BANKING

T06 – Market Risk II

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Overview

1.	Market risk overview
2.	Foreign exchange risk
3.	Interest rate risk
4.	Banking and Trading book
5.	IRRBB – Interest rate risk in the Banking book

Overview (2)

EXCHANGE
RATE RISK

COMMODITY
PRICE RISK

MARKET
RISK

EQUITY
PRICE RISK

INTEREST
RATE RISK

Market risk

FX risk

Bank's FX position can be measured applying several methods i.e. :

1) Measuring the **open FX position** and comparing this amount to RAS (internal threshold of the accepted amount of FX risk),

2) **Liquidity gap** is also taking into account the expected cash-flow structure of the receivables/payments in foreign currencies,

3) **FX Value at Risk model** – not to be interchanged with CVAR – Conditional VaR, we inspect FX changes instead of stock/asset prices (market volatility taken into account).

FX risk example

Before 2008, Hungarian banks borrowed heavily internationally and offered loans denominated in foreign currency both to households and firms. Borrowing in foreign currency meant a build-up of a large, unhedged foreign liability position in the balance sheet of households and firms.[1] These liabilities were largely denominated in Swiss francs and, to a lesser extent, in euros. By March 2009, the **Hungarian currency had depreciated by 26% against the euro, and by 66% against the Swiss franc** by November 2011, both relative to September 2008.

FX risk example   (and the interconnection of risks)

Adj Close

Task (1)
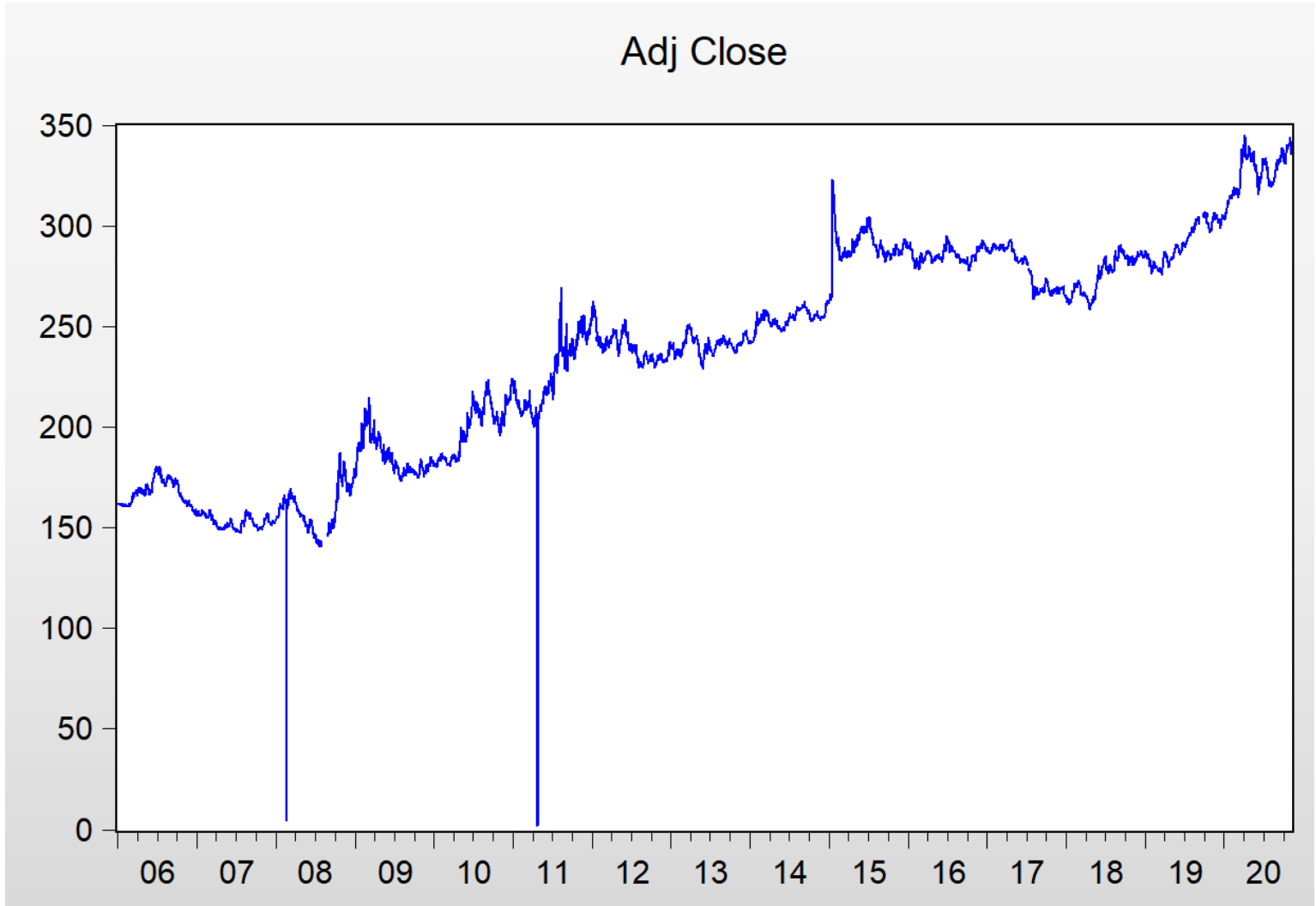
Suppose a client of Hungarian bank (HB) applied for a mortgage in 2007. Because rates in 2007 set by the Hungarian central bank were above 7 % (+ a profit margin of the bank lets assume another 2 %), it seemed rational to denominate this loan in CHF, where SNB set the interest rates slightly less than 2 % (and again, for simplicity, let's assume equal profit margin of 2 % for CHB). We assume the loan was granted on 1.1.2007 with an agreed 5 year interest rate fixation. Payments are to be made yearly in a total of 5 installments.

Requested loan :   4 300 000 HUF

IR mortgage (HB):   9 % p.a.

IR mortgage (CHB):   4 % p.a.

Fixation for both cases: 5 years

Task (1)

1) Determine the yearly mortgage payment in HUF and in CHF as of January 2007. Show the difference caused by 5 % lower interest rate.

   (for simplicity consider using PMT(), IPMT() and PPMT() functions in Excel to determine correct value)

2) Calculate the differences in yearly installments due to changes in exchange rates (assuming unchanging interest rates).

3) Construct a similar, but complete monthly schedule of payments of this 30 year mortgage with a 3Y interest rate fix. Determine into which gaps we should aggregate which payments/cash-flows.

Market risk

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Market risk

IR risk example - HUF

The National Bank of Hungary held its benchmark base rate unchanged at 0.6 percent and the overnight deposit rate at -0.05 percent on October 20th of 2020, as expected after the annual inflation rate slowed to a three-month low of 3.4% in September. Still, it remains above the 3 percent NBH's medium term target. At the same time, the overnight and one-week collateralised lending rates were also kept at 1.85 percent. source: National Bank of Hungary

Market risk

IR risk example - CHF

The Swiss National Bank kept its policy rate at -0.75 percent and the interest rate it charges on overnight deposits it holds for commercial banks at -0.75 percent during its September meeting, aiming to cushion the negative impact of the pandemic on economic activity and inflation. The central bank also said it is willing to intervene more strongly in the foreign exchange market as the Swiss franc remains highly valued. Policymakers noted that interest rates will probably remain at current levels until at least 2022, saying that the inflation rate is set to average -0.6 percent this year, before getting back into positive territory in 2021 (0.1 percent) and increasing slightly further in 2022 (0.2 percent). source: Swiss National Bank

Market risk

Banking and Trading book separation

Problems

TRADING BOOK

Short term

Complex instruments

Smaller volume

Large cash flows

Rate Assumption "A"

Risk Methodology "1"

BANKING BOOK

Long term

Simple instruments

Higher volume

Smaller cash flows

Rate Assumption "B"

Risk Methodology "2"

No Common Business Volume Plan

Banking and Trading book separation

The **trading book** refers to assets held by a bank that are available for sale and hence regularly traded. The **trading book** is required under Basel II and III to be marked-to-market on a daily basis. The **banking book** refers to assets on a bank's balance sheet that are expected to be held to maturity.

Any instrument a bank holds for one or more of the following purposes must, when it is first recognized on its books, be designated as a **trading book instrument:**
> (1) short-term resale;
> (2) profiting from short-term price movements;
> (3) locking in arbitrage profits; or
> (4) hedging risks that arise from instruments meeting 1, 2 or 3 above.

Any instrument which is not held for any of the purposes listed above at inception, **must be assigned to the banking book.**

Market risk

Fig. 2 "Initial-Allocation" decision tree

Overall requirements — **Banking Book**

- Daily fair value through P&L
- No legal impediment to sell or hedge

Met

Not met

BB – Instrument is either

- Unlisted equity
- Allocated for securitisation warehousing
- Real estate holding
- Retail and SME credit
- Equity instrument in a fund to further requirements
- Derivative with one of the above listed instruments as underlying
- Held for the purpose of hedging a particular risk of a position in the types of instruments above

Not met

TB presumption as instrument is either

- Instrument held as accounting trading asset or liability
- Instrument resulting from market making activities
- Equity investment in a fund subject to further requirements
- Listed equity
- Trading-related repo style transaction
- Option including bifurcated embedded derivatives from instruments issued out of the banking book that relate to equity or credit risk

Not met

Trading intention

Purpose is either
- Short-term resale
- Profiting from short-term price movements
- Looking in arbitrage profits
- Hedging risks arising from instruments meeting above criteria

Instrument is either
- Part of CTP
- Managed on a trading desk
- Giving rise to a net short credit or equity position in the banking book

Not met

Not met

Met

Raise request for banking book assignment — **Trading Book**

Until ECB approval available

Market risk

IRRBB – types of risks (3+1?)

1. GAP risk

- arises from the term structure of banking book instruments, and describes the risk arising from the timing of instruments' rate changes. The extent of gap risk depends on whether changes to the term structure of interest rates occur consistently across the yield curve (parallel risk) or differentially by period (non-parallel risk)

2. Basis risk

- describes the impact of relative changes in interest rates for financial instruments that have similar tenors but are priced using different interest rate indices – PRIBOR, EURIBOR etc.

IRRBB – types of risks (3+1?)

3. Option risk

- Risk caused by changes in client behavior. We can distinguish between automatic embedded options and behavioral embedded options

(4) Credit Spread Risk

- While the three sub-types listed above are directly linked to IRRBB, CSRBB is a related risk that banks need to monitor and assess in their interest rate risk management framework. CSRBB refers to any kind of asset/liability spread risk of credit-risky instruments that is not explained by IRRBB and by the expected credit/jump to default risk.

- The institutions can decide to manage CSR as a standalone risk, or they can include this risk in the IRRBB management framework

IRRBB

Product	Dimensions influencing the exercise of the embedded behavioural options
Fixed rate loans subject to prepayment risk	Loan size, loan-to-value (LTV) ratio, borrower characteristics, contractual interest rates, seasoning, geographical location, original and remaining maturity, and other historical factors. Other macroeconomic variables such as stock indices, unemployment rates, GDP, inflation and housing price indices should be considered in modelling prepayment behaviour.
Fixed rate loan commitments	Borrower characteristics, geographical location (including competitive environment and local premium conventions), customer relationship with bank as evidenced by cross-products, remaining maturity of the commitment, seasoning and remaining term of the mortgage.
Term deposits subject to early redemption risk	Deposit size, depositor characteristics, funding channel (eg direct or brokered deposit), contractual interest rates, seasonal factors, geographical location and competitive environment, remaining maturity and other historical factors. Other macroeconomic variables such as stock indices, unemployment rates, GDP, inflation and housing price indices should be considered in modelling deposit redemption behaviour.
NMDs	Responsiveness of product rates to changes in market interest rates, current level of interest rates, spread between a bank's offer rate and market rate, competition from other firms, the bank's geographical location and demographic and other relevant characteristics of its customer base.

IRRBB – Option risk on mortgage loans

Clients depending on interest rates may react differently and prefer prepaying or refinancing their loans. This can also be caused due to a significant new competitor joining the market.

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While assessing IRRBB we must consider the following:

1. How to treat NPLs in this analysis
2. Conditional cashflows based on interest rate scenarios

Prepayment model based on segments and specific client behaviour

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Product and its characteristics

Client behaviour and characteristics

Market risk in the Banking book

IRRBB – Option risk on deposits

	Interest sensitive	Nonsensitive
Stable	Transactional deposits on current accounts	
Volatile	Part of clients is monitoring the changes in interest rates and react quickly to positive changes	Some clinets do not monitor the market conditions, even when significant chesin IR happen, they do not react

Deposit model based on segments and specific behaviour for NMD's

While assessing IRRBB we must consider the following:

1. Stable part of deposits is mapped according to a deposit model
2. Volatile deposits are assessed in terms of their interest sensitivity and mapped to the gap analysis accordingly.

Product and its characteristics

Client behaviour and characteristics

Market risk in the Banking book

IRRBB risk measures – Economic Value of Equity

- There are 6 prescribed scenarios for stress-testing of IRRBB
- They consider both para llel and nonparallel shifts/twists of the yield curve

EVE - Baseline and six shocks

Legend:
- Short up
- Steepener
- Parallel up
- Yield curve
- Parallel down
- Flattener
- Short down
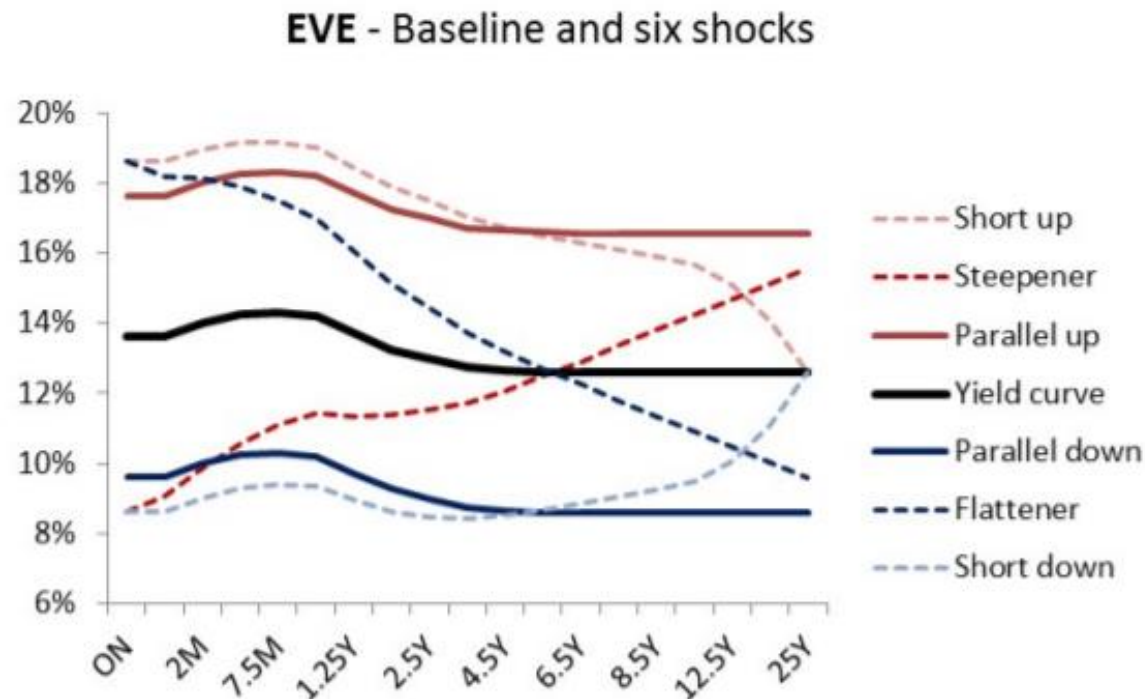
IRRBB risk measures – Net Interest Income

The bank does not know for what rate they will reinvest cash received as repayment of the loan

Risk stemming from mismatch of maturities

Loan with fixed rate with 1 Y tenor

Term deposit with fixed IR and 5 Y tenor

Solution of this mismatch?
A) Hedging using derivatives
B) Natural hedging – purchasing bonds etc.

There are following options:
a) IR decreases – income from interest is lower in 2-5Y compared to Year 1
b) IR stay on the same level – interest income is same
c) IR increase – profit for 2-5Y is higher than in Year 1

In case of a sharp decrease of NII the bank can realize a loss. This source of income is prominent for Czech banks.

IRRBB risk measures – Net Interest Income

How would you resolve this mismatch using strategy A) and strategy B) ?

A) Combination of two IRS swaps in which the bank will pay a fixed rate and receive variable rate (i.e. PRIBOR) for 1 Year and a second IRS with a 5 year tenor where the bank will pay a variable rate and receive a fixed rate.

B) Balance sheet structure management – the bank can purchase a bond with a 5 year tenor and fixed interest rate and secondly getting a loan with 1 year tenor and fixed rate on the money market.

In this case we must also consider secondary effects, although we have managed to decrease Market risk, we have increased Credit risk, as with the increasing amount of operations there is a higher chance of the counterparty default and other associated risks such as liquidity risk in case of accepted collateral.

Market risk in the Banking book

IRRBB risk measures – EVE + NII

Economic Value of Equity Profile					
Category	-100	Base	+100	+200	+300
EVE - Scenario	114,652,217	124,732,750	124,561,279	120,536,261	112,635,050
EVE Volatility - Scenario	-8.08%		4.35%	0.97%	-5.64%
EVE Ratio - Scenario	9.14%	10.11%	10.33%	10.23%	9.78%
EVE - Base	111,577,717	119,373,250	116,026,779	109,066,761	98,390,550
EVE Volatility - Base	-6.53%		-2.80%	-8.63%	-17.58%
EVE Ratio - Base	8.91%	9.72%	9.69%	9.35%	8.65%
Variance from Current Position					
EVE	3,074,500	5,359,500	8,534,500	11,469,500	14,244,500
EVE Volatility	-1.55%	0.00%	7.15%	9.61%	11.93%
EVE Ratio	0.22%	0.39%	0.64%	0.88%	1.13%

Net Interest Income Profile					
Category	-100	Base	+100	+200	+300
NII - Scenario	35,695,996	37,063,643	37,695,157	38,035,767	38,325,875
NII Volatility - Scenario	-3.69%		1.70%	2.62%	3.41%
NII - Base	36,220,718	37,302,420	37,647,695	37,717,372	37,730,573
NII Volatility - Base	-2.90%		0.93%	1.11%	1.15%
Variance from Current Position					
NII	(524,722)	(238,777)	47,462	318,395	595,303
NII Volatility	-0.79%		0.78%	1.51%	2.26%
ROA	-0.04%	-0.02%	0.00%	0.03%	0.05%
NIM	-0.05%	-0.02%	0.00%	0.03%	0.05%
Yield on Loans	-0.05%	-0.02%	0.00%	0.03%	0.06%

IRRBB recap

Variations of the EVE under 6 scenarios

- Own equity excluded
- Margin and spread flows included or not
- Run-off BS in a Re-pricing view

Re-pricing gap

Scope of application: Mandatory for all banks within the scope of application set out in Section III.

Content: Quantitative information.

Frequency: Annual, as at the bank's financial year-end.

Format: Fixed.

Accompanying narrative: Commentary on the significance of the reported values and an explanation of any material changes since the previous reporting period.

In reporting currency	ΔEVE		ΔNII	
Period	T	T-1	T	T-1
Parallel up				
Parallel down				
Steepener				
Flattener				
Short rate up				
Short rate down				
Maximum				
Period	T		T-1	
Tier 1 capital				

Variations of the NII on one year under 2 scenarios

- The whole BS concerned, with margin/spreads included
- Constant BS over one year (renewed) in a prospective view

ΔNII in other internal IR scenarios

*Sensitivity of EVE and NII to changes in modeling assumptions*

Conclusion

- Interconnection between Credit and Market risk is very strong

- All above mentioned risks can be measured for each regulatory portfolio separately (BB/TB) but for some it makes more sense to look at the overall picture and assess risk on a consolidated basis.

- Reassigning assets from one regulatory portfolio to another is strictly regulated and irreversible!

- EVE and NII are measures of interest rate shocks on economic value of bank's equity and net interest income. Both measures are required by the regulation

- Maturity mismatches can be effectively resolved by strategic balance sheet structuring or hedging.

Thank you for your attention.

Reading for the this seminar
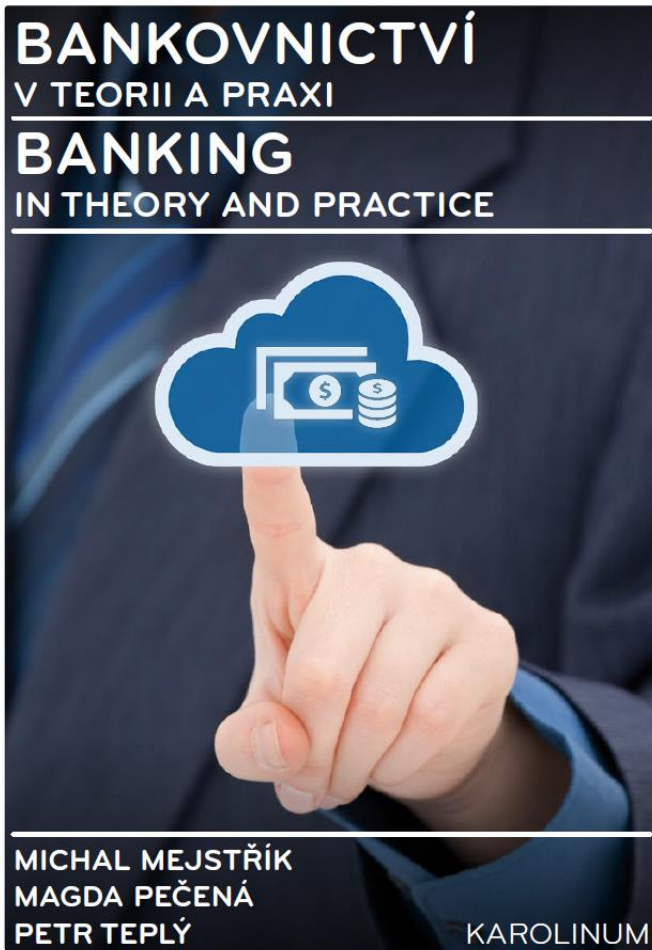
✓ **Chapter IX.S – Market risk measurement**

List of references

(1) Ranciere, R, A Tornell, and A Vamvakidis (2010), "Currency mismatch, systemic risk and growth in emerging Europe", Economic Policy, 25:597-658.

(2) https://www.moodysanalytics.com/-/media/whitepaper/2017/interest-rate-risk-in-the-banking-book-meeting-the-practical-challenges.pdf