



INTERNATIONAL CORPORATE FINANCE

Foreign Exchange Hedging

Anna Chmielewska

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How to hedge FX Exposure

- Natural hedge
- FX Forward
- Options

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You need to pay USD 1M in 1 year

- Wait and buy USD in a year
 - Risk of USD appreciation
- Buy USD now
 - Problem with liquidity
- Forward

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New machine costs \$1 mln

OFF-BALANCE



Assume: spot \$=2.5zł \$Libor=4% Wibor=6.5%

How much USD would you need to buy now?

$$\$1 \text{ mln} / (1 + 4\%) = \$961,583.46$$

How much would you pay?

$$\$961,583 \times 2.5\text{zł}/\$ = 2,403,846.15\text{zł}$$

If borrowed, how much would you pay back?

$$2,403,846.15\text{zł} \times (1 + 6.5\%) = 2,560,096.15\text{zł}$$

Replication

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Our choice

OFF-BALANCE

USD
F

No cash flow today, you just agree how much to pain a year

$$\cancel{\text{Cena}_{USD}} \times F_{USD}$$

BALANCE SHEET

Deposit
USD
\$961,583.46

Loan
PLN
2,403,846.15zł

You are replicating – borrowing now and putting onto the account
In a year you will have 2,560,096.15zł

$$= \frac{\cancel{\text{Cena}_{USD}}}{1 + i_{USD}} \times S_{USD} \times (1 + i_{PLN})$$

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Our choice determines the price

OFF-BALANCE

USD
F

No cash flow today, you just agree how much to pain a year

$$\cancel{\text{Notional}_{USD}} \times F_{USD}$$

BALANCE SHEET

Deposit
USD
\$961,583.46

Loan
PLN
2,403,846.15zł

You are replicating – borrowing now and putting onto the account
In a year you will have 2,560,096.15zł

$$= \frac{\cancel{\text{Notional}_{USD}}}{1 + i_{USD}} \times S_{USD} \times (1 + i_{PLN})$$

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FORWARD RATE FORMULA

F – forward rate

S – spot rate

D – forward value date

d – spot value date

R – counter currency interest rate

r – base currency interest rate

B – counter currency day count basis

b – base currency day count basis

$$F = S * \frac{1 + R * \frac{D-d}{B}}{1 + r * \frac{D-d}{b}}$$

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Forward quotations

$$F_{USD} = S_{USD} \times \frac{1 + i_{PLN}}{1 + i_{USD}}$$

- **What can we tell if $F_{USD/PLN} \geq S_{USD/PLN}$?**
PLN interest is higher than USD interest
- **What would happen if rates in two countries were equal?**
SPOT = FORWARD

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Quotations in practice (I)

Spot = 2.5000 1Y Forward = 2.5601

USD/PLN	bid	ask
USD/PLN	2.4950	2.5050
1Y	600	602

- How to read those?
 - **Forward bid: $2.4950 + 0.0600 = 2.5550$**
 - **Forward ask: $2.5050 + 0.0602 = 2.5652$**

Forward below spot (hrywna/złoty)

**Spot = 0.5020; UAH Libor = 15%;
Wibor = 6.5% 1Y Forward = 0.4649**

UAH/PLN	bid	ask
UAH/PLN	0.5000	0.5040
1Y	372	370

- **How shall we read it?**
 - **Forward bid to $0.5000 - 0.0372 = 0.4628$**
 - **Forward ask to $0.5040 - 0.0370 = 0.4670$**

How do we know (add or deduct)?

USD/PLN	bid	ask
USD/PLN	2.4950	2.5050
1Y	600	602

UAH/PLN	bid	ask
UAH/PLN	0.5000	0.5040
1Y	372	370

- Either think which rate is higher
- ...or watch the spread

If $\text{points}_{\text{bid}} < \text{points}_{\text{ask}}$ add
If $\text{points}_{\text{bid}} > \text{points}_{\text{ask}}$ deduct

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Options

OPTIONS



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How does an option work?

We pay a premium (price) for „insurance” against unfavourable market move.

CALL option – entitles us to buy something at a given price (STRIKE)

PUT option – entitles us to sell something for a preset price (STRIKE)

Buyers decides if they execute or not, i.e. they only execute if it makes sense for them.

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FX Call with Strike = 4 PLN/USD

- **If at maturity USD is for 3.8 PLN**

Not executed

In the market

1 USD = 3.8 PLN

≠

Under contract

1 USD = 4 PLN

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FX Call with Strike = 4 PLN/USD

- If at maturity USD is for 4.2 PLN

Executed

In the market

1 USD = 4.2 PLN

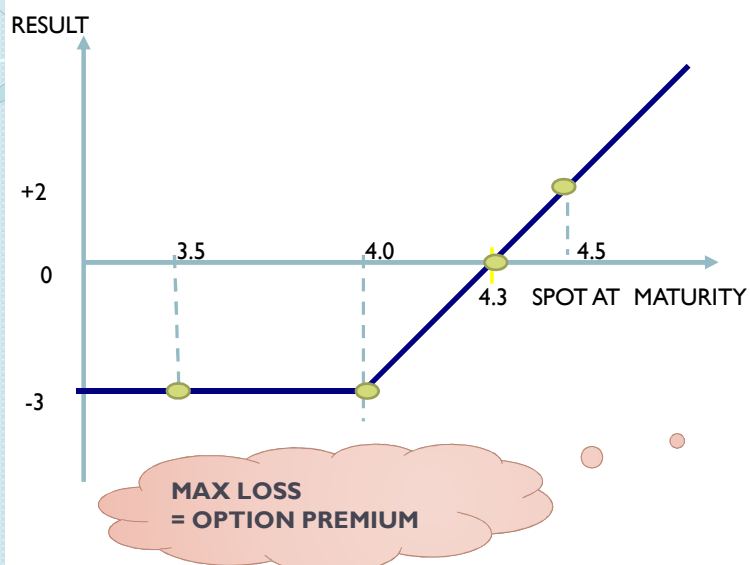
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Under contract

1 USD = 4 PLN

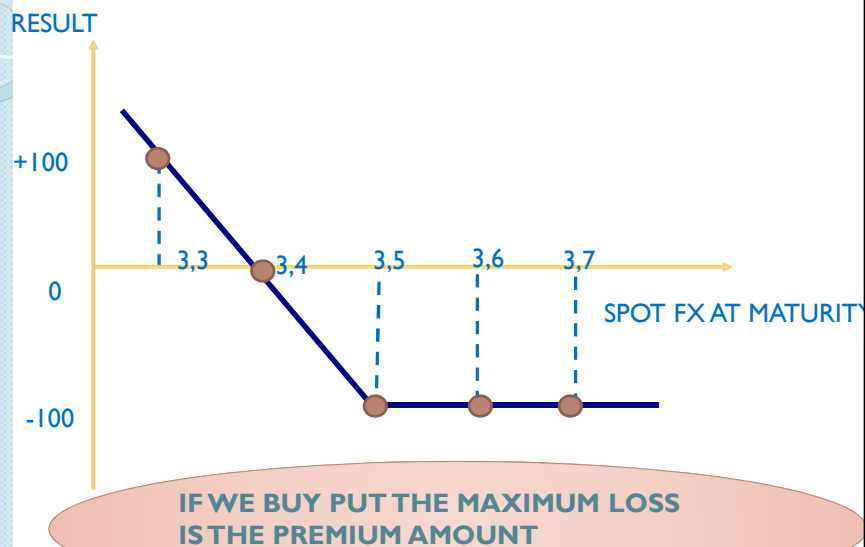
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Call: Strike = 4 PLN/USD



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LONG PUT: Strike = 3,5 USD/PLN



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Lufthansa – case study

- January 1985 – order for 20 Boeings 737
- Delivery: next year
- Payment \$500M at delivery
- Exchange rate at contract date DM 3.2/\$



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What can be done?

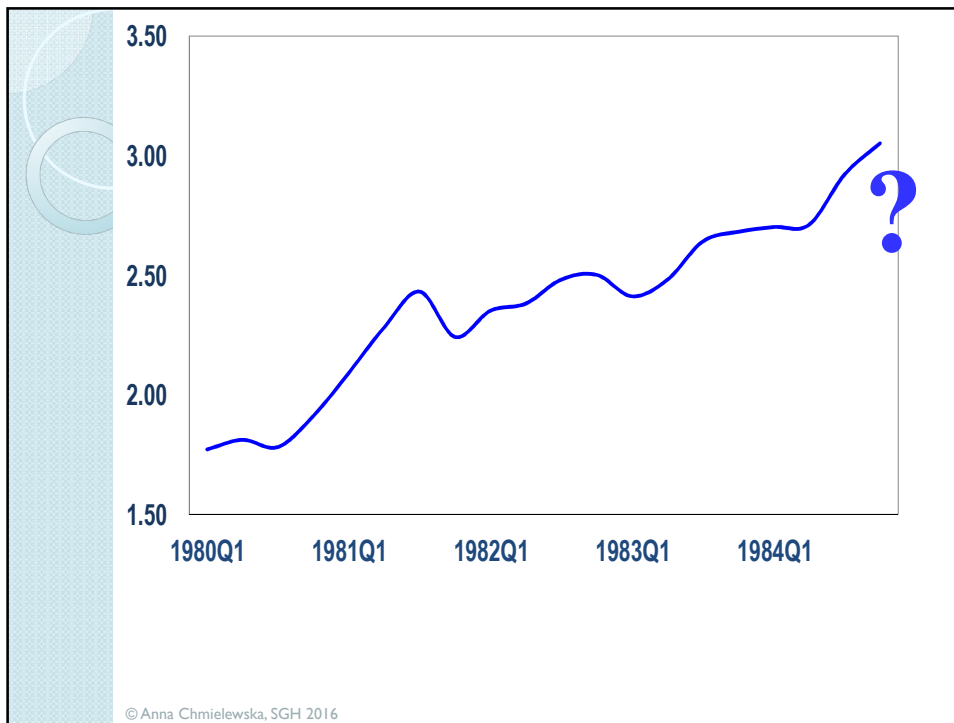
- What choices can be made
- What did Heinz Ruhnau do?
- What were the consequences?

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What made the selection tricky?

- USD had appreciated against DM
- Analysts' consensus indicated that the trend was to revert: USD was expected to depreciate against DM (as the terms of trade in the US have already weakened). Nobody knew when and by how much.
- Heinz Ruhnau decided \$500M is too much risk for his company – therefore it needs to be hedged
- Spot = Forward

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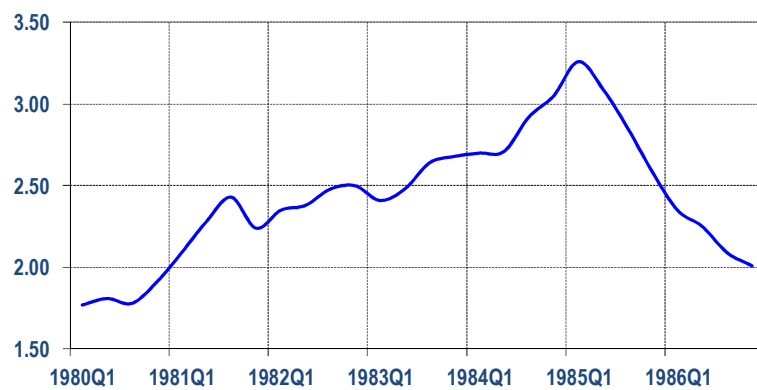
Ruhnau strategy: 50-50

- \$250M unhedged
- Forward hedge for \$250M



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A year later: 2.3DEM/USD



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What were the results

Lufthansa costs:

- Unhedged portion:
 $\$250\text{mio} * \text{DM } 2.3/\$ = \text{DM } 575\text{mio}$
- Hedged portion:
 $\$250\text{mio} * \text{DM } 3.2/\$ = \text{DM } 800\text{mio}$
- Total DM 1,375,000,000

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How did it compare vs alternatives?

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I. No hedge

- No hedge – wait and pay
- Dollar has deoreciated in 1985 from DM3.2/\$ in 1985 down to DM2.3/\$ w 1986

The investment cost

$$\$500M * DM 2.3/\$ = DM 1,150,000,000$$

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2. Forward hedge

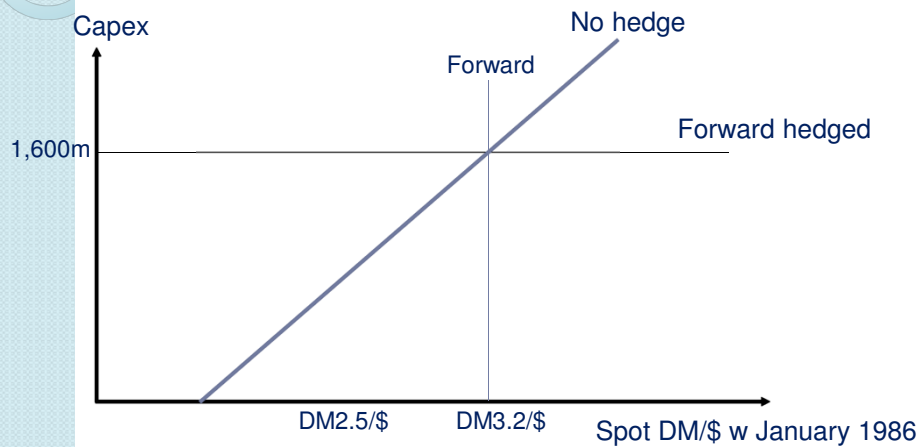
- Forward and securing financing to get it settled
- Assuming all was forward hedged at DM 3.2/\$ the investment cost would be:

$$\$500M * DM 3.2/\$ = DM 1,600,000,000$$



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Possible outcomes



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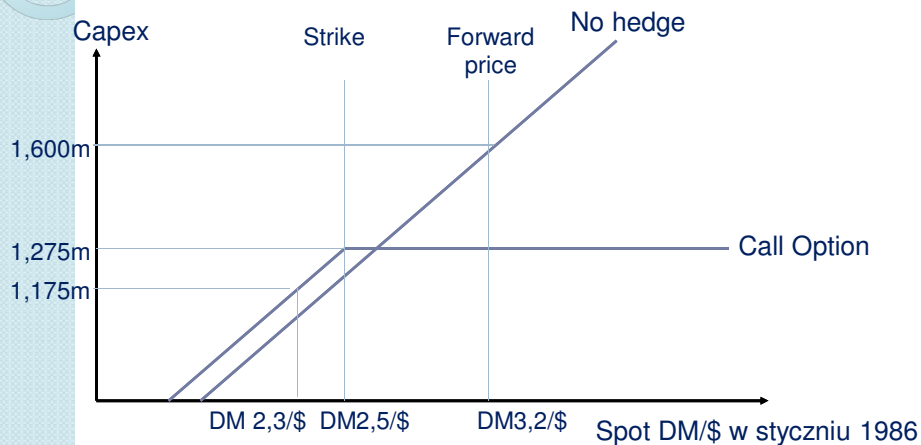
3. Option strategy

- Purchase of FX options covering \$500M
- Possible options with strike at DM 2.5/\$ paying 1.5%
- Premium:
 $\$500,000,000 * 1.5\% * DM\ 3.2/\$ = DM\ 24,000,000$
- Alternative cost (4.5%) for premium: 25,080,000
- January 1986: DM 2.3/\$ no execution
- Cost:
 $\$500M * DM\ 2.3/\$ + DM\ 25.08M =$
 $= DM\ 1,175,080,000$



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Outcomes



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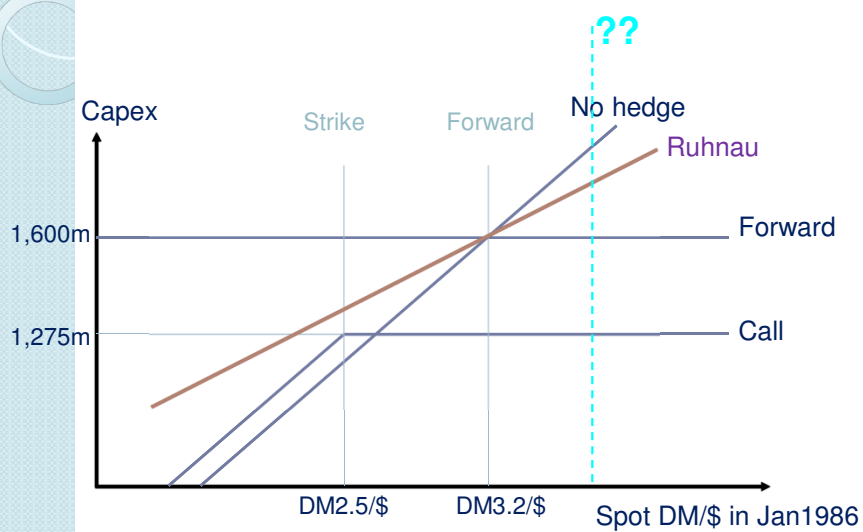
3. Options

- January 1986: DM 2.3/\$ no execution
- We assume „option may be useful”
- Maximum cost is calculated assuming option strike, here DM 2.5/\$
- $\$500\text{M} \times \text{DM}2.5/\$ + \text{DM } 25.08\text{M} =$
- $=\text{DM } 1,275,080,000$



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Spektrum wyników



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And what would be in opposite situation?

1. No hedge	More expensive!!!
2. Forward	No change
3. Option	A bit more expensive (max 1,275,080,000)
4. Ruhnau	More expensive!!!

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 **HOW WOULD YOU
ASSESS RUHNAU
STRATEGY?**

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Hedging – An enemy or friend

For:

- Financial planning
- Bankruptcy
- limiting uncertainty
- selective approach allows to tune to corporate situation

Against

- Limits opportunity gains
- At shareholders cost
- Are markets in equilibrium
- Financial consequences

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How to decide?

Available instruments („inexpensive”)
forward, future, opcje na FX i IR

Your choice should take into account

1. Liquidity
2. Corporate risk aversion
3. Expectations

A. If shds believe the outcome of market move would be beneficial – **chose options**

B. Otherwise – **select forward**

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