

## Assignment 2 (Part 2)

### Background

On March 5, 2008, as part of its efforts to strengthen its capital during the 2007-2008 financial crisis, UBS Group AG (UBSG) issued the 2-year Mandatory Convertible Notes (MCNs) described in the simplified term sheet in Figure 1.

On that day, the closing price of UBSG stock was CHF 32.24.

### Working Assumptions

Assume for simplicity that:

- As of March 5, 2008, the probability of UBSG defaulting over the next 2 years was negligible;
- UBSG was not expected to pay any dividends over the next 2 years;
- The overnight risk-free rate on March 5, 2008 was 2.5% and expected to remain constant at this level;
- There are 21 trading days per calendar month.

### Questions

Answer the following questions using the binomial model with time step  $h = 1/252$  (one trading day) as needed.

- (a) Plot the number of UBSG shares to be delivered to the holders of the MCNs described in the term sheet in Figure 1 upon mandatory conversion at maturity versus the (unknown) UBSG's stock price on the maturity date. In addition, plot the value of those shares on the maturity date versus the UBSG's stock price on that date.
- (b) The Excel spreadsheet *UBSG.xlsx* lists the daily closing prices of UBSG's stock on the Swiss Exchange over the period from March 5, 2007 to March 5, 2008.<sup>1</sup> UBSG

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<sup>1</sup>All prices are in CHF.

paid a CHF 2.20 dividend on April 19, 2007. Use this data to estimate the volatility of UBSG stock as of March 5, 2008.

- (c) Determine the value on March 5, 2008 of the UBSG MCNs described in the term sheet in Figure 1 ignoring the early conversion right given to the holders.
- (d) Determine the value on March 5, 2008 of the UBSG MCNs described in the term sheet in Figure 1 taking into account the early conversion right given to the holders.
- (e) Was early conversion of the UBSG MCNs described in the term sheet in Figure 1 ever optimal? Would your answer possibly change if UBSG paid a dividend during the early conversion period and/or the MCN holders retained the right to the coupon payments upon early conversion? Clearly explain your reasoning.
- (f) What initial position in UBSG stock and overnight borrowing or lending should have been taken on March 5, 2008 in order to replicate a long position in the UBSG MCNs in the term sheet in Figure 1 with CHF 13,000 face value?
- (g) Determine the value on March 5, 2008 of the MCNs described in the modified term sheet in Figure 2 taking into account the early conversion right given to the holders.<sup>2</sup>
- (h) Plot the exercise boundary of the MCNs in the modified term sheet in Figure 2 and explain how the plot can be used to determine when the holders should have converted early.

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<sup>2</sup>The only difference between the term sheets in Figures 1 and 2 is in the specification of the Early Conversion Price.

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<b>1. General Terms</b>	
Description	2 year Mandatory Convertible Notes
Issuer	UBS Convertible Securities (Jersey) Ltd
Issue Date	March 5, 2008
Maturity Date	March 5, 2010 (unless the Notes are terminated early by the holder)
Aggregate Face Value	CHF 13 billion
<b>2. Coupon Payments</b>	
Coupon	9% of the Face Value, payable annually on March 5, 2009 and March 5, 2010 (unless the Notes are terminated early by the holder)
<b>3. Mandatory Conversion at Maturity</b>	
Mandatory Conversion Date	The Maturity Date
Final Price	UBS Group AG closing share price on the Mandatory Conversion Date
Minimum Conversion Price	CHF 51.48
Maximum Conversion Price	CHF 60.23
Mandatory Conversion	<p>The Notes will be redeemed via conversion into a number of UBS Group AG shares determined according to the following schedule:</p> <ul style="list-style-type: none"> <li>– If the Final Price is at or below the Minimum Conversion Price: Face Value / Minimum Conversion Price</li> <li>– If the Final Price is above the Minimum Conversion Price and below the Maximum Conversion Price: Face Value / Final Price</li> <li>– If the Final Price is at or above the Maximum Conversion Price: Face Value / Maximum Conversion Price</li> </ul>
<b>4. Voluntary Early Conversion by the Holder</b>	
Early Conversion Start Date	September 5, 2008
Early Conversion End Date	February 5, 2010
Early Conversion Period	The period starting on (and including) the Early Conversion Start Date and ending on (and including) the Early Conversion End Date
Early Conversion Date	Any trading day in the Early Conversion Period
Early Conversion Price	CHF 60.23
Voluntary Conversion	<p>The holder can convert the Notes during the Early Conversion Period into a number of UBS Group AG shares determined as follows: Face Value / Early Conversion Price.</p> <p>Upon early conversion, the holder will forfeit the right to receive all remaining Coupon Payments</p>

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**Figure 1:** Simplified Term Sheet for UBSG's Mandatory Convertible Notes

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Figure 2: Modified Term Sheet for UBSG's Mandatory Convertible Notes