Financial Instruments and Pricing
Problems 2

Jakub Czartowski
Jakub Janarek
Michael Olesik
Piotr Przedwojski

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1 Ex 1

	CPN 2018	CPN 2019	CPN 2020	Acc.Int.	Dirty Price
30/360 US	1 000.00	1 000.00	1 000.00	647.22	10 627.22
30E/360	1 000.00	1 000.00	1 002.78	652.78	10 632.78
ACT/ACT	1 000.00	1 000.00	1 000.00	649.32	10 629.30
ACT/365 (Fixed)	1 000.00	1 000.00	1 002.74	649.32	10 629.30
ACT/360	1 013.89	1 013.89	1 016.67	658.33	10 638.30

Table 1: 第一表

2 Ex 2

Name	Maturity	Nominal interest %	Clean Price	Accrued Interest	Dirty Price	YTM
OK0419	25/04/2019	-	99.43	0	994.30	1.12%
PS0719	25/07/2019	3.25	101.50	7.66	1022.66	1.26%
PS0420	25/04/2020	1.50	100.09	7.27	1008.17	1.44%
OK0720	25/07/2020	-	97.47	0	974.70	1.46%
PS0422	25/04/2022	2.25	100.45	10.91	1015.41	2.11%

Table 2: 第二表

3 Ex 3

Name	Maturity	Average Lifetime	Duration	Modified Duration
OK0419	25/04/2019	0.515	0.515	0.509
PS0719	25/07/2019	0.764	0.764	0.755
PS0420	25/04/2020	1.50321	1.5003	1.47871
OK0720	25/07/2020	1.764	1.764	1.739
PS0422	25/04/2022	3.3939	3.38535	3.31526

Table 3: 第三表

4 Ex 4

Δy	exact	MD approximation
- 0.5%	11.18	11.09
- 0.1%	2.22	2.21
0%	0	0
+ 0.1%	-2.21	-2.21
- 0.5%	-11.0	-11.09

Table 4: 第四表

5 Ex 5

Let us consider Present Values and Modifed Durations given in the vectors below:

$$PV = \begin{pmatrix} -1 \\ -1 \\ 2 \\ x \\ -x \end{pmatrix} \text{ bln PLN}, \quad MD = \begin{pmatrix} 1 \\ 3 \\ 1.5 \\ 10 \\ 1 \end{pmatrix} \text{ yrs,} \tag{5.1}$$

where x is the amount of money selled and bought by the bank in bond. In order to hedge the possible risks of parallel shifts of the yield curve the following equation has to be fulfilled:

$$(PV g_{ij} MD)\Delta y = (PV \cdot MD^T)\Delta y = 0 \tag{5.2}$$

$$g_{ij} = \delta^i_j \tag{5.3}$$

The equation in terms of variable x is giben by:

$$1 - 9x = 0 \longleftrightarrow x = 0.(1) \text{ bln PLN} \tag{5.4}$$

Thus we need to sell and buy 111.(1) mld PLN worth of bonds.

6 Ex 6

We calculate Modified Durations and Convexities according to the formulas given in Lecture 2

$$MD = -\frac{1}{PV}\frac{\partial PV}{\partial y}$$
$$C = \frac{1}{PV^2}\frac{\partial^2 PV}{\partial y^2}$$

	Bond A	Bond B
MD	3.43125	3.43124
C	15.3592	14.913

Table 5: 第五表

Δy	-5%	5%
Bond A	13.76%	-11.07%
Bond B	15.98%	-12.78%

Table 6: 第六表