

# Citi's Guide to Structured Product Terminology

The performance of structured products can be affected by the way dividends are treated in the underlying equity index calculation. The investor can choose to assume a direct exposure to the dividend flow effectively paid by the stocks composing an index by opting for structured products linked to the growth of a total return equity index

## The definition

The two common approaches in terms of the dividend treatment of equity indexes are (i) the reinvestment of dividends as they are paid by the relevant companies; or (ii) the disregard of this cash flow for index return calculation purposes. The former describes a total return index; the latter a price return index.

The dividend yield is one of the main components in determining the price of a structured product, and the choice between a total return index or a price return index can have an impact on the price of the structure. In the case of a structured product offering exposure to the growth of a price return index, the investor will benefit from a higher participation rate. The same structure linked to a total return index will have a lower participation rate, due to the higher cost of purchasing the option offering the exposure in the appreciation of the index (call option). Dividends paid will be reinvested in the index and, therefore – assuming that all or some of the underlying stocks pay a dividend – the performance of a total return index will be higher than the price return version of the same index.

## Behind the scenes

The two major factors that could affect the investor's choice between a total return index or its price return equivalent are his/her willingness to have a direct exposure to the dividend cash flows paid during the life of the product and the level of growth expected for the underlying index.

In the case of a total return index, the dividends effectively paid and reinvested will be entirely reflected in the value of the index. The investor will benefit from the dividend capitalisation, while assuming the risk of receiving lower-than-expected dividend cash flows.

In the price return structure, the investor is basically hedging his exposure to dividends: if the amount of dividends paid is higher than expected, the investor will lose the opportunity of extra return but, in the case of a lower-than-expected dividend cash flow, the investor will be protected. The call option on the total return index will be generally more expensive.

The level of participation in the growth of the total return index is generally lower than the level of participation in the growth of the price

return index. However, the outperformance generated by dividend reinvestment tends to compensate for the effect of a reduced participation in the growth in scenarios where the realised growth rate is low or moderate.

## Product rationale

We can consider two structures that offer exposure to the growth of an equity index over a five-year investment period; the product is designed to offer, at maturity, full protection of the amount initially invested.

The participation rates in the growth of the total return index and price return index are calculated considering an annualised volatility of 20% and an expected dividend yield of 3.50%. A first hypothetical structure linked to the total return index offers a participation rate of 77% in the growth of the index over the five years. A second structure, linked to the price return version of the same index, offers higher participation in the growth of the index, equal to 115%. The total return index outperforms the price return index by an amount equal to the final value of dividends reinvested in the index. In this scenario, the payout at maturity of the two structures is equal; the lower participation in the growth of the total return index is offset by a higher performance of the index compared with that of the price return index.

1. Total return versus price return index



A. Financial terms of the hypothetical structures		
	Total return	Price return
Maturity	Five years	Five years
Underlying	Equity Total Return Index	Equity Price Return Index
Currency	EUR	EUR
Capital protection	100% of the initial invested capital	100% of the initial invested capital
Final payout	77% of the growth of the index	115% of the growth of the index

## Scenario simulations

Using a Monte Carlo simulation approach, we can compare average payouts under different dividend yield and growth rate assumptions and observe how the choice between a total return and a price return index could affect the product's payout at maturity.

In the first step of the analysis, a fixed growth rate is considered and average payouts at maturity are simulated on the basis of different assumptions on the realised dividend yield. In a second step of the analysis, the dividend yield is considered fixed and three different growth rates are assumed in order to simulate final payouts.

For simulation purposes, the annualised volatility is assumed to be 20% for both indexes and the growth rate is set at 4.72%, reflecting the level used to calculate the participation rates for the two structures. In order to observe the effects on the final average payouts, the realised dividend is set equal to 2.5%, 3.5% and 4.5%, respectively.

Final average payouts corresponding to each dividend yield hypothesis are simulated and compared for the two structures. Figure 2 represents the average payouts at the end of the life of a five-year hypothetical investment associated with each set of dividend assumptions.

Given a hypothetical scenario in which the realised dividend yield is equal to 2.50%, the investment in the structured product linked to the price return index would have generated a higher return on average, offering the investor an outperformance in respect to the structure linked to the total return index. Given a dividend yield of 3.5%, equal to the level assumed in

the pricing, average payouts of the two structures present similar levels. Conversely, in a scenario where the dividend yield is higher (4.5%), the investment in the structure linked to the total return index would have been more profitable for the investor. This structured product linked to the total return index would have offered, in this scenario, participation in the realised growth of the dividends reinvested in the total return index, greater than the dividend income of 3.5% estimated in the pricing.

The final payout of the structured product linked to the price return index is not affected by the amount of dividends effectively paid. Keeping the same volatility assumption and under the hypothesis of a realised dividend yield equal to the level of 3.5% assumed in the pricing of the two structures, it is possible to observe the effect of changes in terms of growth rate.

	Growth rate of 3.72%	Growth rate of 4.72%	Growth rate of 5.72%
Price return index-linked	144.23%	150.06%	156.31%
Total return index-linked	144.96%	150.05%	155.44%

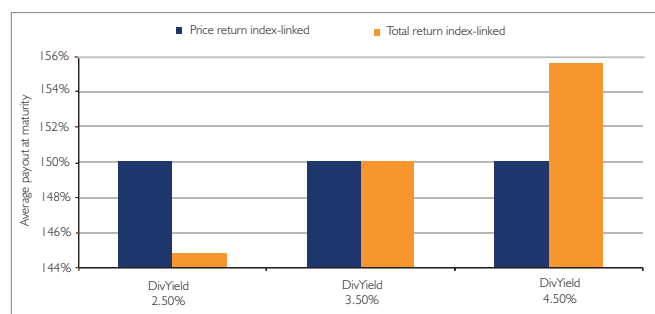
The results of the simulation show that, for a small reduction in terms of the growth rate, a structured product linked to the price return index registers a larger decrease in terms of performance compared with the equivalent product linked to the total return index, which registers only a few basis points change in terms of average payout. An increase in the growth rate produces a better performance in both of the structured products, with a slight outperformance for the structure linked to the price return index.

The investment in a structured product linked to the growth of a price return index will tend to provide, on average, the same expected return as the one offered by the investment in a structured product linked to the growth of the total return version of index if the realised growth rate and the realised dividend yield reflect the same levels considered in the pricing.

In scenarios where the realised dividend yield is higher than the level assumed in the pricing model, and the realised growth rate is equal or lower than the level considered in pricing, the investor in a structured product linked to the growth of a total return index will tend to benefit from higher returns. The effect will be the opposite when the dividend yield is lower than the level assumed in the pricing model and the realised growth rate is equal to or higher than the level considered in pricing.

Considering a realised dividend yield equal to the level assumed in pricing, the increase of the realised growth rate will have a stronger positive effect on the payout of the structured product linked to the growth of a price return index, thanks to the leverage offered by the higher participation rate in the growth of the underlying index.

## 2. Average payout at maturity



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