

Structured Products Allocation in Asset Allocation Views

Morningstar Data Methodology

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Important Disclosure

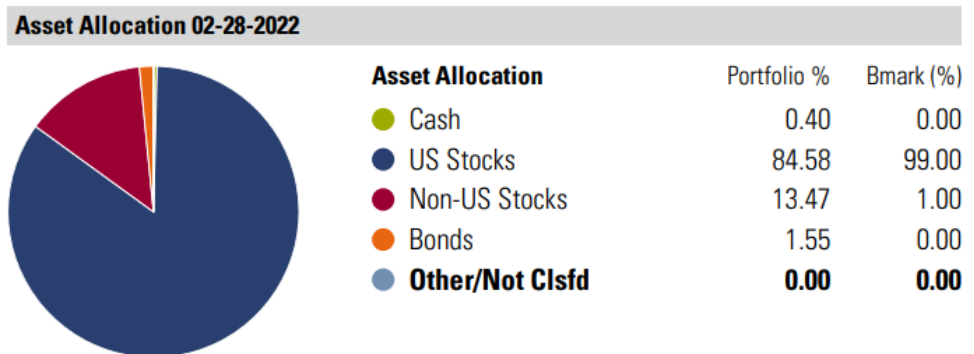
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Introduction

A structured product (also called a structured note) is an investment product that combines a debt issuance with embedded derivatives to create customized payoff profiles. Structured products may have coupon interest and/or principal repayment dependent on the value or return of one or more assets. The underlying assets are usually equity but could also be commodity prices, interest rates, or foreign-exchange rates.

Based on a newly established collaboration with Luma Financial Technologies, Morningstar is integrating structured products into its asset-allocation views in the Advisor Workstation. At the highest level of display, the following asset classes are available.

Exhibit 1 Asset Allocation Display in Advisor Workstation



Source: Advisor Workstation.

Structured products exhibit both debt and equity features (or features inherited from a non-equity underlying), so the classification of these products into asset classes poses a challenge.

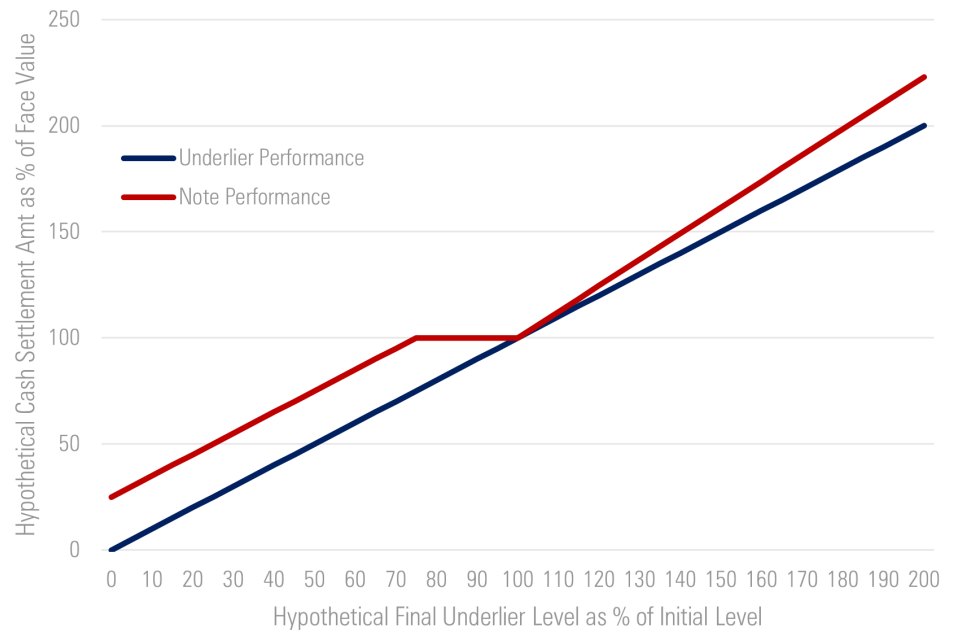
CUSIP 40055QSL7 is an example of a common structured note. It is a “Leveraged Buffered S&P 500 Index-Linked Note” issued by Goldman Sachs Finance Corporation. The principal repayment of the note depends on the return of the index from the initial trade date to the final index observation date according to the following conditions:

- If the final index level is greater than the initial index level, the return on the note is 1.23 times the return of the index.

- ▶ If the index level declines by more than 25% from the initial index level, the return of the note will be negative and equal to the index return plus 25%. The investor could lose a significant portion of the face amount of the note.
- ▶ If the index return is zero or negative, but not below negative 25%, the original principal will be returned.

This note does not pay a coupon, but there is interest-rate risk because the payment does not occur until a future date. Consequently, this product has both equity and interest-rate risk.

Exhibit 2 Payoff Profile CUSIP 40055QSL7



Source: Morningstar, public information.

To maximize the creation of insights for investors, Morningstar's ambition is to minimize allocations to "Other." To achieve this for structured products, a methodology that splits the products into a fixed-income component and an underlying component has been devised. Similar to the methodology that is currently deployed in Morningstar's Advisor Workstation for the classification of derivatives held in funds, the approach for structured products relies on adjusting derivatives exposures by their sensitivities to risk factors, as explained in this document.

Allocation Methodology

Motivation

The solution developed follows a risk-based approximation where the split of the product into risk classes is proportionate to its sensitivity to changes in the asset class and to the market movements in the corresponding asset class. Because this decomposition depends on market conditions in relation to the product's terms, it varies over time.

In addition to providing a meaningful decomposition of a structured product into different asset classes, the allocation methodology has these goals:

- ▶ Asset allocations add to one (100% allocation);
- ▶ Individual asset allocations are positive;
- ▶ Allocations respond logically and dynamically to changes in market conditions and based upon the unique characteristics of a given product;
- ▶ Allocations respond logically and dynamically across non-linear and discontinuous sections of the payoff function.

The following describes the conceptual framework as well as the specific application.

Conceptual Framework

We start with the change in value (V) formula based on risk factors x, y, \dots, z .

$$dV = dV/dx * Dx + dV/dy * Dy + \dots + dV/dz * Dz \quad [1]$$

= change in the value of the structured product in currency units

The partial derivatives (for example, dV/dy) denote changes per unit of the denominator.

Once we have all the parameters, we can allocate the structured product to asset class buckets proportionately to their contribution to the overall risk:

$$\text{Allocation to risk } x = dV/dx * Dx / dV \quad [2]$$

Similar allocation applies for risk factors y and z .

Application

As a concrete example, following equation [2], suppose the risk contribution for equity (EQ) and fixed income (FI) are:

$$FI = dV/dr * Dr$$

where r is a relevant interest rate. The term dV/dr denotes the "rho."

$$EQ = dV/dS * DS$$

where S is the specific underlying equity of the structured product. The term dV/dS denotes the "delta".

For allocation of structured product risks, we define the magnitude of the change of a risk factor (for example, Dx) as a one standard deviation movement in the value of the risk factor.

With these definitions, the allocation of risk is:

- ▶ $EQ / (EQ + FI)$ is allocated to the equity asset class; and
- ▶ $FI / (EQ + FI)$ is allocated to the fixed income asset class.

As required, the sum of allocations is one (100% allocation).

For practical application, we impose a few rules:

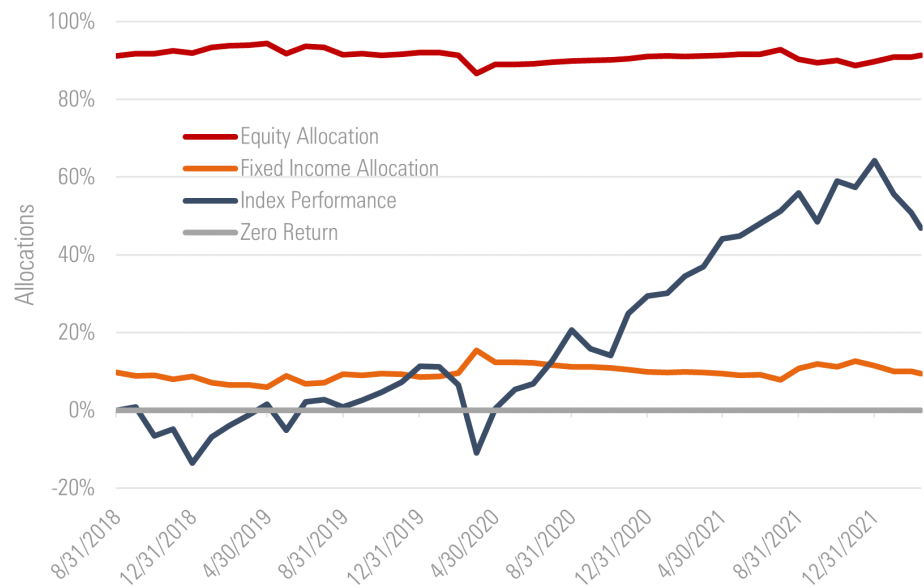
- ▶ To avoid cancellations of risks leading to a DV close to zero, we will work in absolute values of partial derivatives.
- ▶ For a structured product which depends on the best or worst of multiple assets of the same class (for example, a basket of equities), we pick the one whose contribution to the risk is greatest. This is the asset i for which the absolute value of $dV/dx_i * Dx_i$ is largest.
- ▶ For an SP which depends on all elements of a basket of assets of the same class, we use all the assets to compute DV. So rather than the maximum contribution, we use the sum of the contributions.
- ▶ For an SP which depends on all elements of a basket of assets of the differing classes, we use all the assets to compute DV. The contribution of each individual asset is allocated to the appropriate asset class. For example, if the basket contains equity and commodity exposure, the asset allocation will be to both asset classes ("Other" in the case of commodities).

Empirical Performance of the Model: Examples

This section provides results for several examples of structured products with intrinsic values that depend on an equity underlying.

Exhibit 3 shows the return allocation for CUSIP 40044QSL7, which was described earlier. Along with the asset allocations, the return series of the S&P Index is in grey on the right axis. The return of the index is positive over almost all the history, so the product behaves mostly like an equity (blue line). The interesting time is around the onset of the coronavirus pandemic, where the index return became negative. The payoff profile of the product is flat in this range. Consequently, there’s a small increase in the interest-rate allocation because the sensitivity to small changes to the index decreases. The contract doesn’t switch entirely to interest rates because there’s a long time to expiration of the contract.

Exhibit 3 Allocations CUSIP 40055QSL7 (Hypothetical Example)



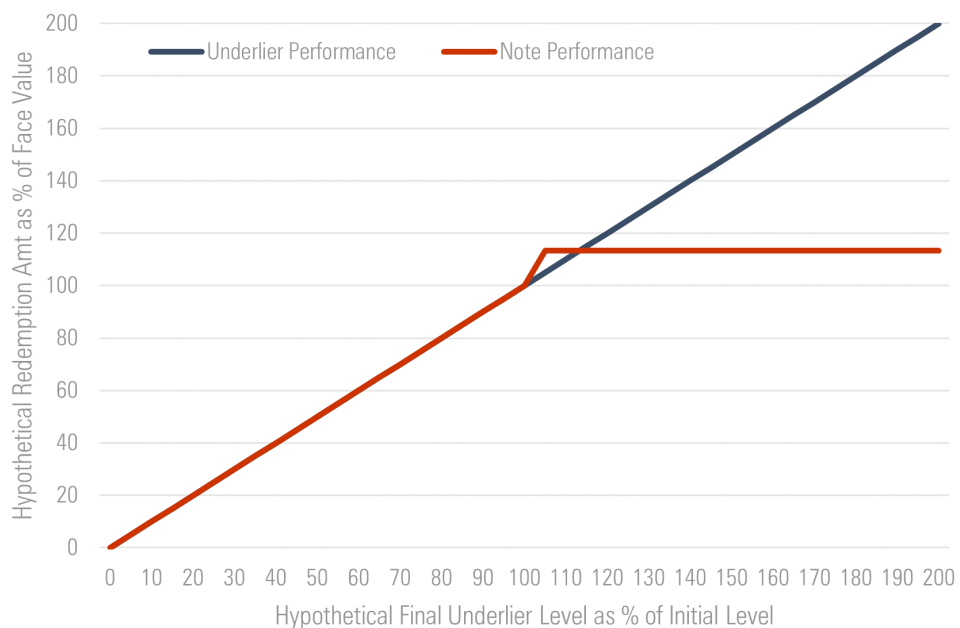
Source: Morningstar.

CUSIP 48132J488

This structured note is another relatively simple structured note issued by JP Morgan Chase. The principal repayment of the note depends on the return of the Russell 2000 from the initial trade date to the final index observation date according to the following conditions:

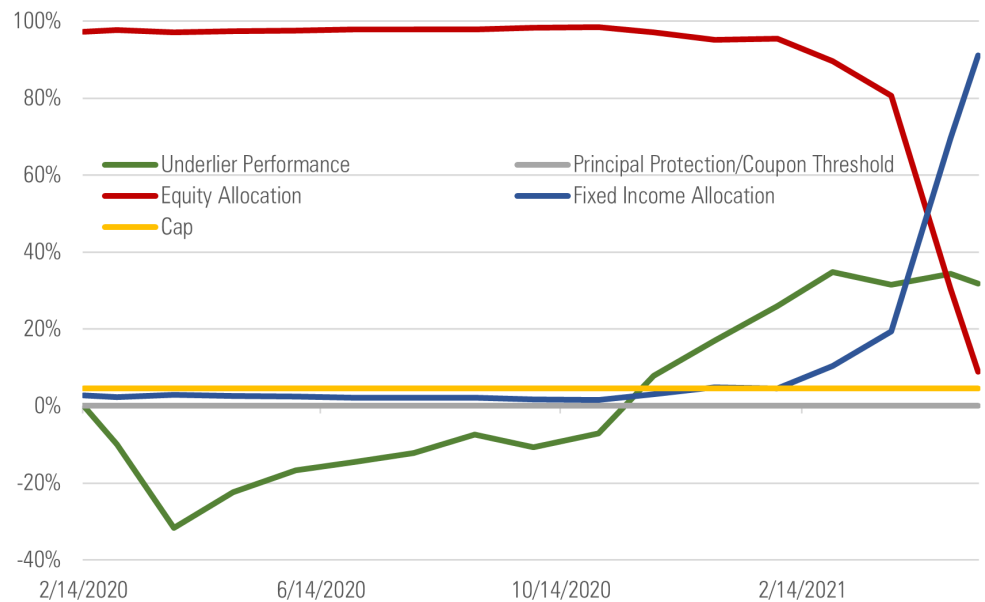
- ▶ If the final index level is less than the initial index level, the return on the note is the return of the index. The investor could lose a significant portion of the face amount of the note.
- ▶ If the index level increases by more than 4.5% from the initial index level, the return of the note will be 13.25%.
- ▶ If the index return is between zero and 4.5%, the return will be three times the return of the index.

Exhibit 4 Payoff Profile CUSIP 48132J488



Source: Morningstar, public information.

Immediately after the issuance of this product, the Russell 2000 decreased with the onset of the pandemic. With a negative return, the product behaves like an equity. This is visible in the allocations because the equity allocation during this time is almost 100%. The final equity allocation using the proposed methodology is 9% and the fixed-income allocation is 91%. This makes sense because the intrinsic value profile is flat at the final performance (32% return), so there's little equity risk.

Exhibit 5 Allocations CUSIP 48132J488 (Hypothetical Example)

Source: Morningstar.

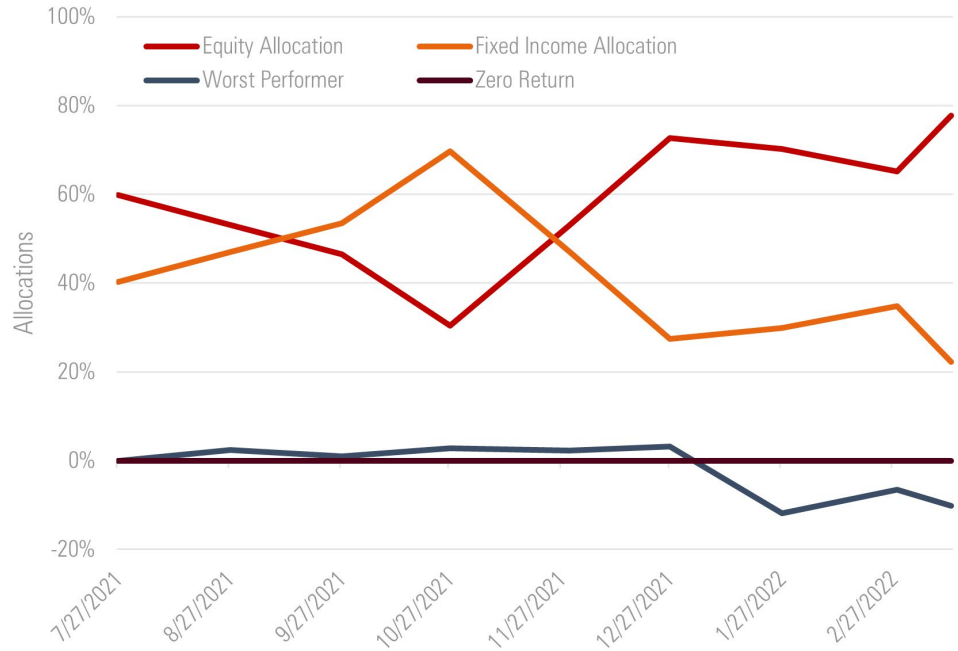
CUSIP 06368ESZ6

This product is an "Autocallable Barrier Note with Contingent Coupons" issued by Bank of Montreal, maturing April 30, 2024. The payoff depends on the worst performance of the Russell 2000, NASDAQ 100, and S&P 500. Characteristics of this note include:

- ▶ A coupon of 1.6% per quarter to be paid if the closing price of each reference asset on the observation date is greater than its barrier level. Observation dates are quarterly.
- ▶ If after Jan. 26, 2022, the closing level of each reference asset is greater than a predefined call level, the notes will be automatically redeemed. Upon redemption, the principal is repaid in full.
- ▶ If the notes are not redeemed before maturity, the payment at maturity is based on the performance of the reference assets. The full notional of \$1,000 is repaid unless any of the assets' final level is below a trigger level. If this occurs, payment will be $\$1,000 * (1 + \text{return of the least performing reference asset})$.

The payoff profile is not provided because it depends on the return of three assets.

Exhibit 6 Allocations CUSIP 06368ESZ6 (Hypothetical Example)



Source: Morningstar.

The gray line in Exhibit 6 shows only the performance of the worst of the three underlying assets. In practice, the value of the note depends on the performance of all of them. Looking only at the worst performer at an instant of time does not tell the entire story, but we can make some general inferences. The allocation for this note switches between equity and fixed income as the return on the worst-performing asset moves from positive to negative. The equity component becomes dominant over time because the loss of principal repayment owing to a negative return of the worst asset becomes more likely.

Risks of Investing in Structured Products

The owner of a structured product assumes a wide range of risks which may be different from nonstructured assets. These risks include, but are not limited to:

- ▶ **Credit risk**—The issuer of the SP is usually a financial institution like a bank. In the event of a default by the issuer, the investor in the note is usually an unsecured creditor to the issuer.
 - ▶ **Market risk**—The value of the SP rises and falls with the price of the underlying assets. The value of the SP might change significantly more than the value of its underlyings. According to the definition of the payoffs, the owner of the SP may miss out on potential gains (capped payoff) or experience losses as compared with holding the underlying asset.
 - ▶ **Liquidity risk**—SPs may suffer from limited availability of quotes in the secondary market, possibly hampering an investor's ability to sell SPs efficiently.
 - ▶ **Gearing risk**—The payoff of the SP may be leveraged (for example, paying twice the return on the underlying), causing the value to change rapidly as the underlying changes.
 - ▶ **Loss of principal**—The payoff may be structured so that, at maturity and contingent on the value or return of the underlying asset(s), less than the original principal is returned.
 - ▶ **Missing coupon payments**—The note may be structured so that, contingent on the value or return of the underlying asset(s), a coupon payment will not be made.
- Call risk**—Under certain conditions, the principal will be repaid early, causing the owner of the note to receive a price below market value and/or miss out on above-market coupon payments. ■■■



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