Pricing Challenge

January 25, 2021

The Challenge

Your task is to determine the fair value of an equity-linked note (ELN) on **March 16, 2020**. The note was issued on January 7, 2020. The ELN entitles the holder to payments (coupon and principal) that are contingent upon the values of three underlying equity indices at various points in time.

ELN's are generally the liabilities of the issuing entity. Consequently, the credit risk of the issuer is an important consideration for determining fair value of the note. For the purposes of this exercise, you should assume that the issuer of the ELN is credit-risk-free.

ELN Description

The ELN entitles the holder to receive payments of the Payout Amount, depending on the the value of the underlying equity indices. So long as the Final Level of each Underlying is at or above its Strike on the Final Fixing Date, the Final Redemption Amount is equal to 100% of par. If the Final Level of at least one Underlying is below its Strike on the Final Fixing Date, the potential loss associated with an investment in the ELN is linked to the negative performance of the worst-performing Underlying. The payments of the Payout Amount are dependent on the development of the value of the Underlyings and thus conditional. A total or substantial loss of the amount invested in the ELN is possible, although any such loss is limited to the amount invested.

Underlying	Bloomberg Ticker	Initial Level	Strike (70%)	Trigger Level (97%)	Payout Threshold (70%)
FTSE MIB Index	FTSEMIB INDEX	$23,723.38$	$16,606.366$	$23,011.6786$	$16,606.366$
Hang Seng China Enterprises Index	HSCEI INDEX	$11,079.79$	$7.755.853$	$10,747.3963$	$7.755.853$
NASDAQ–100 Index	NDX INDEX	$8,846.449$	$6,192.5143$	$8,581.0555$	$6,192.5143$

Issue Details

1. Issue Price: 100% of par

2. Initial Fixing Date: January 7, 2020 (January 8, 2020 for the Hang Seng China Enterprises Index), being the date on which the Initial Level and the Strike and the Trigger Level and the Payout Threshold are fixed.

3. Final Fixing Date: January 9, 2023, being the date on which the Final Level will be fixed.

4. Final Redemption Date: January 17, 2023, being the date on which the ELN will be redeemed at the Final Redemption Amount, unless previously redeemed.

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Payout

1. Payout Amount: with respect to any Payout Date, an amount in cash calculated in accordance with:

$$\text{Par} \times (6.8\%)\,\frac{n}{N}$$

where,

n = the number of Payout Observation Dates during the relevant Payout Observation Period on which the level of none of the Underlyings at the Valuation Time was below its Payout Threshold

N = the total number of Payout Observation Dates during the relevant Payout Observation Period.

2. Payout Observation Dates: each day during the relevant Payout Observation Period which is an exchange business day for all Underlyings, being the dates on which the level of each Underlying at the Valuation Time is observed for purposes of determining whether any Payout Amount shall be paid on the relevant Payout Date.

3. Payout Observation Periods: with respect to any Payout Date, the relevant Payout Observation Period specified in the table hereafter.

4. Payout Threshold: with respect to each Underlying, the relevant Payout Threshold specified in the table above, being 70% of its Initial Level.

5. Payout Dates: as specified in the table hereafter, being the dates on which the Issuer shall pay any Payout Amount to the holders, unless previously redeemed.

Payout Date	Payout Observation Period
April 14, 2020	Jan 7, 2020 (excl.) to April 7,2020 (incl.)
July 14, 2020	April 7, 2020 (excl.) to July 7, 2020 (incl.)
Oct 14, 2020	July 7, 2020 (excl.) to Oct 7, 2020 (incl.)
Jan 14, 2021	Oct 7, 2020 (excl.) to Jan 7, 2021 (incl.)
April 14, 2021	Jan 7, 2021 (excl.) to April 7, 2021 (incl.)
July 14, 2021	April 7, 2021 (excl.) to July 7, 2021 (incl.)
Oct 14, 2021	July 7, 2021 (excl.) to Oct 7, 2021 (incl.)
Jan 14, 2022	Oct 7, 2021 (excl.) to Jan 7,2022 (incl.)
April 14, 2022	Jan 7, 2022 (excl.) to April 7, 2022 (incl.)
July 14, 2022	April 7, 2022 (excl.) to July 7, 2022 (incl.)
Oct 14, 2022	July 7, 2022 (excl.) to Oct 7, 2022 (incl.)
Jan 17, 2023	Oct 7, 2022 (excl.) to Jan 9, 2023 (incl.)

Early Redemption

1. Trigger Redemption: Upon the occurrence of a Trigger Event on any Trigger Observation Date, the Issuer shall redeem the ELN's on the relevant Trigger Redemption Date at the Trigger Redemption Price.

2. Trigger Level: with respect to each Underlying, the relevant Trigger Level specified in the table above, being 97% of its Initial Level.

3. Trigger Observation Dates:

July 7, 2020

Oct 7, 2020

Jan 7, 2021

April 7, 2021

July 7, 2021

Oct 7, 2021

Jan 7, 2022

April 7, 2022

July 7, 2022

Oct 7, 2022

4. Trigger Redemption Price: an amount in cash equal to 100% of par.

5. Trigger Event: if the level of each Underlying at the Valuation Time on any Trigger Observation Date is at or above its Trigger Level.

6. Trigger Redemption Dates:

July 14, 2020

Oct 14, 2020

Jan 14, 2021

April 14, 2021

July 14, 2021

Oct 14, 2021

Jan 14, 2022

April 14, 2022

July 14, 2022

Oct 14, 2022

Final Redemption

1. Final Redemption Amount

   (i): If the Final Level of each Underlying is at or above its Strike, a cash amount equal to 100% of par; or (ii) If the Final Level of at least one Underlying is below its Strike, a cash amount equal to par multiplied by the ratio of the Final Level of the Worst-Performing Underlying (Final Level Worst) divided by its Strike (Strike Worst), in accordance with the following formula:

$$\text{Par} \times \frac{\text{Final Level Worst}}{\text{Strike Worst}}$$

2. Worst-Performing Underlying: out of all the underlying's, the Underlying in respect of which its Final Level divided by its Strike results in the lowest value.

3. Initial Level: with respect to each Underlying, the relevant Initial Level specified in the table above, being 100% of its level at the Valuation Time on the Initial Fixing Date.

4. Strike: with respect to each Underlying, the relevant Strike specified in the table above, being 70% of its Initial Level.

5. Final Level: with respect to each Underlying, 100% of its level at the Valuation Time on the Final Fixing Date.

6. Valuation Time: with respect to each Underlying, the time with reference to which the Licensor/Index Sponsor calculates the closing Index level.

Deliverables

Your submission shoulid include (at a minimum):

- A detailed account of the valuation model you have developed to price the ELN, including all assumptions you have made

- A listing of all code written / employed to facillitate valuation