Greenback SLBs: an impact standardisation proposal

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Sustainability-Linked Bonds (SLBs) have great potential to drive transition when structured to incentivise a material improvement in the issuers' sustainability performance. The proposed "greenback SLB" uses an option perspective on how to make SLBs more ambitious and material.

DEFINITION 1: A "greenback SLB" *is a sustainability-linked bond where the expected pay-out of the step structure is at least one dollar (one percentage point) in absolute risk-discounted value, with an assumed 50% step probability.*

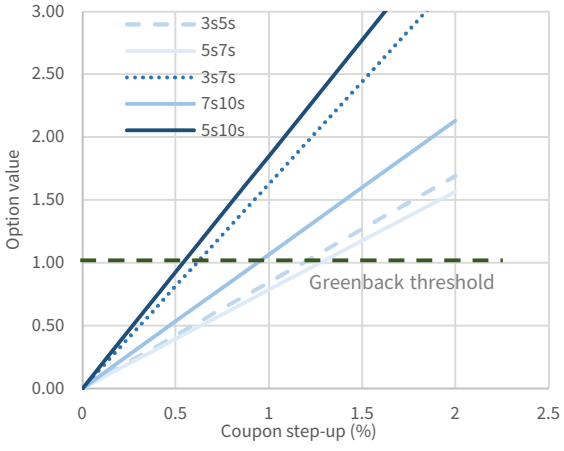
The greenback SLB is likely to provide higher coupon steps than prevailing market standards (Figure 1). This would mean a lower initial cost-of-capital for issuers and more defined sustainability hedging characteristics for investors. The definition has the advantage of adjusting coupon step-ups to market conditions and underlying issuer credit risk and would be a strong driver of sustainability incentives.

DEFINITION 2: A "standardised greenback SLB" *is where the coupon pay-out structure and maturity at primary issuance approximately align to the standard points on the CDS curve, i.e., 3y, 5y, 7y and 10y points (and 3s5s, 5s7s, 5s10s curves).*

Aligning SLB structures to facilitate hedging is a clear advantage for risk hedging and flow management. If the SLB step conditions are such that they are correlated to credit risk (which is often the case), then forwards can be used to hedge that change in credit risk. Standardised term structures along forwards also avoid back-loaded SLB structures.

Figure 1. Greenback thresholds for a step-up SLB, using EUR BBB risky discount factors, 4.5% fixed coupon and 50% prob. Penultimate row in table is the step-up required for a $1 optionality value, final row the commensurate SLB premium (lower coupon on the SLB versus an equivalent vanilla bond). Source: AFII.

Option value	with 50% prob /4.5% fixed coupon				
Disc: EUR BBB	Step structure				
Coupon step	3s5s	5s7s	3s7s	7s10s	5s10s
0	0.000	0.000	0.000	0.000	0.000
0.125	0.106	0.098	0.204	0.133	0.231
0.25	0.212	0.196	0.408	0.266	0.462
0.375	0.317	0.294	0.611	0.400	0.693
0.5	0.423	0.392	0.815	0.533	0.925
0.625	0.529	0.490	1.019	0.666	1.156
0.75	0.635	0.588	1.223	0.799	1.387
0.875	0.741	0.686	1.427	0.932	1.618
1	0.847	0.784	1.630	1.065	1.849
1.25	1.058	0.980	2.038	1.332	2.312
1.5	1.270	1.176	2.446	1.598	2.774
2	1.693	1.568	3.261	2.131	3.698
Step-up	118.1	127.6	61.3	93.9	54.1
Fixed discount	-22.3	-16.5	-16.5	-12.2	-12.2



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Introduction

The greenback[1] SLB definition and motivations are explained in technical detail in the following sections, with the key benefits summarised here:

- **A greenback SLB could serve as a benchmark for issuers of potential savings created by the SLB:** an issuer of a greenback step-up[2] SLB can more easily justify the extra cost of issuance if the potential to lower its cost-of-capital is at least a dollar in discounted terms.

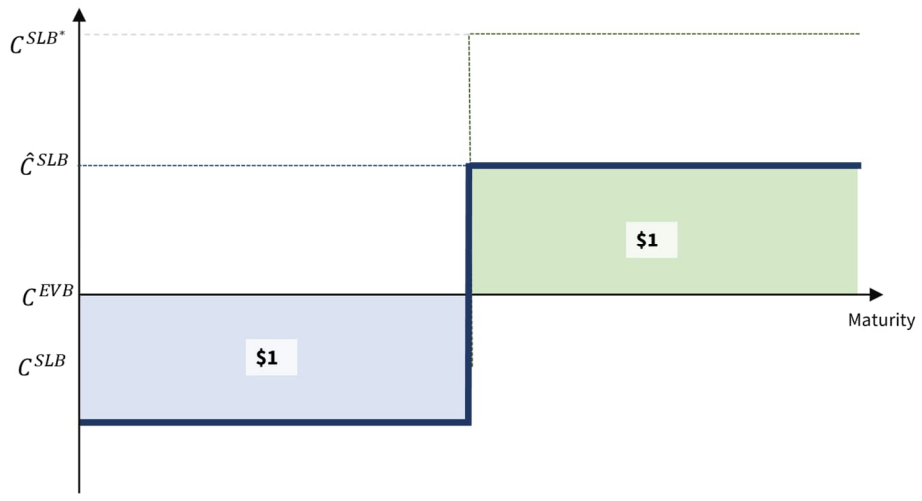
- **It could provide a benchmark for investors of the optionality value/sustainability hedging potential in the SLB:** the dollar expression helps in understanding the sensitivity of their investment to the Sustainability Performance Target (SPT), i.e. the hedging value. Given the constraints of managing portfolios, having the greenback as a rule of thumb can assist in determining priorities among various investment propositions. It also gives an easy measure to gauge potential payoff of the extra investment in due diligence and monitoring costs related to an SLB.

- **The greenback structure would focus investor and issuer discussion on the achievability of sustainability targets as other structural parameters are set.** The 50% assumed probability is a benchmark that should serve to provide a basis of discussion on the ambition level of sustainability targets. Pricing away from the 50% probability level will imply the market's assessment of this.

We believe that this will lead to a very focused discussion around the ambition level of sustainability targets, as those will be the key unknowns in the "trade". Another advantage is that ambitious targets will likely reduce the reputational risk concerns around step-ups sometimes aired by investors.

- **Standardised structural metrics should bring down cost of issuance/investment.** A standardisation on the pay-out time structure, based on credit hedging potential, should facilitate a quicker investor understanding and more efficient issuance process.

Figure 2. A greenback SLB structure. The expected value of the step-up is equivalent, on a discounted basis, to the value of the lower coupons being paid in the pre-step part of the deal.



[1] A "greenback" refers to the US currency in paper form, where denominations are USD1 or higher. For the purposes of our definition, it is generalised to absolute values to incorporate both step-up and step-down structures. "Notes on Risk-Neutral Pricing of SLBs and Step-down Structures", AFII, 26 Oct 2022, discusses the less common step-down structures.

[2] For the remainder of this note, we shall discuss SLBs in the context of the market standard of step-ups. Much of the reasonings can be mirrored to represent step-down SLBs. Please contact AFII to discuss further.

Exchanging front end lower coupons for back end higher coupons

Valuations of SLBs have two main components: the achievability of the sustainability targets (probability of step) and the optionality/the total cumulative value of coupon differentials.[3] The SLB can also be expressed in terms of two risk-neutral, no-arbitrage conditions:

- The SLB structure should be equal in value to an equivalent vanilla bond (EVB) structure.
- The non-step period of the SLB (call it *0…t-1*) should be equal in value to the expected value of the step-up period (*t…T*).

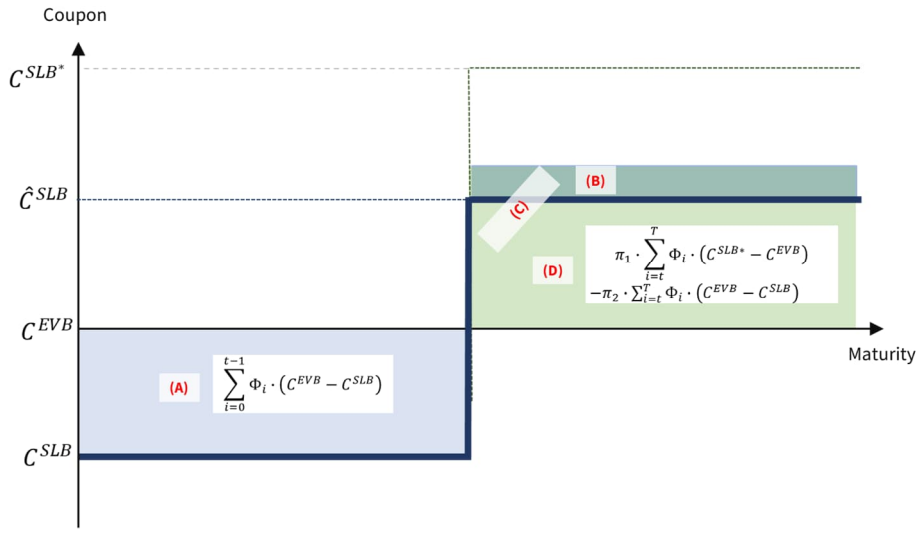
We illustrate this in Figure 3 below, which is a graphical representation of the following equation which relates the (discounted) value of the SLB coupons and the EVB:

$$\sum_{i=0}^{t-1} \Phi_i \cdot (C^{EVB} - C^{SLB}) = \pi_1 \cdot \sum_{i=t}^{T} \Phi_i \cdot (C^{SLB*} - C^{EVB}) - \pi_2 \cdot \sum_{i=t}^{T} \Phi_i \cdot (C^{EVB} - C^{SLB})$$

where Φ_i is the discount factor for time *i* (which runs from *0…t…T* where *t* is the step date and *T* is the maturity date), *C* is the coupon for the *EVB*, the start date SLB and the stepped up *SLB**. The probability to step is denoted π_1 with the non-step probability $\pi_2 = 1 - \pi_1$.

The terms in Equation (1) set the condition that (for the investor), the cost of having a lower fixed SLB coupon up until the step date *t* (the left side of the equation, (A) in Figure 3) should not be greater than the expected gain from the optionality (the right side of the equation, (C)-(B)=(D) in Figure 3). The expected gain is equal to the probability to step multiplied by the discounted value of the stepped-up coupons minus the cost if the step does not happen.

Figure 3. Overview of the coupon structure and risk-neutral relationships in an SLB. The pre-step period "loss" to the investor, the area in (A), needs to be compensated by an equivalent (discounted) expected value in the backend (post-step), area (C)-(B)=(D). $\hat{C}^{SLB}$ is the expected value-equivalent of the coupon step-up C^{SLB*}.



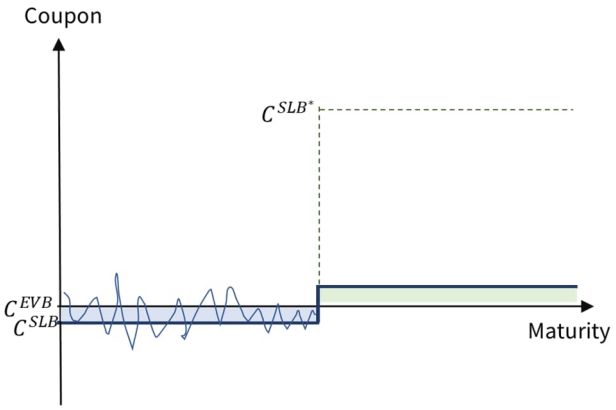
[3] A longer discussion on the separation of probability versus steps can be found in "An option pricing approach for sustainability-linked bonds", AFII, 18 Mar/8 Nov 2022. The paper shows how in cases where probabilities can be inferred from certain statistical processes (and calibrations), traditional option pricing can be applied.

The greenback definition

This framework gives an analytical way to discuss the common **objections to SLBs** that focus on either **lack of ambition or lack of financial materiality**.[4] Referring to Figure 3, both these factors relate to saying that area (D)=(A) is "too small".

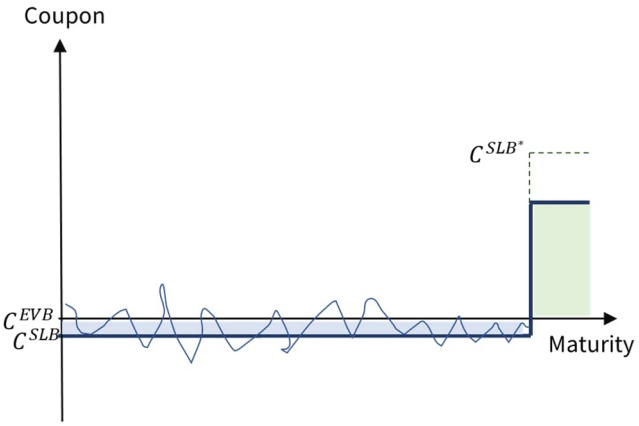
Lack of ambition is equivalent to a low probability to step, π_1, illustrated in Figure 4.[5] Even if the discounted value of the step-up is substantial, it is deflated in terms of expected value due to the low probability for it happening. The issue with this, as highlighted by the squiggly line, is that it becomes very difficult to discern any option value in it, for example if one needs to take modelling error margins into account. In this situation, the issuer will have a hard time to obtain a lower cost-of-capital, as the investor gets near zero upside.

Figure 4. An SLB with a low probability for the step to happen, making the expected step value and optionality small.



In Figure 5 we instead show the case where the pay-out is not financially material, even if there is a high probability of it happening, e.g., because of low coupon steps or a short pay-out period. This is the most obvious example of "weak" SLBs, where there issuances would have, for example, only one or two pay-outs of stepped up coupons, if they were to happen.

Figure 5. An SLB with a low financial value of the step-up happening, making the expected step value and optionality small.



Both of these cases provide less-than-compelling arguments for investors and issuers in SLBs alike: why should one put the effort into analysis of something that neither will provide a measurably lower cost-of-capital (if successful), nor a significant financial hedge (if sustainability conditions are not met)[6]? Geometrically speaking, we need to see area (A) = area (D) to increase such that they are considered adequate in terms of issuer compensation, as well as investor potential upside.

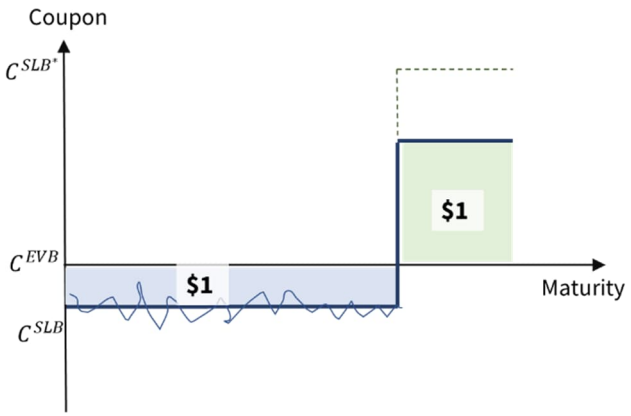
[4] See, for example, "SLBs Need to Address Credibility Issues to Resume Growth", ESGToday, 15 Feb 2023. There are certainly counter-arguments being made, e.g. "SLBs: complementary my dear Investor", AFII, 13 Apr 2023, and "In defence of SLBs", GlobalCapital, 4 Apr 2023.

[5] An ambitious target will be harder to achieve and, thus, generate a higher probability of a step up.

[6] On the merits of hedging, see "Understanding dynamics between sustainable and traditional debt: To SLB or not to SLB?", AFII, 26 Jan 2023.

To find a solution to this issue, we define the **greenback SLB** as one where the financial materiality is worth at least one dollar (1% of nominal) of the bond price, assuming a 50% probability of the step to happen.[7] The geometrical equivalent is to declare a minimum size of 1 of areas (A) = (D) in Figure 3, and illustrated in Figure 6. The combination of a high enough probability to step and the financial value of the step-up is large enough ($1) to make the pricing of the SLB fixed coupon significantly different from the EVB.

Figure 6. Greenback SLB: jointly, the value of the probability of step and the financial upside of the step-up is $1.



What assumptions do we need to make in order to have a common understanding of whether an SLB is a greenback or not?

- Step-up date *t* and maturity *T*. In the section "Standardising coupon pay-outs based on forward risk pricing" we outline some arguments on more standard pay-out structures than in the market today, based on the CDS curve trading points 3y, 5y, 7y and 10y.
- Discounting curve/method, Φ_i. This should be relatively straightforward to decide on, and if using a risk- discounting approach (e.g., using a discount curve from bonds with a similar rating to the SLB) the method has several benefits as discussed in "Advantages to a price approach" below.
- Probability of step, π_1. We set a fixed probability to step at 50%, in a thinking similar to how recovery values are assumed to be 40% in terms of making CDS pricing models work in practice. This number is, in our opinion, substantially above what is being implied in the market today, where targets are often considered to be easily achievable, and therefore giving a low probability to step. That in turn is a (quantitative) reflection of a lack of ambition in many SLBs. The point here is to give a fixed point to which other variables could be calibrated: being able to look at sustainability targets such that there is a 50% chance of achieving them will give common grounds for discussions between investors and issuers.

  Clearly, once the structure of the other parameters has been set, the view of the probability to step will be key to valuation of the SLB. A further discussion of this is available in the section, "Step probabilities as a driver of the investor-issuer exchange" in our earlier AFII paper. In future research, we will return to various ways to infer probabilities, from expert estimates and scenario analysis to econometric analysis.

Given these assumptions/common understandings, one can simply evaluate what coupon with step-up (C^{SLB*}) is required to achieve a $1 optionality value in the SLB.[8] Furthermore, when having that number, one can also derive what the fixed coupon of the SLB should be, C^{SLB}. These numbers form the bottom rows of Figure 1 and Figure 7 overleaf.

[7] Bond pricing discussions are fraught with a mix of terminologies. Our "one dollar" definition comes from the literature often referring to bond pricing in terms of $100 as the nominal, and the greenback then diverging by at least $1 from the nominal.

[8] For computational simplicity, we assume that the option value is measured as the expected value of the step-up relative to an EVB.

Greenback or not: some examples

Below we provide several calculations on SLB structures[9] across the pay-out period (x-axis, also see section below) and step-up (y-axis).

Figure 7 (left), where greenback status (option value >1) is highlighted in green, shows the baseline case of an SLB in EUR with a 4.5% coupon, an assumed 50% step probability, and discounted using a EUR BBB discount curve. The penultimate row indicates the coupon step-up required for reaching "greenback" status: e.g., for an SLB with a 5 year observation date and 5 year pay-out period, the coupon step-up would need to be in excess of 51.8bp in order to achieve greenback status. The final row then indicates what the SLB fixed coupon spread would be, relative to equivalent vanilla bond (EVB). In this case, assuming an EVB coupon of 4.5%, the SLB should price at 4.378bp or almost exactly 4 3/8s, with a step-up of 54bp.

Figure 7 (right) shows the same bond but with (a higher) USD BBB discount curve, which leads to higher step-ups required to reach a greenback level, but with slightly lower fixed SLB coupons on pay-out structure. Figure 8 (left) shows a greenback for EUR B rated discount: fixed coupons increase marginally, with step-ups moving a fair bit more to compensate for inherent default risk. Figure 8 (right) restrikes the probability of step to 100% which leads to a (linear) 50% drop in required coupons for greenback status.

Figure 7. (Left) Baseline, EUR BBB discounting curve, (Right), USD discount curve.

Option value	with 50% prob /4.5% fixed coupon				
Disc: EUR BBB	Step structure				
Coupon step	3s5s	5s7s	3s7s	7s10s	5s10s
0	0.000	0.000	0.000	0.000	0.000
0.125	0.106	0.098	0.204	0.133	0.231
0.25	0.212	0.196	0.408	0.266	0.462
0.375	0.317	0.294	0.611	0.400	0.693
0.5	0.423	0.392	0.815	0.533	0.925
0.625	0.529	0.490	1.019	0.666	1.156
0.75	0.635	0.588	1.223	0.799	1.387
0.875	0.741	0.686	1.427	0.932	1.618
1	0.847	0.784	1.630	1.065	1.849
1.25	1.058	0.980	2.038	1.332	2.312
1.5	1.270	1.176	2.446	1.598	2.774
2	1.693	1.568	3.261	2.131	3.698
Step-up	118.1	127.6	61.3	93.9	54.1
Fixed discount	-22.3	-16.5	-16.5	-12.2	-12.2

Option value	with 50% prob /4.5% fixed coupon				
Disc: USD BBB	Step structure				
Coupon step	3s5s	5s7s	3s7s	7s10s	5s10s
0	0.000	0.000	0.000	0.000	0.000
0.125	0.100	0.091	0.190	0.120	0.210
0.25	0.200	0.181	0.381	0.240	0.421
0.375	0.300	0.272	0.571	0.360	0.631
0.5	0.400	0.362	0.762	0.480	0.842
0.625	0.500	0.453	0.952	0.599	1.052
0.75	0.599	0.543	1.143	0.719	1.263
0.875	0.699	0.634	1.333	0.839	1.473
1	0.799	0.724	1.524	0.959	1.683
1.25	0.999	0.906	1.905	1.199	2.104
1.5	1.199	1.087	2.286	1.439	2.525
2	1.599	1.449	3.047	1.918	3.367
Step-up	125.1	138.0	65.6	104.3	59.4
Fixed discount	-23.2	-17.4	-17.4	-13.0	-13.0

Figure 8. (Left), EUR B discount curve, (Right), EUR BBB discount curve assuming 100% step probability.

Option value	with 50% prob /4.5% fixed coupon				
Disc: EUR B	Step structure				
Coupon step	3s5s	5s7s	3s7s	7s10s	5s10s
0	0.000	0.000	0.000	0.000	0.000
0.125	0.091	0.079	0.170	0.100	0.179
0.25	0.182	0.158	0.341	0.200	0.358
0.375	0.273	0.238	0.511	0.300	0.538
0.5	0.365	0.317	0.682	0.400	0.717
0.625	0.456	0.396	0.852	0.500	0.896
0.75	0.547	0.475	1.022	0.600	1.075
0.875	0.638	0.555	1.193	0.700	1.254
1	0.729	0.634	1.363	0.799	1.433
1.25	0.912	0.792	1.704	0.999	1.792
1.5	1.094	0.951	2.045	1.199	2.150
2	1.459	1.268	2.726	1.599	2.867
Step-up	137.1	157.7	73.4	125.1	69.8
Fixed discount	-24.5	-18.7	-18.7	-14.4	-14.4

Option value	with 100% prob /4.5% fixed coupon				
Disc: EUR BBB	Step structure				
Coupon step	3s5s	5s7s	3s7s	7s10s	5s10s
0	0.000	0.000	0.000	0.000	0.000
0.125	0.212	0.196	0.408	0.266	0.462
0.25	0.423	0.392	0.815	0.533	0.925
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0.5	0.847	0.784	1.630	1.065	1.849
0.625	1.058	0.980	2.038	1.332	2.312
0.75	1.270	1.176	2.446	1.598	2.774
0.875	1.482	1.372	2.853	1.864	3.236
1	1.693	1.568	3.261	2.131	3.698
1.25	2.117	1.960	4.076	2.663	4.623
1.5	2.540	2.352	4.891	3.196	5.548
2	3.386	3.135	6.522	4.261	7.397
Step-up	59.1	63.8	30.7	46.9	27.0
Fixed discount	-22.3	-16.5	-16.5	-12.2	-12.2

[9] These calculations are indicative, assuming annual coupons and other simplifications. More exact calculators are forthcoming.

Standardising coupon pay-outs based on forward risk pricing

The discussion around a greenback SLBs does not give guidance on how to structure the coupon step-up period: a short pay-out period could be matched by a large coupon step, or vice versa.

Assume an SLB with an SPT in 5yrs, payable for two years, for a full maturity of 7 years. If the step happens and is correlated with an (increase) in credit risk, the 5x2 forward (sell 5yr protection, buy 7yr protection) can be used to hedge that additional risk.[10,11] The amount of forward protection that will be need to be bought will be related to i) the probability of the step to happen and ii) the increase in credit risk due to the step up.

Assume that i) – the probability to step - is given exogenously, and furthermore for ii) that there is a 1-for-1 relationship between the sustainability metric and credit risk.

In that case, an investor should be indifferent to buying a straight bond, or to buy an SLB with a matched forward to it. Hence, we can then set the value of the SLB option premium equal to that of the forward protection.[12]

Let us now relax the assumptions. First, what happens if there is non-perfect correlation between the credit risk and the sustainability performance?[13] The result still stands that the SLB premium should be related to the *expected* value of the increase in credit risk (the credit forward), but it does decrease hedge effectiveness/model uncertainty. This suggests that in setting an SPT, to reduce model uncertainty, structurers should aim for defining SPTs that have high, verifiable correlation with credit risk.

The same model (un)certainty argument holds for the probability estimation. The *expected* probability for the step to happen should be used for estimating the option premium inherent in the SLB. A poor/precise understanding of the probability distribution that drives the step probability will increase/decrease model risk. Hence, when defining an SPT, attention should be given to constructing it such a reasonable probability distribution for it can be derived.[14]

Of course, many SLB issuers will not have outstanding CDS curves traded on their names. Still, by extrapolating the value of forward protection from similar names (in terms of ratings, sectors or similar metrics), it is likely that useful information around forward pricing can still be achieved.[15]

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[10] This is equivalent to conditional curve trades that have been used in CDS index space. Buying forward protection, as suggested here, is equivalent to a "steepener" trade (with flat nominals rather than DV01 weights). E.g., "CDS Curve Trading Handbook 2007", p. 113ff., Barclays Capital, Feb 2008.

[11] In the limit case, the SLB is the outstanding bond deliverable into the CDS contract (e.g., being the longest maturity bond on the curve). In this case, one could also make the forward risk directly linked to the SLB coupon-step size.

[12] There are considerable practical issues here, not least that CDS forward trade in a non-true format, i.e., there are cash-flows prior to the forward start-date. This should, however, from a pricing perspective, not be a major issue.

[13] One could argue that a perfect instance of a correlation would be when the performance target itself is a credit rating (and further assuming ratings are perfectly correlated to default risks.)

[14] This is one of the key points of our earlier paper where the distinction is sought between step-up priceable and non-priceable SLBs, where the former are defined as such structures where a density function of step-probabilities can be inferred.

[15] Further questions arise in terms of how much forward production should be bought in terms of hedging spread widening rather default risk - the option "delta". We intend to return with a quantitative approach to calculate such hedge ratios.

Advantages to a price approach

Focusing on the actual price of the SLB has several advantages as the discounted value of the step, if we assume that it is going to happen, is essentially decided by four factors:

1. Length (number of coupons) of the step
2. Size of the coupon step
3. Risk-free rates for discounting
4. Market-implied default rate/risk-discounting rates

Factors 1 and 2 are directly observable in the SLB structure and give the value of the cash value of the step coupon. Factor 3 can be directly observed in the market. Factor 4 can be closely implied in the market.[16] Using a dollar price measure for the financial materiality of an SLB has a number of advantages:

- **Adjusts for credit riskiness of the issuer:** a company with high credit risk, where the probability of not crystallising the step is lower due to the risk of default/non-survival during the step pay-out period, will see a lower discounted value of the step. Everything else being equal, a HY issuer will have to have higher/longer coupon pay-outs than an IG company to compensate for that risk.

- **Adjusts for the rates environment:** as has been quite clear over the past few years, where we have gone from a negative/zero rate environment to a substantially higher rate environment, discounting future cash flows changes the value of step-ups significantly. 25bps in five years is worth considerably less in a 4% rates environment vs a 0% environment.

Further refinements could be considered: the option price approach does not take into account the coupon step magnitude in the context of the general credit spread level more than in a secondary context. A step-up of 25bp may seem high if the general market spread level is 50bp, but less so if the prevailing market spread is 150bp. One could consider setting the coupon step as a percentage of the underlying bond spread rather than holding relatively fixed as in our cases above. In this context, the greenback definition should be used as a floor ("*at least* $1 option value") rather than a fixed point for discussing coupon step sizes.

Final remark

We suggest that the "greenback SLB" approach to offers a workable and positive solution to setting sufficiently ambitious and beneficial targets for both investors and issuers, and look forward to market feedback on this proposal.

[16] One can use a number of different approaches to infer survival probabilities or one can simply use (as below) risk-discount curves as observed in the market.

Previous AFII publications on sustainability-linked bonds

Option-based pricing

An option pricing approach for sustainability-linked bonds; Notes on risk-neutral pricing of SLBs and step-down structures

Risk management

SLBs: complementary, my dear Investor; A review of SLBs approaching KPI observation dates; Understanding dynamics between sustainable and traditional debt; SLB triggers: What if Nobian or PPC miss their targets? Enel – Market update on 2022 KPI observation; One small step for Orlen, one giant leap for the SLB market

Evaluation of KPI/SPT selection

BHP: Think big with an SLB; Nissan: Shift expectations with an SLB?; Air France-KLM: Come fly with SLBs; JBS: A meaty SLB impact proposal; SLB bond radar: Eni (potentially) coming to market; Enel: A case study in transition finance using SLBs; Chile sustainability-linked bond: Optionality analysis; Adani and what could be the world's coolest SLB; Sri Lanka: restructuring with biodiversity links?

SLB due diligence

Sembcorp: "Carbon footprint arbitrage of a lifetime"; Enbridge oil sands SLB - participation trophy alert; Banks hit by 'fraud' complaint to SEC over Adani SLB coal links

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