & $IE_{FC}\downarrow$) & revenues abroad.

Case Study: Laker Airways (Skytrain) (1977-1982)

After a long legal battle in the U.S. and the U.K, Sir Freddie Laker was able to fly his **low cost airline** from LON to NYC (1977). Big success.

Situation: Rapid expansion. Laker **buys planes** from MD financed in **USD.**

• **Cost**

(i) **fuel**, typically paid for **in USD**

(ii) **operating costs** incurred **in GBP**, but with a small USD cost component (advertising and booking in the U.S.)

(iii) **financing costs** from the purchase of aircraft, denominated **in USD**.

• **Revenue**

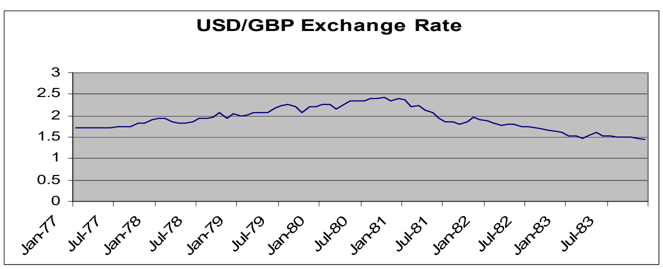
Sale of **airfares** (probably, **evenly divided** between **GBP** and **USD**), plus other GBP revenue.

Currency mismatch (***gap***):

Revenues	**Payables**
mainly GBP, USD	mainly USD, GBP

⇒ Laker behaves like a **net importer**.

• What happened to S_t?



1977-1981: Big USD **depreciation** (currency gap increases Laker's CFs).

1981-1982: Big USD **appreciation** (currency gap reduces Laker's CFs).

1982: Laker Airlines bankrupt.

Q: Can we solve Laker Airways problem (economic exposure)?

• Solutions to Laker Airways problem (EE):
- Increase sales in US
- Transfer cost out to GBP/Shift expenses to GBP (α_{DC}↑ /$\boldsymbol{\alpha_{FC}}$ ↓)
- Increase IE in GBP (IE_{DC}↑ /$\mathbf{IE_{FC}}$ ↓ –i.e., borrow more in the UK)
- Diversification

• Firms with a *currency gap:* Big swings in S_t can seriously affect CFs.

• Very simple approach to managing EE: Minimize currency gaps.
⇒ Match inflows in FC & outflows in FC, as much as possible.

• European & Japanese car makers have been matching inflows and outflows by moving production to the U.S.

But, not all companies can avoid currency gaps: Importing and Exporting companies will always be operationally exposed.

Q: Why Operational Hedging?

- Financial hedging –with FX derivative instruments– is **inexpensive**, but it is short-term, liquid only for **short-term maturities**.
- Operational hedging is more **expensive** (increasing α_{FC} by building a plant, expansion of offices, etc.), but a **long-term instrument**.

A different view: Financial hedging only covers FX risk (S_t through P), but not the risk associated with sales in the foreign country (**Q-risk**).

Example: The foreign country enters into a recession, Q goes down, but S_t remains stable. An operational hedge works better to cover Q-risk.

Thus, financial hedging **does not work** very well if the **correlation** between price in FC (**P**) & quantity sold (**Q**) is low.

But, if Corr(P,Q) is high, financial hedging will be OK.

Example: A U.S. firm exports to Europe. Two different FX scenarios:

(1) S_t = *1.00 USD/EUR*

Sales	in US	USD 10M
	in EU	EUR 15M
Cost of goods	in US	USD 5M
	in EU	EUR 8M

(2) S_t = *1.10 USD/EUR*

Sales	in US	USD 11M
	in EU	EUR 20M
Cost of goods	in US	USD 5.5M
	in EU	EUR 10M

Taxes:	US	30%
	EU	40%
Interest:	US	USD 4M
	EU	EUR 1M

Example (continuation):

CFs under the Different Scenarios (in USD)

	S_t = 1 USD/EUR	S_t = 1.1 USD/EUR (10% higher)
Sales	10M+15M = 25M	11M+22M = 33M
CGS	5M+8M = 13M	5.5M+11M = 16.5M
Gross profit	5M+7M = 12M	5.5M+11M = 16.5M
Interest	4M+1M = 5M	4M+1.1M = 5.1M
EBT	7M	11.4M
Tax	0.3M+2.4M = 2.7M	0.45M+3.96M = 4.41M
EAT	**4.3M**	**6.99M**

$$\text{CF Elasticity} = \frac{(6.99 - 4.3)/4.3}{.10} = 6.255 \qquad (\approx 6.3\%)$$

Interpretation: A **1%** depreciation of the USD, increases EAT by **6.3%** (probably, very significant EE!).

⇒ US firm benefits by S_t (USD/EUR) ↑ –like a **net exporter**! ¶

Example (continuation):

Q: How can the US exporting firm avoid economic exposure? (match!)
- Increase US sales
- Borrow more in Euros (increase outflows in EUR)
- Increase purchases of inputs from Europe (increase CGS in EUR)

(A) **US firm increases US sales by 25%** (unrealistic!)

EAT (S_t = **1 USD/EUR**) = USD 6.05M

EAT (S_t = **1.1 USD/EUR**) = USD 8.915M

⇒ a 10% depreciation of the USD, EAT increases by only 47%.

(B) **US firm borrows only in EUR: EUR 5M**

EAT (S_t = **1 USD/EUR**) = USD 4.7M

EAT (S_t = **1.1 USD/EUR**) = USD 7.15M

⇒ a 10% depreciation of the USD, EAT increases by 52%.

Example (continuation):

(C) **US firm increases EU purchases by 30%** (US purchases ↓ by 30%)

EAT (S_t = **1 USD/EUR**) = USD 3.91M

EAT (S_t = **1.1 USD/EUR**) = USD 6.165M

⇒ a 10% depreciation of the USD, EAT increases by 58%.

(D) **US firm does (A), (B) and (C) together**

EAT (S_t = **1 USD/EUR**) = USD 6.06M

EAT (S_t = **1.1 USD/EUR**) = USD 8.25M

⇒ a 10% depreciation of the USD, EAT increases by 36%. ¶

Note: For some firms, operational hedging is limited! For these companies, Financial hedging!

• International Diversification

Not all firms can do matching. They still have a very good FX risk management tool: *International diversification* (a portfolio approach.)

True international diversification:

- Location of production
- Sales
- Input sources
- Borrowing of funds, etc.

• In general, the variability of CF is reduced by diversification:

ΔS_t is likely to increase the firm's competitiveness in some markets while reducing it in others.

⇒ EE should be low.

• Not surprisingly, big MNCs do not have EE.

• Some Firms are Always Exposed

Not all firms can do matching and/or international diversification. Many domestic firms are exposed to FX risk.

Example: Small restaurants ("*sodas*") in Arenal, Costa Rica.

If the USD appreciates against the CRC (=CR colón), Arenal's sodas see revenues increase, due to higher U.S. tourism.

But, the costs (labor, local food, utilities, etc.) are all in CRC, not much affected by the USD.

⇒ An implicit currency gap!

These sodas, which are completely domestic firms, have significant exposure to FX risk. They behave like **net exporters**. ¶

In many of these cases, very difficult to minimize FX exposure.

- **Case Study: Walt Disney Co.**

We want to know if Disney faces EE.

Four divisions (in **2006**): Media Networks Entertainment; Theme Parks and Resorts; Studios; & Consumer Products.

Total Inflows (2006). Revenue USD 34.3B, Operating income: **USD 6.49B**, EPS: USD 2.06:

Media (ABC, ESPN, Lifetime, A&E, etc. *Low*). Rev: 14.75B, OI: 3.61B

Amusement Parks (Cruise Line & 10 parks: Euro Disney, Tokyo Disney + HK park, etc. *Medium*). Rev: 9.95B, OI: 1.53B

Studios (Disney, Pixar, Touchstone, etc. *High*). Rev: 7.2B, OI: 0.73B

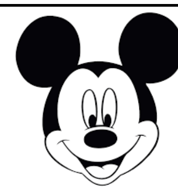
Consumer products (Licensing, Publishing, Disney store (Europe). *Medium*) Rev: USD 2.4B, OI: 0.62B

Outflows (2006) – around 80% in USD

$S_{Sep\ 06}$ = 81.9778 TWC/USD (TWC = Trade-weighted currency index)

$\text{Price}_{Sep\ 06}$ = USD 30.50

- **Case Study: Walt Disney Co.**



Compute **CF-elasticity** (**2006-2013**): OI up to **USD 10.72B**.

- DIS bought **Marvel** (USD 4B) in 2009 and **Lucasfilm** (USD 4B) in 2012.
- DIS introduced a new division: **Interactive Media** (Kaboosee.com, BabyZone.com, **Playdom** (USD 563.2M, social gaming), etc.)
- DIS ordered **two new cruises** with 50% more capacity each in 2011.
- Shangai theme park (opened in 2016).

	2006 (in USD)		2013 (in USD)	
	Revenue	Operating Income	Revenue	Operating Income
Media	14.75B	3.61B	20.35B	**6.82B**
Theme Parks	9.95B	1.53B	14.09B	**2.22B**
Studios	7.2B	0.73B	5.98B	**0.66B**
Consumer Products	2.4B	0.62B	3.56B	**1.11B**
Interactive Media	-	-	1.06B	**-0.09B**
Total	**34.3B**	**6.49B**	**45.04B**	**10.72B**

• Case Study: Walt Disney Co.

With the two data points (**2006** & **2013**) we calculate the CF-elasticity:

(1) Using accounting data (OI to measure CFs):

13-06 Change in OI = **USD 10.72B** – **USD 6.49** = USD 4.23B (**65.18%**)

13-06 $e_{f,t}$ = 81.9778/75.1918 – 1 = **.09025** (or **9.03%** **depreciation of USD**, *as direct quote*)

$$\Rightarrow \textbf{CF-elasticity} = \frac{\%\text{ change in OI}}{e_{f,t}} = \frac{.6518}{.09025} = 7.2222$$

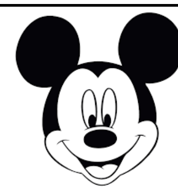
(2) Using financial data (stock returns to measure ΔCFs):

13-06 DIS Stock Return = $r_{DIS,t}$ = 64.49/30.50 – 1 = **111.44%**

$$\Rightarrow \frac{r_{DIS,t}}{e_{f,t}} = \frac{1.1144}{.09025} = 12.35$$ (very big!)

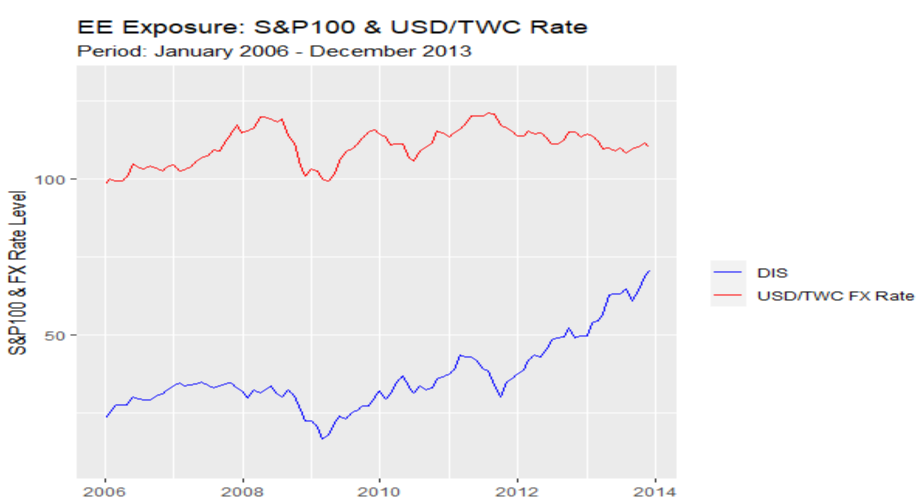
Conclusion: CF-elasticities point out to a significant EE for DIS (DIS behaves as a net exporter.

• Case Study: Walt Disney Co.



(3) Visual check: Stock price (blue) & USD/TWC (red).

⇒ Not very clear relation, though we see a depreciating USD and a surging DIS price.



• Case Study: Walt Disney Co.

• According to elasticities, DIS behaves like a **net exporter**:

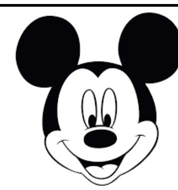
S_t (USD/TWC) ↑ ⇒ CFs ↑.

• Managing Disney's EE

1. **Increase** expenses **in FC**
   - Make movies elsewhere
   - Move production abroad
   - Borrow abroad

2. **Diversify** revenue stream
   - Build more parks abroad (planning an expansion in Tokyo)
   - Add more cruises (3 more ordered in 2016 & 2017)
   - New businesses (Disney+ in 2020)

• Case Study: Walt Disney Co.



• Q: Are the CF-elasticities informative? Is S_t the only variable changing from **2006** to **2013**?

A: No! DIS added assets, thus more revenue and OI is expected. We need to be careful with these numbers.

• We need to "**control**" for variables that also affect DIS stock returns, to **isolate** the effect of $e_{f,t}$. Otherwise, these numbers may be misleading.

• Using the 3 Fama-French factors, Market, SMB & HML, we run:

$$r_{DIS,t} = \alpha + \gamma_1 (r_M - r_f)_t + \gamma_2 SMB_t + \gamma_3 HML_t + \beta\, e_{f,t} + \varepsilon_t$$

Recall that we test EE by testing H_0 (No EE): $\beta = 0$.

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

We use the t-test. We reject H_0 at 5% level when $|t_\beta| > $ **1.96.**

• Case Study: Walt Disney Co.

Now, we run the EE regression, with the 3 Fama-French factors, with **49 years** (**1973:Feb** – **2022:Jan**):

$r_{DIS,t} = \alpha + \gamma_1 (r_M - r_f)_t + \gamma_2 SMB_t + \gamma_3 HML_t + \beta\, e_{f,t} + \varepsilon_t$

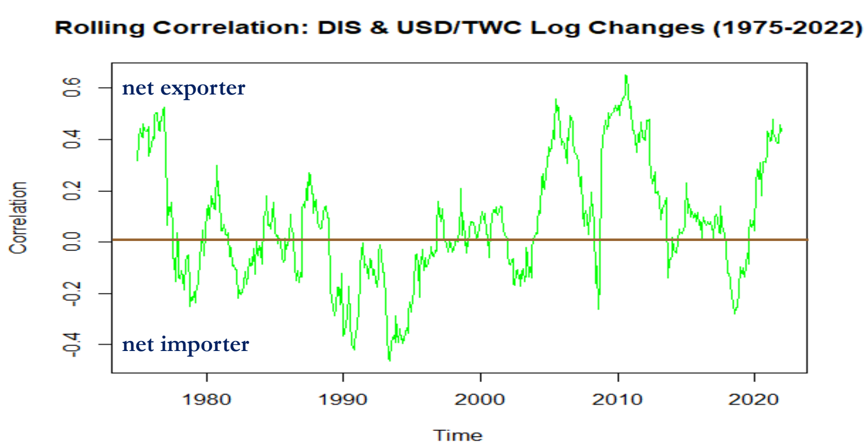
R^2 = 0.4294
Standard Error = 6.5698
Observations = 588

	Coefficients	Std Error	t Stat	P-value
Intercept	-0.0924	0.2757	-0.3351	0.7377
$e_{f,t}$	**-0.0532**	0.1655	**-0.3213**	0.7481
$(r_M - r_f)$	1.2614	0.0637	19.8037	0.0000
SMB	-0.0008	0.0928	-0.0090	0.9928
HML	0.1635	0.0910	1.7972	0.0728

After controlling for other factors that affect Disney's excess returns, we cannot reject H_0, since $|t_\beta = -0.32| < 1.96$ (at 5% level). Again, **no EE**.

• Case Study: Walt Disney Co.

More structure is easier to spot, using **24-month** rolling correlations between $e_{f,t}$ & $r_{DIS,t}$. From **1975 – 2022**: we see periods of DIS *as a net exporter* & DIS *as a net importer*.



Note: Average correlation: **0.0943**. (On average, a **net exporter**).

• **Case Study: Walt Disney Co. – Robustness**

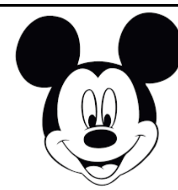
• Robustness of findings & Data mining.

Q: Why **2006-2013** for the CF-elasticities and **1973-2022** or **1973-2022** for the regressions? Why not **2002-2022** or **2006-2017**?

In stats, more data is better. But, we use data that we believe is **representative** of the present and, more important, **what we expect in the future**; after all, we are hedging future CFs!.

But, be very aware of the potential for **data mining**. Result may be dependent on a specific sub-period, specific measures of CFs or a specific model for returns.

• **Case Study: Walt Disney Co. – Robustness**



Example: We use data up **2006-2017** to compute EE. The elasticities change sign: OI and stock price kept increasing (with accumulated changes of **127.74%** & **223.18%**, respectively), but the **USD appreciated** (accumulated **6.96%**).

⇒ 2006 – 2017 elasticities:

$$-\frac{\Delta OI_{DIS,t}}{e_{f,t}} = \frac{1.2774}{-.0696} = -18.35$$

$$-\frac{r_{DIS,t}}{e_{f,t}} = \frac{2.2318}{-.0696} = -32.07$$

Interpretation: a 1% appreciation of the USD, OI increases by **18.35%**. Now, DIS behaves like a **net importer**.

Remark: More data (only 4 more years!) changed substantially conclusions. This should be a **warning**: something is **not robust** in the results.

• But, not only S_t changed in this period: It is better to use a regression!

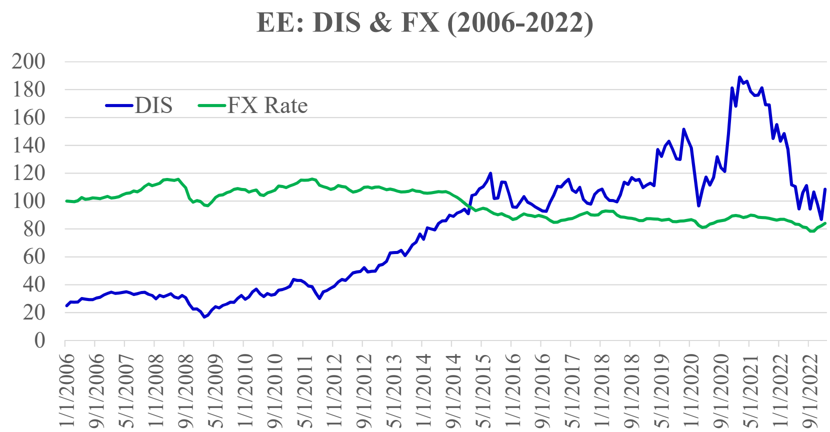
• **Case Study: Walt Disney Co. – Robustness**

Visual **2006 – 2017** evidence:

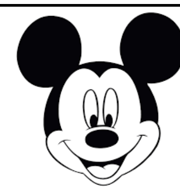
2006 - 2013: DIS is *a net exporter.*

2006 - 2017: DIS is *a net importer.*

⇒ Careful with sub-period analysis!



• **Case Study: Walt Disney Co. – Robustness**



Q: Can regression results be also subject to data mining?

Yes! Suppose, we think Disney is a different company from 1973! We use only the last **20 years** (**2002:Jan** – **2022:Jan**):

$R^2 = 0.5264$

Observations = 241

	Coefficients	Std Error	t Stat	P-value
Intercept	-0.0593	0.3169	-0.1873	0.8516
$e_{f,t}$	**0.1667**	0.1992	**0.8368**	0.4036
$r_M - r_f$	1.1141	0.0791	**14.0778**	0.0000
SMB	0.0339	0.1329	0.2547	0.7992
HML	0.1423	0.1126	1.2639	0.2075

Now, β is positive (but still not significant). But, **data mining** may work. For example, from **1997-2017**, $|t_\beta = -1.74| < 1.645$ (at 10% level, **EE**) or **1987-2007**, $|t_\beta = -2.28| < 1.96$ (at 5% level, **EE**).

• Do U.S. Firms Hedge?

From a survey of the largest 250 U.S. MNCs, taken in (2001):

(1) Most of the MNCs in the survey understood translation, transactions, and economic exposure completely or substantially.

(2) A large percentage (32% - 44%) hedged themselves substantially or partially. However, a larger percentage did not cover themselves at all against transactions and economic exposure.

(3) A significant percentage of the firms' hedging decisions depended on future FX fluctuations.

(4) Over 25% of firms indicated that they used the forward hedge.

(5) The majority of the firms surveyed have a better understanding of transactions and translation exposure than of economic exposure.

• Canadian Evidence

The Bank of Canada conducts an annual survey of FX hedging. The main findings from the 2011 survey are:

- Companies hedge approximately 50% of their FX risk.
- Usually, hedging is for maturities of six months or less.
- Use of FX options is relatively low, mainly because of accounting rules and restrictions imposed by treasury mandate, rules or policies.
- Growing tendency for banks to pass down the cost of credit (credit valuation adjustment) to their clients.
- Exporters were reluctant to hedge because they were anticipating that the CAD would depreciate. On the other hand, importers increased both their hedging ratio and duration.

PROJECT – PPP & FX Forecasting

We test & forecast S_t using a regression model based on relative PPP.

Model: $e_{f,t} = \alpha + \beta\,(I_d - I_f)_t + \varepsilon_t$

Data: CPI & S_t from **1974:Dec** to **2024:April** (for Mexico, 1993:Nov – 2024:April.). Transform data to get $e_{f,t}$ & $(I_d - I_f)_t$.

I - Testing PART (use whole sample).

(A) Visual test, with graphs

- Plot $e_{f,t}$ against $(I_d - I_f)_t$. Do you see a 45 degree line?
- Plot R_t over time. Is R_t constant? Are deviations from mean persistent?

(B) H_0 (Relative PPP true): **α=0** and **β=1**

H_1 (Relative PPP not true): **$\alpha\neq$0** and/or **$\beta\neq$1**

Formal test: t-test and F-test. Use 5% level.

II - Forecasting PART (use estimation & validation sample)

(1) Estimate the model using data up to **2020:December**. (1975:Jan-2020:Dec is the estimation period). Get estimated coefficients ($\hat{\alpha}$ & $\hat{\beta}$).

You want to forecast S^F_{t+1} from **2021:Jan - 2024:April** (validation period).

Steps:

1. Assume $E_t[I_{d,t+1} - I_{f,t+1}] = I_{d,t} - I_{f,t}$

2. Using $\hat{\alpha}$ & $\hat{\beta}$, generate one-step-ahead (one-month ahead) forecasts for $e^F_{f,t+1}$. The first one-step-ahead forecast (done only with 2020:Dec info):

$$e^F_{2021:Jan} = \hat{\alpha} + \hat{\beta}\,(I_{d,2020:Dec} - I_{f,2020:Dec})$$

$$\Rightarrow S^F_{2021:Jan} = S_t * (1 + e^F_{2021:Jan})$$

3. Compute the forecast error:

$$\varepsilon_{2021:Jan} = S_{2021:Jan} - S^F_{2021:Jan}$$

4. Repeat **2** & **3**. Get Q=40 one-month-ahead forecasts ($S^F_{2021:Jan}$, $S^F_{2021:Feb}$, …, $S^F_{2024:April}$) & 40 forecast errors: Compute *out-of-sample* MSE.

II - Forecasting PART (use whole sample)

4. Repeat 2 & 3. Get Q=40 one-month-ahead forecasts ($S^F_{2021:Jan}$, $S^F_{2021:Feb}$, …, $S^F_{2024:April}$) & 40 forecast errors: Compute *out-of-sample* MSE.

$$\text{MSE} = \frac{\sum_{t=1}^{Q} \varepsilon_{t+T}^2}{Q}$$

(2) Forecast S^F_{t+1} from **2021:Jan - 2024:April** using RWM. Compute *out-of-sample* MSE

• Q: In terms of MSE, which model is better? Briefly discuss success/failure of model.

Check: https://www.bauer.uh.edu/rsusmel/4386/ppp-project_24.htm