EE Exposure and Midterm 1 Review

(for private use, not to be posted/shared online)

- **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 (s_t).

- **This Class**
- **Measuring EE:**
  - Accounting data (EAT, EBT, Operating Income, EPS changes)
    - CF elasticity = $\frac{\%\text{ change in EBT}}{s_t}$
    - Financial/economic data (returns)
    - Regression
- **Managing EE**
  - Main Tool: Operational Hedging (Matching Inflows and Outflows)
- **Review Problems for Midterm 1**

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.

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:

$$\text{CF elasticity} = \frac{\%\text{ change in EBT}}{\%\text{ change in } s_t} = \frac{.2592}{.10} = 2.59$$

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,

$$\textbf{CF elasticity} = \frac{.026}{.0298} = \mathbf{0.8724}$$

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

A Regression based Measure and a Test

In general, regression is done in terms of % changes:

$$cf_t = \alpha + \beta\, s_t + \xi_t,$$

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:

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

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.

⇒ 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:

$$cf_t = \alpha + ß_0\, s_t + ß_1\, s_{t-1} + ß_2\, s_{t-2} + \ldots + ß_q\, s_{t-q} + \delta_1 X_{1,t} + \ldots + \varepsilon_t.$$

Sum of ß's: Total sensitivity of cf_t to s_t $(= ß_0 + ß_1 + ß_2 + ß_3 + \ldots)$

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 $\boldsymbol{\rho_{K,s}}$ (correlation between $r_{K,t}$ & s_t) = **0.150**. It looks small.

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

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

$$r_t = \alpha + \beta\, s_t + \varepsilon_t$$

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.

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:

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

$R^2 = 0.01596$

Standard Error = 5.56447

Observations = 409

	Coefficients	*Standard Error*	*t-stat*	*P-value*
Intercept (α)	0.38592	0.27515	1.4026	0.1615
s_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!

$\beta > 0$, 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:

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

$R^2 = 0.03221$

Standard Error = 7.4465

Observations = 409

	Coefficients	*Standard Error*	*t-stat*	*P-value*
Intercept (α)	0.38896	0.36821	1.0563	0.2914
s_t (β)	**0.83941**	0.22805	**3.6809**	0.0003

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

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

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

Again, the R^2 is low! ¶

An Easy Measure of EE Based on Financial Data

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Steps:

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

$$r_t = \alpha + \beta\, s_t + \varepsilon_t$$

2) Check statistical significance of regression coefficient for s_t:

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

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Again, the R^2 is low! ¶

• Returns are not only influenced s_t. In investments, it is common to use the 3 factors from the **Fama-French models** to model stocks returns:

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

In Kellogg's case:

$$r_{K,t} = \alpha + \gamma_1 (r_{Mar} - r_f)_t + \gamma_2 \text{SMB}_t + \gamma_3 \text{HML}_t + \varepsilon_t$$

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:

$$r_{K,t} = \alpha + \gamma_1 (r_{Mar} - r_f)_t + \gamma_2 \text{SMB}_t + \gamma_3 \text{HML}_t + \beta\, s_t + \varepsilon_t$$

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

	Coefficients	Std Error	t-stat
Intercept	0.0798	0.2691	0.2967
Market ($R_m - R_f$)	0.3893	0.0647	6.0204
Size (SMB)	-0.1144	0.0898	-1.2738
B-M (HML)	0.1546	0.0851	1.8157
s_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
s_t (β)	**0.3963**	0.1966	**2.0157**
Market ($R_m - R_f$)	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 s_t (USD/TWC) & the 3 FF factors:

R^2 = 0.9664
Standard Error = 0.8136
Observations = 454

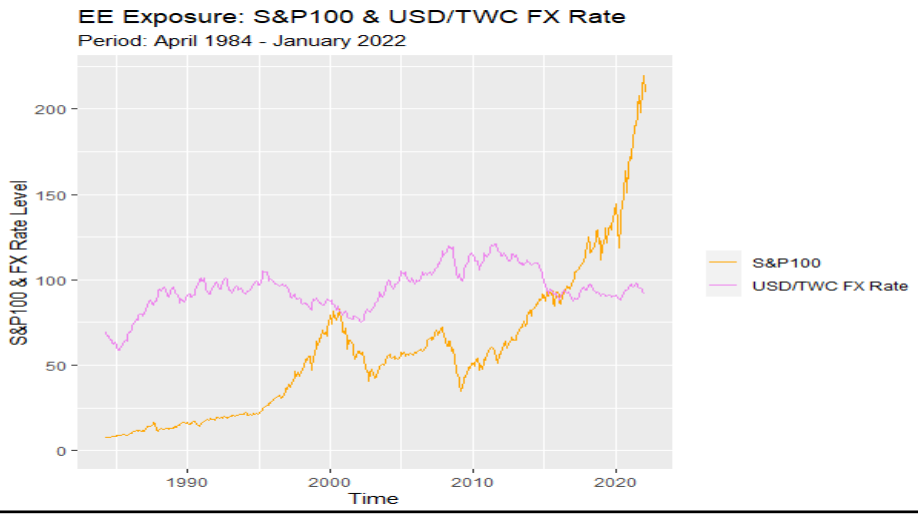
	Coefficients	Std Error	t-stat	P-value
Intercept	-0.0247	0.0389	-0.6357	0.5253
s_t	**-0.0225**	0.0231	**-0.9756**	0.3298
Market - r_f	0.9988	0.0090	110.5233	>.00001
SMB	-0.2459	0.0133	-18.4659	>.00001
HML	0.0068	0.0126	0.5381	0.5907

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

EE: Evidence

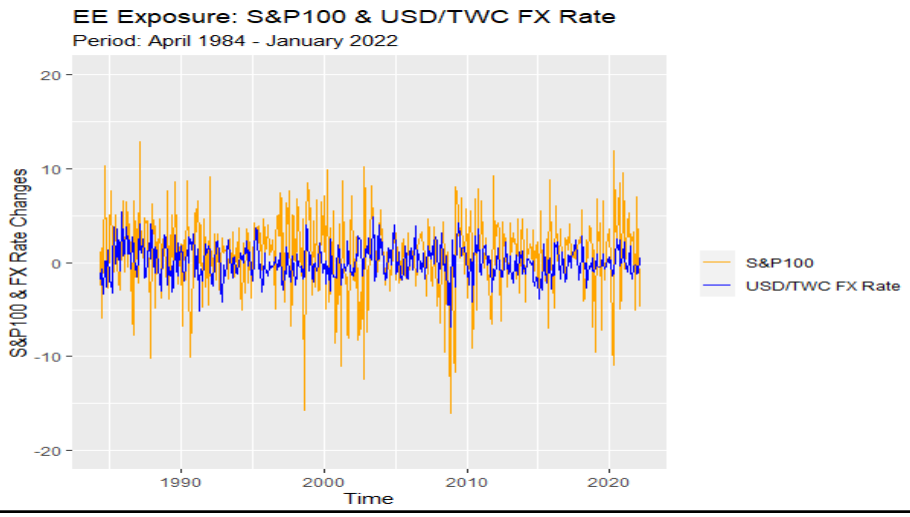
Data mining may find periods of a positive and negative relation between both **S&P100** & USD/TWC FX Rate series. Overall, not clear.

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 ($0<\alpha< 1$, with $\alpha=\alpha_{FC}+\alpha_{DC}$)

Gross profits: $(1-\alpha)$ PQ – Fixed Cost

EBT = [$(1-\alpha)$ PQ – Fixed Cost] – IE (IE: Interest Expense)

EAT = [$(1-\alpha)$ 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}.

EE: How changes in S_t affect CFs of the firm (say, EAT)?

A first derivative answer this question:

$$\frac{\partial EAT}{\partial S_t} = \left[(1-\alpha)\frac{\partial PQ}{\partial S_t} - \frac{\partial IE_{FC}}{\partial S_t}\right] * (1-t)$$

where

$$\frac{\partial PQ}{\partial S_t} > 0 \ \ \& \ \ \frac{\partial IE_{FC}}{\partial S_t} > 0.$$

If the first derivative is 0: EAT = Constant, independent of the FC

$\Rightarrow$ **No EE**.

• Q: How can a company reduce EE?

- A company can play with $\boldsymbol{\alpha_{FC}}$: The better the (elasticity) match, between Revenue and Costs in FC, the smaller the EE.
- A company can play with $\mathbf{IE_{FC}}$.

• Matching Inflows and Outflows

To get a manageable EE, firms tend to play with α_{FC}. For example, if Fixed Costs and IE are small relative to VC, then, the bigger α_{FC}, the smaller the exposed CF to changes in S_t.

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 & revenues home.
- If $S_t \downarrow$ (DC appreciates) & CF ↑ (typical, **net importer**), operational hedges tend to shift expenses home & 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

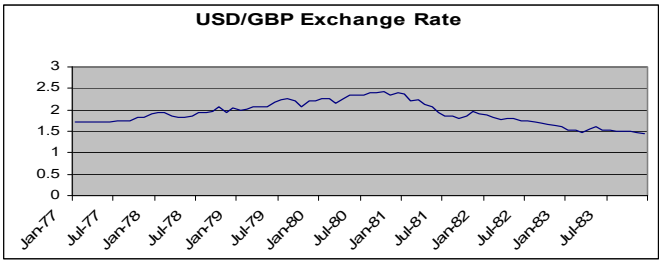
Sale of **airfares** (probably, **evenly divided** between **GBP** and **USD**), plus other GBP revenue.

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 ($\alpha_{DC}\uparrow$ /$\alpha_{FC}\downarrow$)
- Increase IE in GBP ($IE_{DC}\uparrow$ –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**

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

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

$\Rightarrow$ US firm benefits by S_t (USD/EUR) $\uparrow$ –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

$\Rightarrow$ 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

$\Rightarrow$ 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

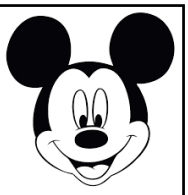
Consumer products (Licensing, Publishing, Disney store (Europe). *Medium*) Rev: USD 2.4B, OI: 0.62B

Outflows (2006) – around 80% in USD

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

$\mathbf{Price}_{Sep\ 06}$ = 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 s_t = 81.9778/75.1918 – 1 = **.09025** (or **9.03% depreciation of USD**, *as direct quote*)

$$\Rightarrow \text{CF-elasticity} = \frac{\%\text{ change in OI}}{s_t} = \frac{.6518}{.09025} = 7.2222$$

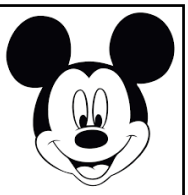
(2) Using financial data (stock returns to measure ΔCFs):

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

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

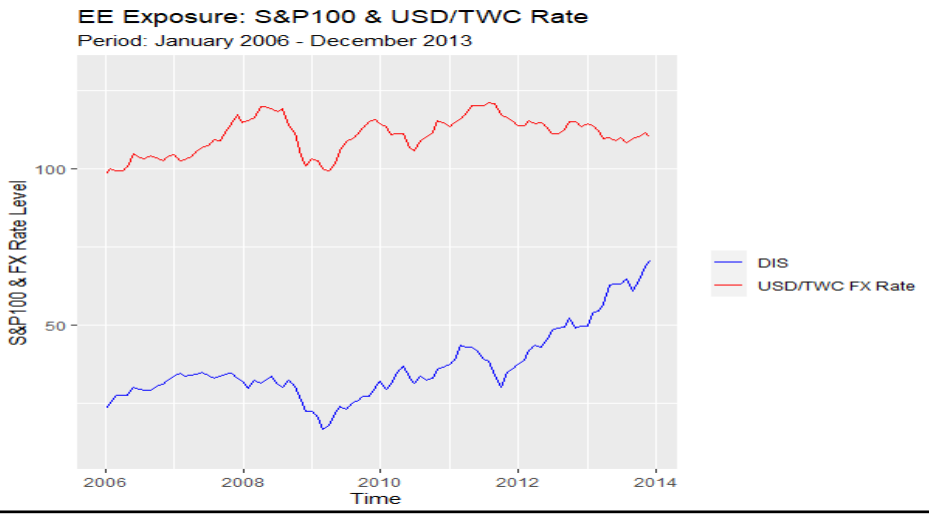
• These numbers point out to a significant EE for DIS.

• **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**:

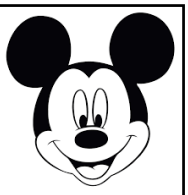
S_t (USD/TWC) ↑ ⇒ CFs ↑.

• 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 s_t. Otherwise, these numbers may be misleading.

• In investments, it is common to use the 3-factors from the Fama-French models to explain stocks returns. The 3 factors: Market, SMB (size) & HML (value). In the DIS case:

$$r_{DIS,t} = \alpha + \gamma_1 (r_{Mar} - r_f)_t + \gamma_2 \text{SMB}_t + \gamma_3 \text{HML}_t + \varepsilon_t$$

A momentum can be added to accommodate the extension of Carhart (1997) of the Fama-French model.

• **Case Study: Walt Disney Co.**

• EE regression using excess returns from past **34 years** (**1988:Jan – 2022:Jan**) against s_t (USD/TWC) and the 3 FF factors (Market, SMB, HML):

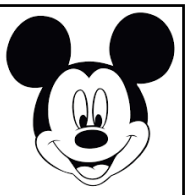
$$r_{DIS,t} = \alpha + \gamma_1 (r_{Mar} - r_f)_t + \gamma_2 \text{SMB}_t + \gamma_3 \text{HML}_t + \beta\, s_t + \varepsilon_t$$

$R^2 = 0.4357$
Standard Error = 5.5418
Observations = 409

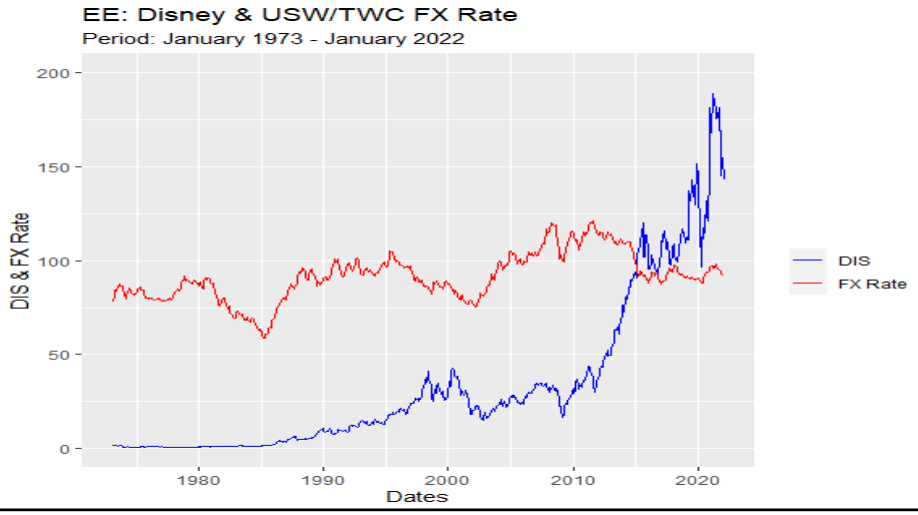
	Coefficients	Std Error	t Stat	P-value
Intercept	-0.0781	0.2791	-0.2800	0.7796
s_t	**-0.1376**	0.1725	**-0.7972**	0.4258
r_{Mar} - r_f	1.1472	0.0671	17.1023	0.0000
SMB	-0.0272	0.0932	-0.2925	0.7701
HML	0.2497	0.0883	2.8280	0.0049

Not significant (& negative β!, $|t_\beta = \textbf{-0.80}| < \textbf{1.96}$). We say "After controlling for other factors that affect Disney's excess returns, there is **no EE**."

• **Case Study: Walt Disney Co.**

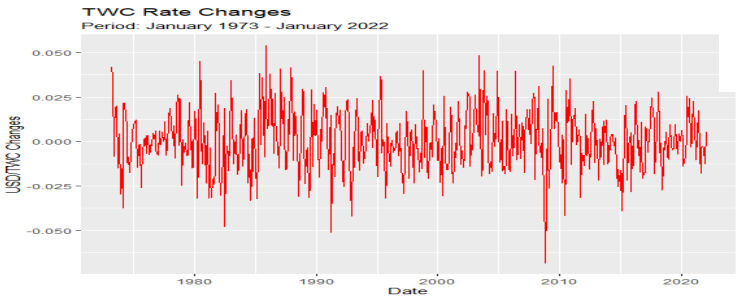


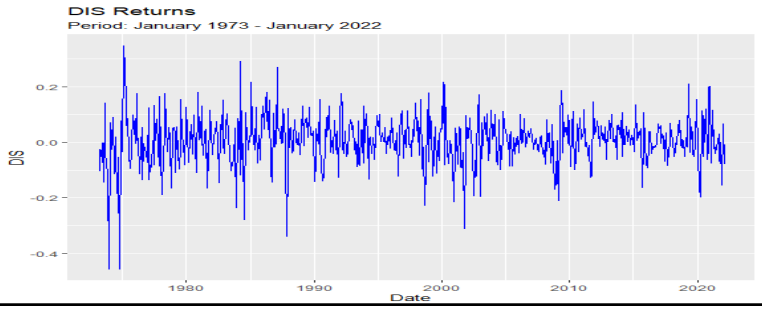
Usually, more data ⇒ Stronger stats results (lower SE for estimates). We have almost 50 years of data for DIS and the TWC Index: **1973:Feb – 2022:Jan**



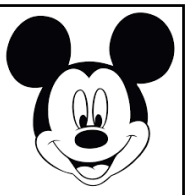
• **Case Study: Walt Disney Co.**

As usual with returns, very difficult to see structure.

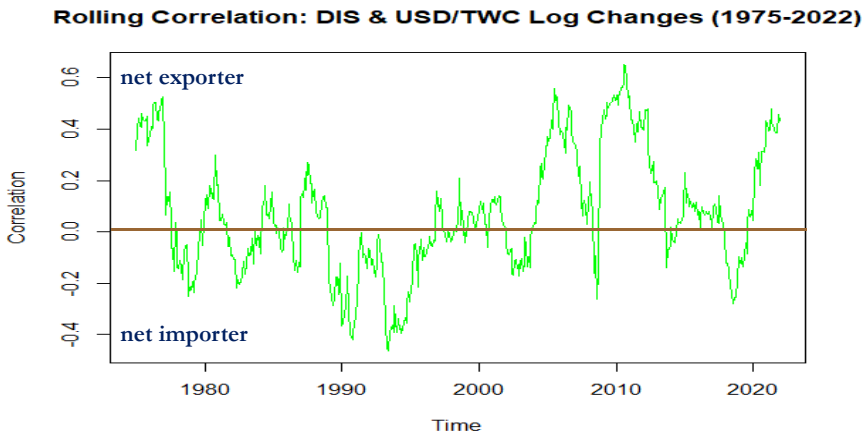




• **Case Study: Walt Disney Co.**



More structure is easier to spot, using **24-month** rolling correlations between s_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.**

Now, we run an EE regression, with 3 FF factors, with **49 years** (**1973:Feb – 2022:Jan**):

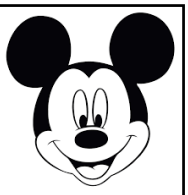
$r_{DIS,t} = \alpha + \gamma_1 (r_{Mar} - r_f)_t + \gamma_2 \text{SMB}_t + \gamma_3 \text{HML}_t + \beta\, s_t + \varepsilon_t$

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

	Coefficients	Std Error	t Stat	P-value
Intercept	-0.0924	0.2757	-0.3351	0.7377
s_t	**-0.0532**	0.1655	**-0.3213**	0.7481
r_{Mar} - 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.**



• Robustness of findings.

Q: Why **2006-2013** for the CF-elasticities and **1988-2022** 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.**

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:

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

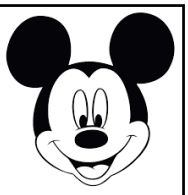
$$-\frac{r_{DIS,t}}{s_t} = \frac{2.2318}{-.0696} = \textbf{-32.07}$$

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.**



Example (continuation): What is driving the sign reversal of the **CF-elasticity** with new data up to **2017**?

	2013 (in USD)		2017 (in USD)	
	Revenue	**Operating Income**	**Revenue**	**Operating Income**
Media	20.35B	6.82B	23.51B	**6.90B**
Theme Parks	14.09B	2.22B	18.42B	**3.77B**
Studios	5.98B	0.66B	8.38B	**2.36B**
Cons Products & Interactive Media	4.62B	1.02B	4.83B	**1.74B**
Total	**45.04B**	**10.72B**	**55.14B**	**14.78B**

The **reversal of sign** in CF-elasticity is driven by the interval **2013-2017**:

13-17 Change in OI (%) = **37.87%**

13-17 $r_{DIS,t}$ = 98.57/64.49 – 1 = **52.85%**

13-17 s_t = 75.1918/88.11 – 1 = **-14.66%** (or 14.66% **USD appreciation**)

⇒ **CF-elasticity** = % Change in OI / s_t = .3787/(-.1466) = **-2.5832**

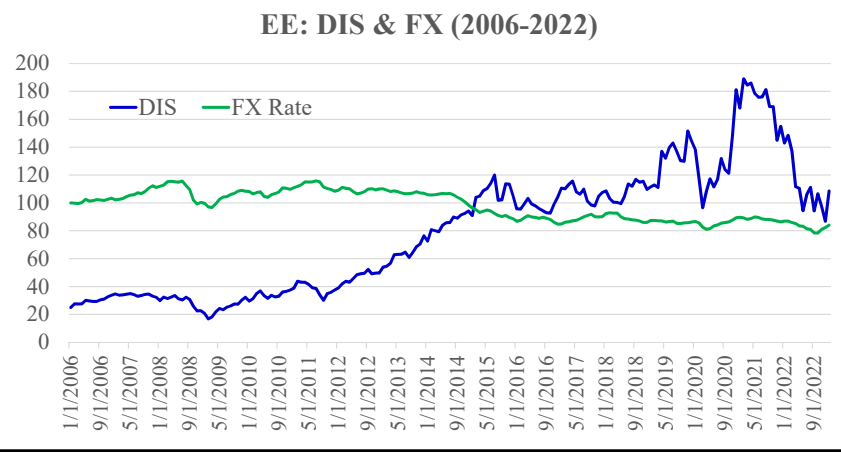
• **Case Study: Walt Disney Co.**

Visual **2006 – 2017** evidence:

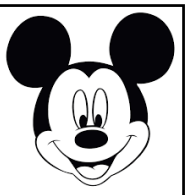
2006 - 2013: DIS is *a net exporter.*

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

⇒ Careful with sub-period analysis!



• **Case Study: Walt Disney Co.**



Update 2006-2022:

Consolidated reporting to 2 segments: Parks, Experiences & Products, and Media & Entertainment Distribution.

	2006 (in USD)		2022 (in USD)	
	Revenue	**Operating Income**	**Revenue**	**Operating Income**
Media & Entertainment	21.95B	4.34B	**55.04B**	**4.22B**
Parks, Experience & Products	12.35B	2.15B	**28.71B**	**7.91B**
Total	**34.3B**	**6.49B**	**83.75B**	**12.12B**

The **reversal of sign** in CF-elasticity is driven by the interval **2013-2017**:

06-22 Change in OI (%) = **86.74%**

06-22 $r_{DIS,t}$ = 98.57/64.49 – 1 = **209.28%**

02-22 s_t = 75.1918/88.11 – 1 = **-23.00%** (or 23% **USD appreciation**)

⇒ *net importer*

• **Case Study: Walt Disney Co.**

Q: Can regression results be subject to data mining?

Suppose, we think Disney is a different company from 1973!

We decide to use 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
s_t	**0.1667**	0.1992	**0.8368**	0.4036
r_{Mar} - 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**).

• **More Examples: 1 – Foreign Auto Exporters** (January 2015, *WSJ*)

During the last semester of **2014**, the USD appreciated against the major currencies (**13%** against the EUR, & **15%** against the JPY).

Because of the expected loose monetary policies abroad, the strong USD was expected to continue in 2015.

According to earnings forecasts, Germany's three large carmakers were expected to increase (unhedged) earning by EUR 12B (USD 14.2B).

Also, Nissan was planning to make more vehicles for the U.S. market in Japan in 2015, but profit impact was expected to be "marginal," because it makes so many of its vehicles in North America.

Source: Wall Street Journal, Jan 12, 2015. ¶

• **More Examples: 2 – H&M vs. Zara** (July 2015, *Reuters*)

In late June 2015, Sweden's Hennes & Mauritz warned it expects the strong USD to translate into rising sourcing costs after it hurt Q2 profits.

H&M buys the bulk of its clothes in Asia (in USD) while selling most of them in Europe (in EUR).

Inditex, the Zara owner, produces more garments in house and sources the majority of them in or near Europe.

• **More Examples: Conclusions**

Better match ⇒ lower EE.

Zara has a better match between FC receivables & FC costs than H&M, and, thus, lower EE.

Similar situation applies to Nissan relative to the big 3 German firms (confirmed by Nissan's executive Ghosn: Nissan's has a very good match in USD, creating a very low EE).

Should a Firm Hedge?

• Fundamental question: Does hedging **add value** to a firm?

Two views:

(1) **Modigliani-Miller Theorem** (**MMT**): ⇒ hedging adds **no value**.

(2) MMT assumptions are violated ⇒ hedging adds value.

The **MMT** depends on a set of **assumptions**:

MMT requires that a firm operates in **perfect markets**.

• **Hedging is Irrelevant: The MMT**

Intuition: What is the value of your car?

Example 1: Last year, you bought a car with a bank loan.

Q: Is the value of your car affected by the loan you took to pay for it?

• MMT provides a similar story to value a firm.

- Firms make money if they make good investments.
- The **financing source** of those good investments is irrelevant.
- Different mechanisms of financing will determine how the CFs are divided among shareholders or bondholders.

• Hedging works like insurance.

Example 2: You bought insurance for your car.

Q: Is the value of your car affected by the insurance you took?

• MMT's hedging implications.

If **methods of financing** and character of financial risks **do not matter**, managing them is not important:

⇒ **Hedging should not add** any value to a firm.

• Hedging increases the portfolio of the firm. But, hedging is **not free**:

⇒ Hedging might reduce the value of a firm.

• Another result: Investors can hedge (and/or diversify) by themselves.

Example: Ms. Sternin holds shares of a U.S. **exporting firm** and shares of a U.S. **importing firm**. Ms. Sternin's portfolio is hedged.

Hedging at the firm level -since it is not free- will negatively affect the value of Ms. Sternin portfolio. ¶

- **Hedging Adds Value**

Key: MMT assumptions are violated in the "real world."

(1) Investors might not be able to replicate an optimal hedge

Example: Investors might not be big enough or have enough information

(2) Hedging as a tool to reduce the risk of bankruptcy

Implication: No hedging needed for firms with little debt or with good access to credit. Under this view, large MNCs may be wasting their capital.

(3) Hedging as a tool to reduce investment uncertainty

Example: Merk, a U.S. pharmaceutical firm, has used derivatives to ensure that investment (R&D) plans can always be financed. ¶

(4) Hedging as a bank loan requirement

Kumar and Rabinovitch (2015) find evidence that having bank debt is a significant driver of hedging decisions in the oil and gas industry.

(5) Tax advantage

Tax convexity –i.e., tax liability is progressively increasing with income– works in favor of hedgers.

In addition, given that firms that hedge can borrow more, they can take advantage of the tax deductibility of interest.

(6) Herding

"*Everybody else is doing it.*"

• Interesting finding for hedging: Firms that hedge with derivatives have a 6.7% – 7.8% higher valuation –Berriospide *et al.* (2008).

- **Hedging: Some Conclusions**

Two extreme views:

(1) *Hedging adds no value.* In practice, this view understands the potential benefits, but **diversified investors** can manage risk exposure by themselves.

(2) *Hedging adds value.* In practice, this view understands that markets are efficient, but the **reduction in uncertainty** improves stock prices.

• Intermediate view:

- Hedging is likely to add value for:
  - ◊ Small firms with undiversified ownership.
  - ◊ Firms with a lot of debt.
  - ◊ Firms with limited growth opportunities if financially constrained.
  - ◊ Firms with risk that cannot be hedged by market instruments.

• Do U.S. Firms Hedge?

From a 2001 survey of the largest 250 U.S. MNCs:

(1) Most of the MNCs **understood** translation, TE, & EE completely or substantially.

(2) A large percentage (**32% - 44%**) **hedged** themselves substantially or partially. But, **a larger percentage did not hedge** at all TE & EE.

(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. Main findings from 2011 survey:

• Firms **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.

Review of Midterm 1

• **What's included?**

- Lectures 1-7 (today).
- Cases 1 & 2.

• **What to bring to the exam**

- Open book/everything exam.
- Computer required. Have handy the excel worksheets we used in class.

• **Prepare for exam**

- Review old exam questions posted online:
    - Solved problems
    - Unsolved problems (to be review in this lecture)

Note: Past students mentioned the exams are long, some said "*too long*." Expect to work around **3 hours** on the exam.