Systematic Trading Strategies

Extracting The Dividend Risk Premium

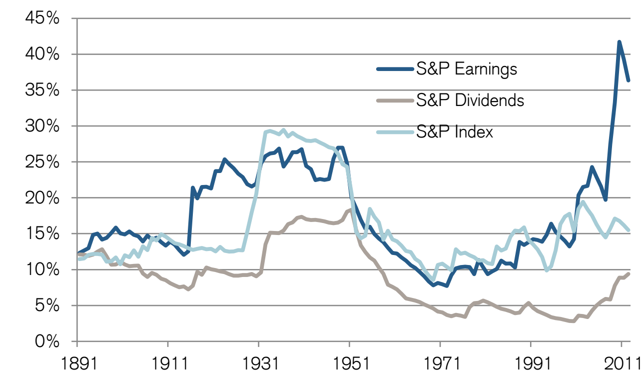
Equity Derivatives Strategy

Over the last handful of years, dividends ceased to be considered as only a side product of equity investments, and the assertion that they constitute an asset class of their own right has become more and more common. While this is mostly linked to the recent development of a mature, liquid dividend futures market, there are also fundamental and technical reasons to differentiate dividends from stocks or corporate bonds; in particular dividends are at times loosely correlated to equity, and exhibit lower volatility (Exhibit 1).

In this report we draw the following conclusions:

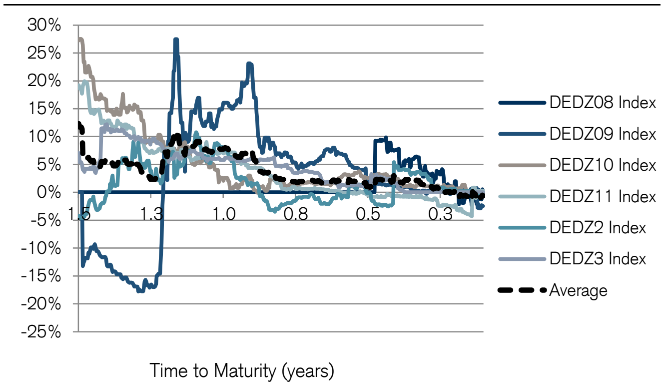
1. **Dividends follow their own dynamics:** looking at dividend futures, we find that the pricing of dividends depends on the investment horizon; while it is difficult to differentiate long-term dividend futures from equity, short-term dividends trade according to specific risk factors and bear a specific risk premium (Exhibit 2).
2. **The dividend risk premium is rich:** this risk premium can be isolated and estimated. We find that it tends to be expensive compared to the Equity risk premium. This is due either to a wrong appreciation of dividend risk on behalf of investors, or because of specificities of the dividend market (notably investment banks tend to be large, structural sellers of dividends).
3. **It is possible to build profitable systematic dividend strategies:** in the last section of the report, we investigate systematic strategies to extract this risk premium. We suggest to go systematically long a hypothetical, constant maturity dividend future, and hedge the remaining equity exposure by going short the underlying index against it. Backtests and sensitivity analysis show that such a strategy would yield a sustainable Sharpe ratio that would be over 1.0 after trading costs.

Exhibit 1: 10Y Variability of S&P Index, Earnings and Dividends



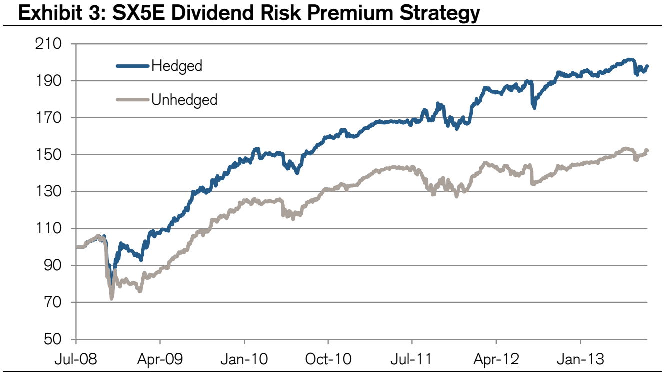
Source: Credit Suisse Equity Derivatives Strategy

Exhibit 2: SX5E Dividend Futures Risk Premium



Source: Credit Suisse Equity Derivatives Strategy

Exhibit 3: SX5E Dividend Risk Premium Strategy



Source: Credit Suisse Equity Derivatives Strategy

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Extracting The Dividend Risk Premium

A Stand-Alone Asset Class

Evidence of the Dividend Risk Premium

Dividend Risk Premium Extraction Strategies

Appendix

A Stand-Alone Asset Class

The assertion that dividends constitute an asset class of their own right is common. In this section, we document how dividends pass the following two "acid tests" of an asset class:

1. **Dedicated trading vehicle:** Dividends have ceased to be a side product of Equity and can now be traded independently from other asset classes, thanks to liquid, specific derivatives instruments. The dividend market benefits from a reasonably balanced and stable investor base
2. **Specific dynamics:** The decision process that leads to a dividend payment is, to some extent, independent from the factors that govern the evolution of share prices or other asset classes. Dividend futures prices also reflect this dynamic.

Dividend Futures: Liquidity and Transparency

Dividend Futures Specifications

On 30 June 2008, the Eurex exchange launched a range of listed futures benchmarked on the EURO STOXX 50 Dividend Point (SX5ED) index, as a replacement for dividend swaps, the OTC instrument that had been traded so far - see Appendix 4 for more details on dividend indices, swaps and futures.

Similarly to how individual share prices are aggregated in order to compute the EUROSTOXX 50 (SX5E) index price, the SX5ED is calculated by adding up qualifying dividends (that is, ordinary, cash dividends) paid out by constituents of the SX5E index, weighted according to the number of shares of the relevant constituent in the SX5E basket.

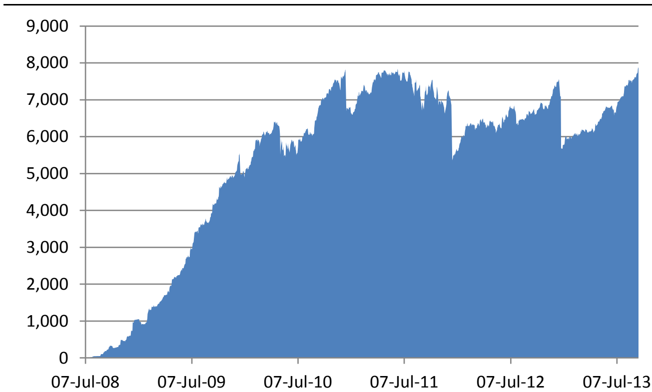
EURO STOXX dividend futures have annual expiries, set to be the third Friday of December and are (in the remainder of this report, but also on Bloomberg) referred to using this nomenclature: DEDZ, followed by the expiry year, for instance DEDZ3 for 2013. On expiry, the future settles at the final value of the SX5ED index calculated over the relevant year. The future has a value of €100 per index point.

Stable Liquidity Since 2009

Despite a difficult start due to market turmoil in Q4 2008 (see our February 2009 report A Window of Opportunity in Dividends), SX5ED dividend futures rapidly found a stable investor base beyond trading desks and hedge funds who were the main investors in the earlier dividend swap market. Open interest on the futures reached EUR 6bio in early 2010 and up to EUR 8bio in 2011 and again in September 2013 (Exhibit 4). With over 740,000 open contracts on Eurex, every 1-point parallel move in SX5ED dividends futures represents over EUR 75m P&L aggregate impact for investors.

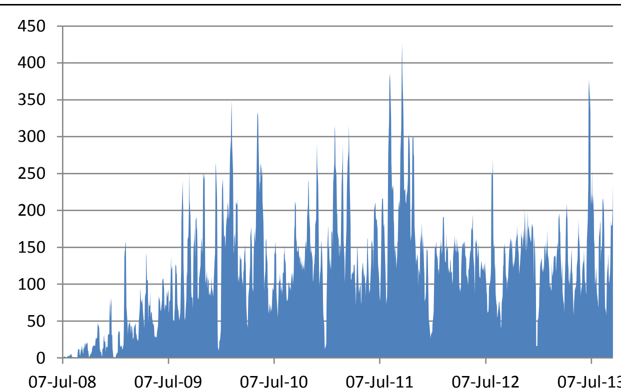
The aggregate daily trading volume on SX5ED dividend futures has averaged EUR 138m since the beginning of 2013 (Exhibit 5). However, most of the liquidity concentrates on the 4 front dividend maturities which altogether represent 80% of the daily volume (Exhibit 6 next page).

Exhibit 4: SX5E Div Futures Aggregate Open Interest (EURm)



Source:Shiller, Credit Suisse Equity Derivatives Strategy

Exhibit 5: SX5E Div Futures Daily Volume (5-day average, EURm)



Source: Datastream, Credit Suisse Equity Derivatives Strategy

What About Liquidity in Other Dividend Futures Markets?

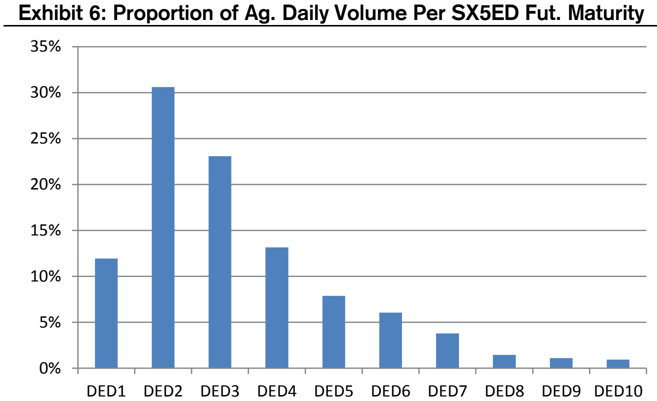
Comparatively to SX5E, FTSE dividend futures, launched by LIFFE in May 2009, exhibit far less liquidity, with an aggregate open interest of GBP 700mio, roughly unchanged since 2010. Other dividend futures (Nikkei, DAX, CAC) are illiquid.

Outside of SX5E, it is fair to say that dividend futures liquidity is sketchy at best (FTSE), or continues to concentrate on OTC products such as div swaps (S&P and Nikkei).

Exhibit 8: FTSE Div Futures Aggregate Open Interest (GBPm)

Source: Credit Suisse Equity Derivatives Strategy

Exhibit 6: Proportion of Ag. Daily Volume Per SX5ED Fut. Maturity



Source: Credit Suisse Equity Derivatives Strategy

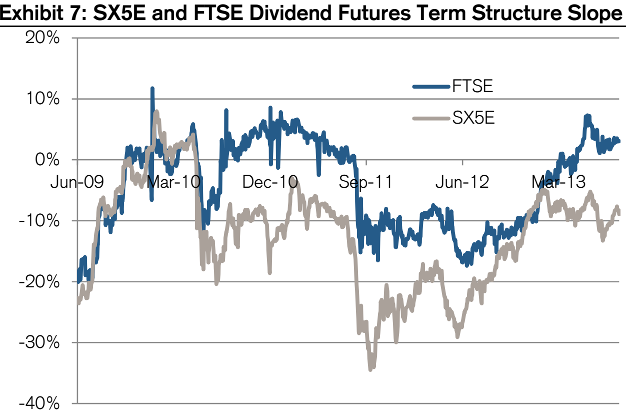
A More Balanced Market Structure

Historically, the SX5E has been the underlying for an active structured product market, the reason being that SX5E has been a very liquid equity index, easy to replicate with its 50 constituents (against 500 for the S&P, 100 for the FTSE or 225 for the Nikkei), and with a superior dividend yield.

Because most of the products offered to institutional or retail clients (continuous flow from retail to sell downside risk through knock-in puts, large trades from US investors going short long-term vanilla puts) incorporate a long equity exposure, European banks have developed a systematic short SX5E forward axe. This axe was historically hedged through liquid, shorter-term instruments like SX5E futures, which left banks' trading desks with a structural long SX5E dividend axe.

The size of this SX5E dividend overhang is manifesting itself through a depressed SX5E dividend term structure. As shown on Exhibit 7, the slope of SX5E dividend futures term structure has been systematically more negative than that of an equivalent index such as FTSE – with we believe no fundamental reasons given the strong economic ties between UK and continental Europe, evident from the correlation between both time series.

Exhibit 7: SX5E and FTSE Dividend Futures Term Structure Slope



Source: Credit Suisse Equity Derivatives Strategy

Until 2008, banks have been offloading most of this overhang to hedge funds through dividend swaps, in a one-sided market that is partly at the origin of the SX5E dividend crash in Q4 2008 and Q1 2009. Since then however, although the banks' structural dividend axe remains, the investor base has become more diversified, including retail and institutional investors on top of hedge funds. This is directly linked to the launch of dividend futures in 2008, which offer liquidity, transparency and protection against counterparty risk and helped move the dividend market to maturity.

The Economics of Dividends: Earnings, Payout and Dividend Policy

Dividends correspond to a payment made by a firm to its shareholders, usually in cash but sometimes under more complex forms (shares, scrip). When making a dividend decision, a firm is therefore fundamentally arbitraging between providing shareholders with an immediate benefit (a cash payment) and a future benefit (future return from reinvesting cash in new investment opportunities). A number of market factors such as friction costs, macro risk, capital structure concerns may lead to a dissociation on how financial markets value those two benefits, with the result that dividends may at times gain a life of their own.

Fundamentally, dividends correspond to a division of a firm's profit between the shareholder and the firm itself:

Shareholder: Dividends = Earnings x Payout Ratio

Firm: Retained Earnings = Earnings x (1 – Payout Ratio)

Dividends are therefore the result of two inputs:

1. **The capacity to pay dividends**, which eventually depends on a firm's ability to generate earnings in the long run. This is partly dictated by macroeconomic concerns that are out of the reach of a company's management.
2. **The propensity to pay dividends**, which is the result of an active decision by management and depends on idiosyncratic factors such as taxation, capital structure, clientele effects or the existence of reinvestment opportunities

The Lower Volatility of Dividends

We start by noting that, although share price and dividends are both influenced by the capacity of a firm to generate earnings, dividends tend to be far less volatile year-on-year than share price, which in turn is less volatile than earnings themselves (Exhibit 10 next page).

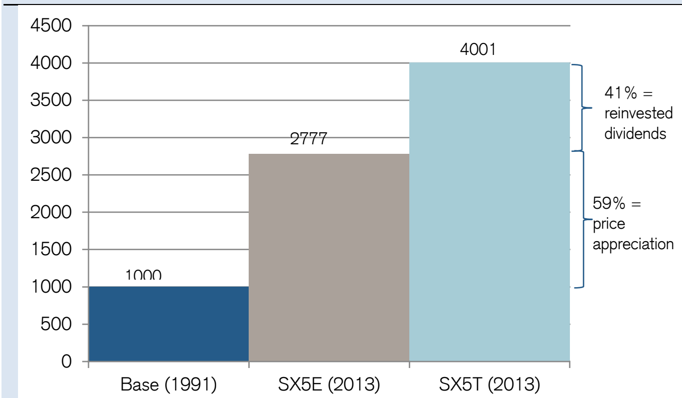
Dividends Are 40% of Equity Return

Dividends represent a significant proportion of returns received from equity investing.

As shown on Exhibit 9, an investor having invested € 1,000 into the EURO STOXX 50 (SX5E) index at its inception in 1991 would be better-off by EUR 3,000 today according to the performance of the EURO STOXX Total Return (SX5T) index. This is split as follows: EUR 1,777 from share price appreciation, and EUR 1,224 from reinvested dividends.

This 59%/41% split makes dividends an important contributor to shareholders wealth, almost on an equal foot with price performance. This is somewhat surprising given the weight typically put on price appreciation concerns when it comes to equity investment decisions. It may provide more granularity to think of dividends and share price as two equally important drivers of performance.

Exhibit 9: SX5E Performance Attribution – 1991/2013

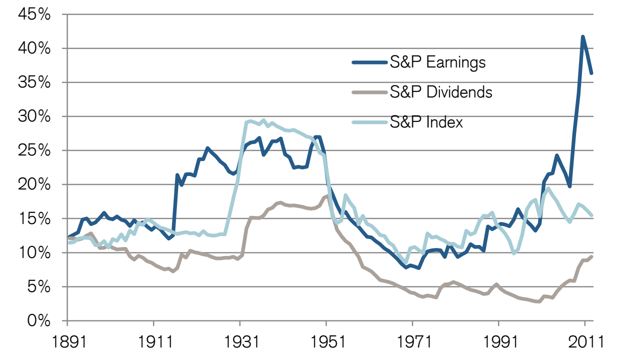


Source: Credit Suisse Equity Derivatives Strategy

It is natural for share prices to be less volatile than earnings: the share price is a function of future earnings aggregated over a long time period, effectively smoothing out the impact of year-on-year variations. However the lower volatility of dividends suggests both that:

1. Payout ratios themselves tend to be volatile
2. There exists a systematic bias in the determination of the payout ratio that creates a negative correlation of payouts versus earnings. Why?

Exhibit 10: 10Y Variability of S&P Index, Earnings and Dividends



Source: Shiller, Datastream, Credit Suisse Equity Derivatives Strategy

Payout Target and Long Term Dynamics

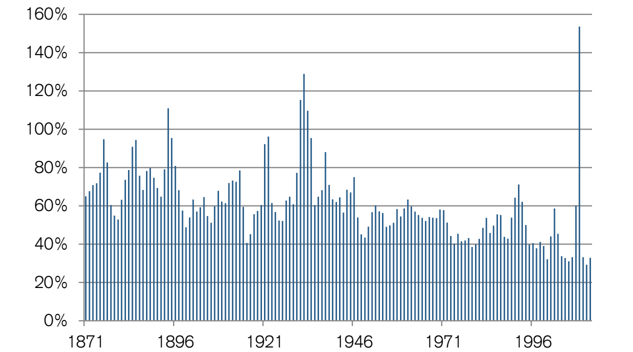
Two approaches coexist when it comes to explaining dividend policy, i.e. the set of rules governing the split of a company's profits between dividend and retained earnings in the long run. In both cases however, the dividend policy aims at maximizing shareholder satisfaction through the determination of a long-term dividend payout target.

In the first approach (Gordon and Walter models or the Residuals theory of dividends), a company will pay dividends to its shareholders when it cannot find investment opportunities with an internal rate of return superior to the shareholder's required rate.

In the second approach, dividend payments are governed by the need to optimize the firm's balance sheet and will depend on its debt to equity ratio, together with the respective rate of taxation of dividends or capital gains.

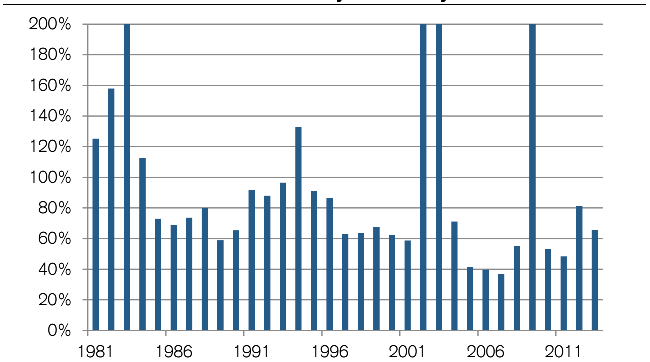
In particular, a lower capital gains tax relative to dividend tax would make the payment of dividends less likely. In the US where dividend withholding tax has historically been higher than capital gains tax, payout ratios have tended to be low, with a typical range of 40/60% versus 60/80% in the Eurozone (Exhibit 11 and 12). A 50% fall in capital gains tax initiated in the 1980s has pushed payout ratios to close to 30% since the turn of the century, the lowest level across 140 years of data collected by Prof. Shiller.

Exhibit 11: S&P Dividend Payout History



Source:Shiller, Credit Suisse Equity Derivatives Strategy

Exhibit 12: Eurozone Dividend Payout History



Source: Datastream, Credit Suisse Equity Derivatives Strategy

Signaling Effects and Short Term Dynamics

In the short term however, a firm can decide to deviate from its dividend payout target and adjust the payout ratio by allocating a higher proportion of earnings to dividend payment, and compensate by digging into prior reserves, or even borrowing cash.

This can result in a payout ratio that can be higher than 1 when dividend payments are superior to the earnings generated by a company on that corresponding year. This is typically the case in times of economic distress, such as in 2009 when dividend payouts amongst S&P and Eurozone companies were the highest ever paid on record.

We see two potential reasons why a company manager could decide to temporarily depart from an optimal, long-term payout ratio:

1. **Avoid dividend signaling effect:** in the absence of other information sources, and given the potential for accountings manipulations,

existing and prospective shareholders may use dividend payments as the revealing sign of a company's health and of its management performance. Managers are therefore less likely to cut dividends than they are to increase them.

2. **Minimize dividend volatility**: dividend risk is one of the factors that impact a company's share price according to the dividend discount model (see page 10), since a higher volatility of dividends would commend a higher equity risk premium. It would also be detrimental to shareholders that operate under a yield model.

As shown on Exhibit 13, there is a strong tendency amongst S&P and Eurozone companies to adjust dividend payout ratios to changes in earnings: when earnings fall, payouts tend to increase in order to limit the fall in dividend payments. Conversely when earnings increase, payouts fall and retained earnings increase. This would allow companies to either finance positive NPV projects, or increase reserves in order to preserve future dividend payments should macro conditions become less favorable.

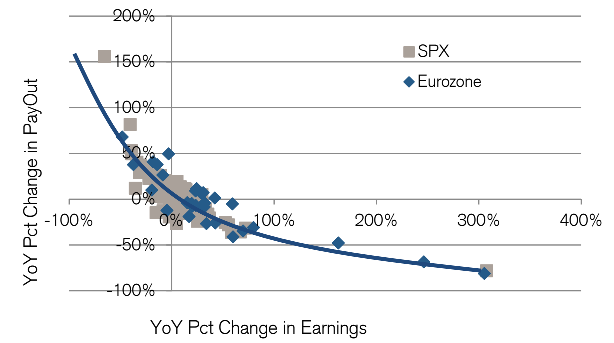
Additionally we note that companies are more likely to increase payouts when earnings fall, than they are to decrease payouts when earnings rebound, creating a convexity in dividend payments versus earnings (Exhibit 14).

Evidence from the Financial Markets

Dividend prices as quoted on financial markets also reflect the above dynamics. We use the EURO STOXX 50 Dividend Points Future Index (SX5EDFT) as a proxy for pure "implied" dividend exposure. SX5EDFT is a strategy index calculated by STOXX that is notionally invested in an equally weighted portfolio of SX5E dividend futures. We compare SX5EDFT to the SX5E index and also the Markit iBOXX (IBXXELAT) corporate bond index.

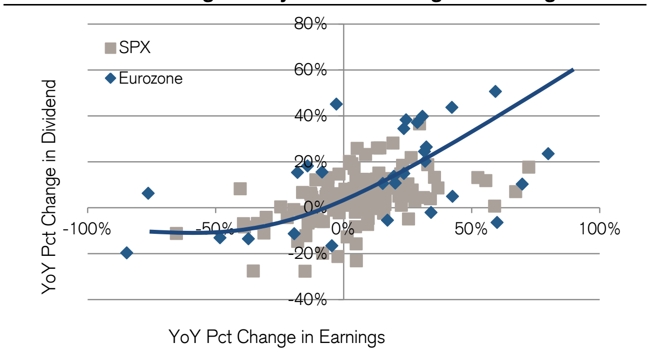
As shown on Exhibit 15, the performance of dividend futures stands somewhere between that of debt and equity.

Exhibit 13: % Change in Payout vs % Change in Earnings



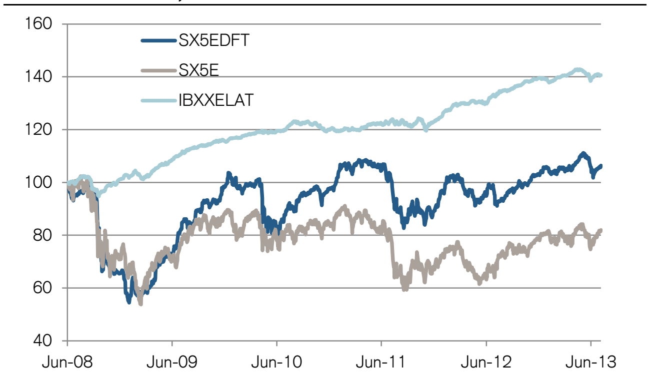
Source: Shiller, Datastream, Credit Suisse Equity Derivatives Strategy

Exhibit 14: % Change in Payout vs % Change in Earnings



Source: Shiller, Datastream, Credit Suisse Equity Derivatives Strategy

Exhibit 15: SX5E, IBXXELAT and SX5EDFT Perf. Since 2008



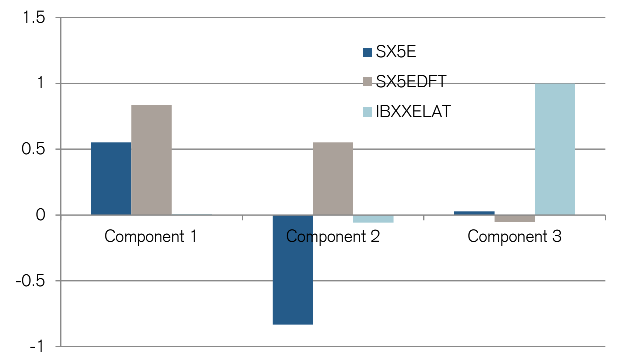
Source: Credit Suisse Equity Derivatives Strategy

In order to investigate the underlying drivers of all three time series, we performed a Principal Component Analysis of their weekly returns since 2008. Principal Component Analysis is a statistical tool that, in this particular example, allows to extract the 3 unobserved, mutually independent factors (the "components") that drive SX5EDFT, SX5ED and IBXXELAT returns, and calculate the sensitivities (loadings) of each asset to those factors.

Exhibit 16 suggests that most of the times, the SX5E and SX5EDFT indices are positively correlated, driven by the same factor (Component 1). However, about 13% of the times, a second factor (Component 2) kicks in, driving down SX5E but keeping SX5EDFT afloat. This is reminiscent of payout dynamics documented on pages 6 and 7: at times of economic crisis, an increase in payouts allows to minimize the fall in dividends, which dissociate from the general fall in risky assets. This dynamic make dividend futures an interesting portfolio diversifier during market drawdowns.

IBXXELAT seems to evolve to a large extent in a class of its own, insensitive to the above two factors that drive equity or dividend prices, and responding only to its own, idiosyncratic factor (Component 3).

Exhibit 16: PCA Loadings, SX5E, IBXXELAT, SX5EDFT Since 08



Source: Credit Suisse Equity Derivatives Strategy

Timing and Seasonality of SX5E Dividends

There is typically a couple of months delay between the dividend declaration date, when a proposed dividend payment is formally approved and announced by a company, and the ex-div date (date after which any share bought does no longer entitle its new owner to receive the dividend).

The ex-div date is the most important when it comes to stock pricing and trading since it is on that day that the risk that a dividend, although declared, may finally be cut falls to zero. This is the reason why ex-div dates have been chosen as the reference date for all dividend indices. However the declaration date, and also any guidance from firms provided during regular earnings reports, are also important into forming a precise view on dividends, and contribute to alleviating dividend risk perceptions.

For SX5E constituents, declaration dates or ex-div dates tend to be concentrated around specific months.SX5E firms tend to pay annual dividends, immediately after reporting annual earnings. As shown on Exhibit 17, SX5E dividends therefore display strong seasonality, with 50% of dividends typically going ex-div between the months of May and June alone. This is not the case for an index such as FTSE where dividends are distributed more evenly.

Additionally, SX5E dividends tend to be announced a couple of months before the ex-div date: 2012 dividends started being announced in July 2011, while the bulk of dividends were announced between November 2011 and February 2012. By the end of February, 70% of 2012 SX5E dividends had already been announced (Exhibit 18).

Exhibit 17: SX5E Dividend Index vs FTSE (2012)

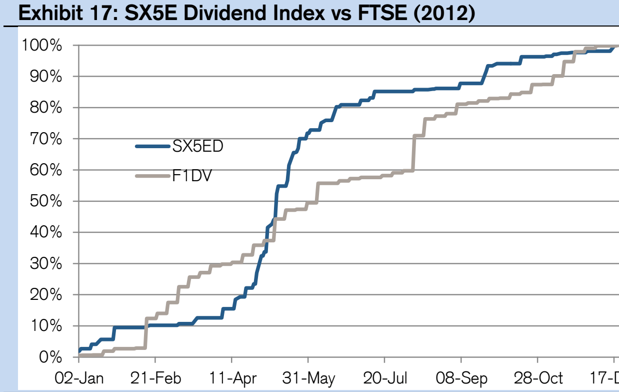
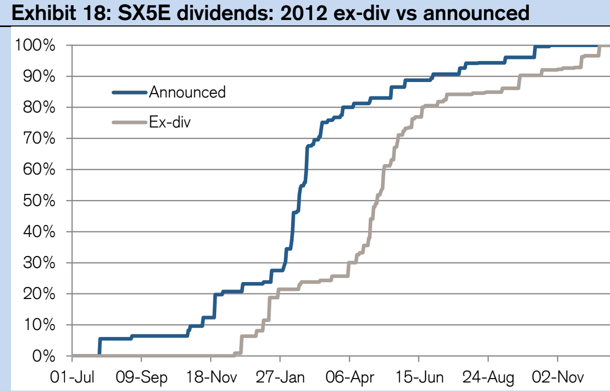


Exhibit 18: SX5E dividends: 2012 ex-div vs announced



Source: Credit Suisse Equity Derivatives Strategy

Evidence of the Dividend Risk Premium

The pricing dynamics of dividends and their investment vehicles, dividend futures and swaps, varies with the time-to-maturity of the dividend. For dividends expected to be paid within a year or so, the correlation with equity is weak, whereas for longer tenors the correlation increases considerably. This is at the origin of the notorious "Pull-to-Realized" effect on SX5E dividend futures, a manifestation of the gradually fade of a specific Dividend Risk Premium.

The "Pull-to-Realized" effect

Fading Volatility and Correlation to Equity

About 1.5 years prior to expiry, dividends futures undergo a profound change in their risk dynamics, and start trading at a discount to a fixed bullet payment corresponding to the expected dividends. This discount corresponds to the risk remaining in every single dividend strip prior to going ex-div, and gradually goes to zero as constituents go ex-div one after the other.

The consequence of the "Pull-to-Realized" is that SX5E dividend futures' volatility starts fading as early as Q4 the preceding year. As shown on Exhibit 20, the realized volatility of SX5E dividend futures, which more than 1.5 years ahead of maturities would typically range between 10 and 30%, starts falling 13 months prior to maturity – that is when dividends start to be announced. By mid-April, before the dividend payment season has actually started, the volatility has already fallen to less than 3%. As shown on Exhibit 19, dividend futures typically start converging towards their end value about 5 quarters before expiry (September of the previous year), starting with a circa 10% discount. By the end of March of the expiry year, this discount has fallen to about 3%.

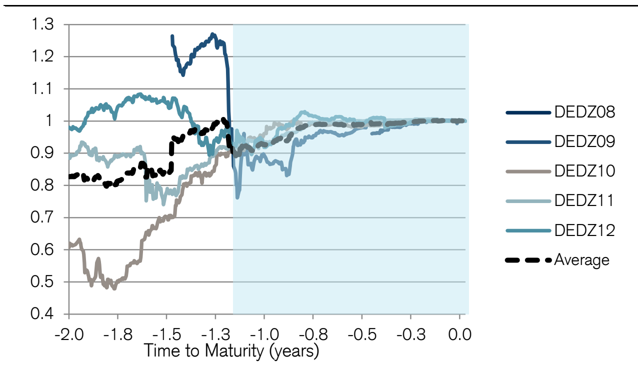
The Three Reasons behind Pull-to-Realized

We see three reasons for this behavior (see textbox on page 10 for a more fundamental discussion):

1. **Long-term dividends trade like Equity:** single stock dividends can be forecast with an appropriate level of precision only up to one or two years ahead. Beyond that, index dividends tend to be estimated through a "proportional dividend" or dividend yield model, rather than a bottom up aggregation of individual dividend forecasts; consequence is a large correlation of long-term dividend futures to Equity, and a dividend futures volatility in-line with that of Equity (10 to 30%).

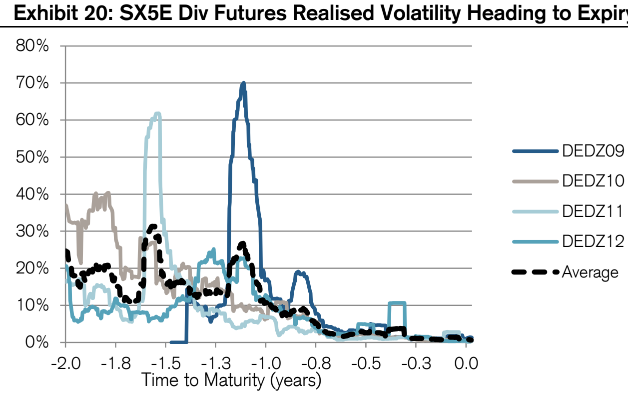
2. **Short-term dividends trade like zero-bonds:** It is possible to generate index dividend forecasts through the bottom up aggregation of its constituents' individual dividend forecasts (see dividend index construction in Appendix 4), in an exercise that takes into account single companies earnings and payouts estimates, and the index composition dynamics. Because of index diversifications, those forecasts will be more reliable and stable than individual, single stock dividend forecasts. Short term dividends future would therefore trade as a zero-bond, with

Exhibit 19: SX5E Dividend Futures "Pull-To-Realized"



Source:Shiller, Credit Suisse Equity Derivatives Strategy

Exhibit 20: SX5E Div Futures Realised Volatility Heading to Expiry



Source: Datastream, Credit Suisse Equity Derivatives Strategy an expected final payment (the expected dividend) discounted at a risky rate (the risk-free rate plus a Dividend Risk Premium).

3. **Dividend uncertainty fades early:** most of the dividends paid over a year by SX5E constituents are concentrated over a couple of months only and already declared very early in the year (see textbox on page 8). Most of the risks linked to a given calendar year's dividends therefore start disappearing as early as November the previous year. Additionally, those dividends already announced allow drawing more precise forecasts on the ones yet to be announced.

Why Do Dividends Have Delta?

There are also fundamental reasons why longer-term dividend expectations should correlate well with share prices, while short-term expectations should not.

In its most generic form, the dividend discount model states that a share price is equal to the discounted value of expected future cash flows linked to the equity holding: dividends for the period where dividends can be forecasted, and an expected terminal value thereafter:

$P = \sum_{i=1}^{N} \frac{D_{T_i}}{(1+k_e)^{T_i}} + \frac{P_N}{(1+k_e)^{T_N}}$ (1)

Where P = observed share price, DTi = expected net value of dividend paid at time Ti, ke = equity discount rate (check name), PN = expected terminal value at time TN when dividend forecast period ends

In the particular case of an equity index, index dividend forecasts are generated through the bottom up aggregation of its constituents' individual dividend forecasts (see dividend index construction in Appendix 4), in an exercise that takes into account single companies earnings and payouts estimates, and the index composition dynamics.

According to the analysis in equation (1), equity investors face two sources of risk: 1) the estimation of dividends over the forecast period, and 2) the estimation of terminal value. Dividend estimates and terminal value are less correlated than say coupon and notional for a corporate bond investor, since a firm could, at least theoretically, decide to cut dividends in the short term with limited impact on the expected terminal value.

The equity terminal value could be estimated through an infinite period dividend discount model, where dividend payments would be expected to grow at a fixed rate from an expected baseline level:

$P_N = \sum_{j=1}^{\infty} \frac{D(1+g)^{T_j}}{(1+k_e)^{T_j}} = \frac{D}{k_e - g}$ (2)

Where D = long term dividend baseline, g = expected dividend growth rate

Using the observed share price as a starting point and dividend estimates for the forecast period, one could in theory infer the "implied" value of future dividends from (1) and (2) as follows:

$$D = \left[P - \sum_{i=1}^{N} \frac{D_{T_i}}{(1+k_e)^{T_i}}\right](k_e - g)(1+k_e)^{T_N}$$

The above suggests that implied dividends where maturity would fall outside of the forecast horizon could be split in two components: the dividend "delta", which has a strong, positive correlation to share price, and the dividend "alpha" which would be expected to have a negative value.

Conversely implied dividends that fall within the forecast horizon would behave somewhat independently from the share price with zero delta, and more like a zero-bond with a strong, positive alpha (a fixed payment discounted at an appropriate rate that would incorporate a specific risk premium).

The Time-Varying Delta of Dividends

From the discussion above, we would ask: when do dividend futures stop being a proxy to equities, and start trading as an independent risky asset? In other words, when do dividends stop carrying an Equity Risk Premium, and start giving exposure to the Dividend Risk Premium?

Getting closer to the expiry, the dividend "delta" (i.e. its sensitivity to Equity movements) is expected to go gradually to zero, while the alpha (i.e. the "fixed" dividend) is expected to increase up to the discounted value of the dividend forecast. This effect should be particularly marked when the dividend enters the forecast period.

We looked at the following linear model:

$$Dividend_t^Y = \alpha_t + \delta_t Index_t + \varepsilon_t.$$

Where:
Dividend$_t$ = settlement price of the SX5E dividend future expiring in December of year Y, at time t prior to expiry.
a$_t$ = time-varying dividend alpha
d$_t$ = time varying dividend delta
Index$_t$ = value of the SX5E index at time t

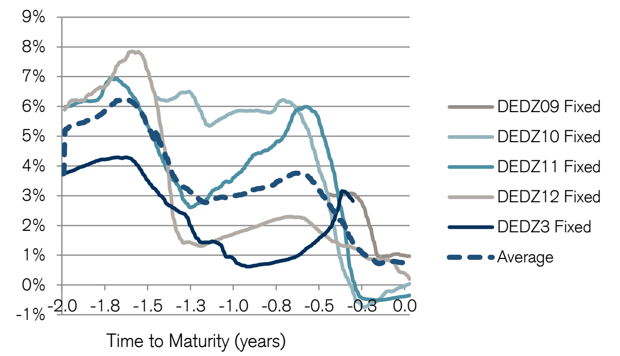
We estimated the above model for every day heading to expiry for all expired dividend futures. The results are shown on Exhibit 21 and 22.

According to this analysis, the switch from delta to alpha seems to happen over two phases, in May/September of the year preceding expiry (e.g. May 2011 for the DEDZ12 future), and again in May/September of the expiry year. The results are very stable from one dividend futures to another.

Both phases correspond to dividend payment seasons: in the first phase dividends announced for year n-1 provide valuable information for investors trying to forecast dividends for year n and provide an anchor for dividend expectations. In the second phase, dividends gradually go ex-div, removing any remaining risk of a dividend cut: the price of dividends gradually converges towards their expected value.

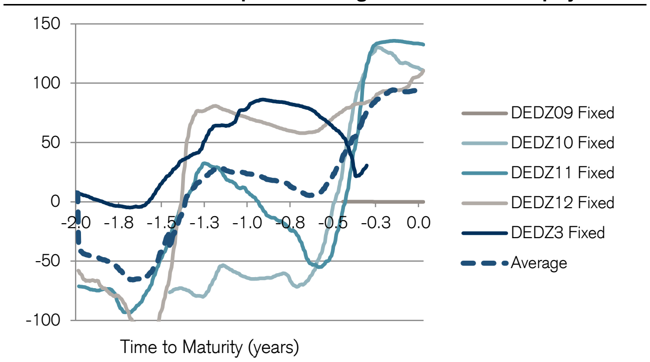
This also suggests that the optimal holding period for dividend futures may start as early (as late?) as 1.5 years before expiry.

Exhibit 21: Dividend "Delta" heading into Div Future expiry



Source: Credit Suisse Equity Derivatives Strategy

Exhibit 22: Dividend "Alpha" heading into Div Future expiry



Source: Credit Suisse Equity Derivatives Strategy

Calc'ing the Dividend Risk Premium

The above analysis suggests that it is only from 1.5 years before maturity that Equity market traders begin to form relatively precise expectations on SX5E dividends for the expiry year. Having an anchor on expected dividends is a condition for the calculation of the Dividend Risk Premium – with any result earlier than 1.5 years prior to maturity likely to carry a lot of error. We will limit our analysis to this horizon.

Richard Manley and Christian Mueller-Glissmann (*The Market for Dividends and Related Investment Strategies*, Financial Analysts Journal, Volume 64, Nov 2008) calculate the dividend risk premium as follows:

$$\frac{ID_{Y,t}}{(1+r_{Y,t})^T} = \frac{ED_{Y,t}}{(1+r_{Y,t}+DRP_{Y,t})^T} \quad (3)$$

Where

$ID_{Y,t}$ = Implied Dividends for year Y, at time t

$ED_{Y,t}$ = expected dividends for year Y, at time t

$r_{Y,t}$ = risk-free rate for year y, at time t

$DRP_{Y,t}$ = dividend risk premium for year y, at time t

From where we derive the annualized Dividend Risk Premium:

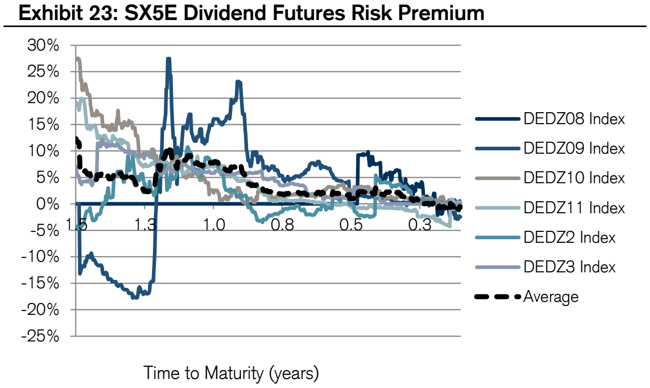
$$DRP_{Y,t} = \sqrt[T]{\frac{ED_{Y,t}}{ID_{Y,t}}}\left(1 + r_{Y,t}\right) - r_{Y,t} - 1 \quad (4)$$

Because the discount rate for expected dividends includes a risk premium, implied dividends are expected to trade at a discount to market expectations. As time to expiry T goes to zero, this premium is expected to gradually go to zero, consistent with the observed Pull-to-realized effect discussed on page 9.

We applied (4) to calculate the dividend risk premium on SX5E dividend futures, making the following simplifying assumptions:

- Dividend Futures are assumed to be equal to implied dividends (which is expected to be true if you discard the impact of daily margining and compounding to expiry)
- Expected Dividends are assumed to show no bias, i.e. we use the realized value of the SX5ED dividend index for the relevant year as a proxy for expected dividends.

Exhibit 23: SX5E Dividend Futures Risk Premium



Source: Credit Suisse Equity Derivatives Strategy

Exhibit 23 yields the following important remarks:

1. **<u>Dividends' unit price of risk is stationary:</u>** the annualized Dividend Risk Premium goes to zero as we get to maturity. This is a consequence of divided risk itself going to zero, while the price of risk stays relatively stationary. Calculating price of risk as in the below:

   Risk Premium = Risk x Unit Price of Risk,

   where Risk = the realized volatility of the dividend future, we find that the unit price of risk is, on average, equal to 0.5 – a dividend volatility of 20% implying a risk premium of 10%.

2. **<u>The Dividend Risk Premium is rich:</u>** if we compare to the Equity Risk Premium, the dividend risk premium itself seems rather high. Based on calculations provided by the Credit Suisse Global Strategy team, the Equity Risk Premium has been on average 7.8% since 2008 for a realized volatility of 28%, implying a unit price of risk of 0.3 only.

The Dividend Risk Premium is Rich

A high risk premium could either stem from a high expected dividend risk, or a systematically high market price for this risk. It may also be inflated by recurrent market imbalances such as illiquidity or large position overhangs.

The profitability of Dividend Risk Premium strategies discussed later in this report suggests any or all of the following:

1. **<u>Dividend investors may systematically overestimate the risk of single stock dividend cuts</u>**. The frequency of a dividend cut superior to 60% year-on-year by SX5E constituents has been only 4% since 1991, although since 2008 this risk has risen to 7% (Exhibit 24 next page). This makes large dividend cuts a low probability, high impact event and therefore the market price of that risk is likely to be impacted by strong risk aversion.

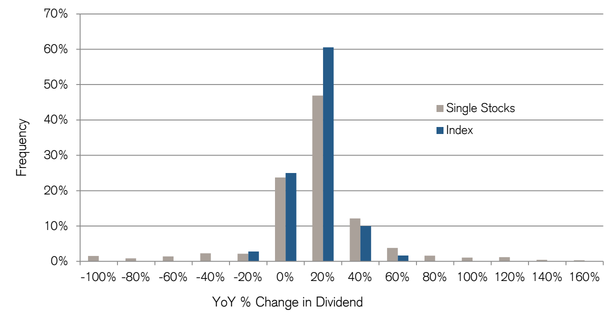
   One acid test for a systematic bias in assessment of single stock dividend risk would be to analyze the profitability of a strategy systematically going long single stock dividend futures (not investigated in this report).

2. **Dividend investors may systematically underestimate the benefit of diversification in dividend indices.** Comparing the distribution of year-on-year change in index dividends (SPX and Eurozone) to that of single stocks (SX5E constituents since 1991) shows a highly concentrated distribution: the maximum year-on-year fall in dividends over the last 140 years of S&P data, and 40 years of Eurozone data, has been 27.8%.

   Correlation risk for dividends gravitates around macro tail risks such as the 1930's Depression or more recently the Subprime Crisis, but also around political risks such as dividend taxation and regulatory constraints, which are difficult to predict and impacted by strong risk aversion. One possible way to test for systematic bias in index dividend correlation risk would be to analyze the profitability of a strategy that would systematically go long index dividend futures, and hedging through going short dividend futures on the index constituents (not investigated in this report).

3. **Dividend investors may require a premium for liquidity risk.** In particular the memory of the dividend liquidity crunch in 2008, when SX5E dividends fell 10% lower than the SX5E index on virtually no bid (see our February 2009 report A Window of Opportunity in Dividends), may still push SX5E dividend futures to trade at a large discount to expected dividends.

Exhibit 24: YoY Changes in Dividends – Index vs Stock *



Source: Credit Suisse Equity Derivatives Strategy
* Stock = constrituents oif the SX5E index since 1991, index = SPX since 1871, Datastream TOTMKEUR since 1982

4. **The large long-SX5E dividend overhang of banks' trading desks creates a systematic mispricing** of dividends. One way to gauge the impact of this overhang would be to compare the profitability of two identical long dividend futures strategies, one on SX5E, and one on an index where there is limited retail product offering, such as FTSE. Results displayed in Appendix 3 suggest that this mispricing could represent as much as 4.7% per year, or 16 bps per year on the value of the SX5E forward assuming 3.5% dividend yield.

Dividend Risk Premium Extraction Strategies

In this section we investigate systematic strategies designed to extract the dividend risk premium. We first design a way to get a stable exposure to dividends through strategies rolling dividend futures and then look at dividend strategies that based on backtests yielded a Sharpe ratio of up to 1.2 since 2008.

Stable Exposure to Dividend Risk

As discussed on page 9, dividend futures have a fixed expiry and tend to trade at close to zero volatility for a large portion of the year, which makes risk budgeting difficult.

In order to provide a more constant exposure to implied dividends, we try to mimic a hypothetical n-year constant tenor dividend future by taking a position in dividend futures with expiry dates around the desired tenor. This position is rolled daily to gradually take the weight in the dividend future with closest expiry (the front future in the below) to zero, while the position in the other future (the back future) would gradually go to 100%. See Exhibit 24 next page.

Compared to a strategy that would simply roll 100% of the position in the front future at a given date during the year (say July after most of the dividends have been paid), this "constant-maturity" strategy has the following benefits:

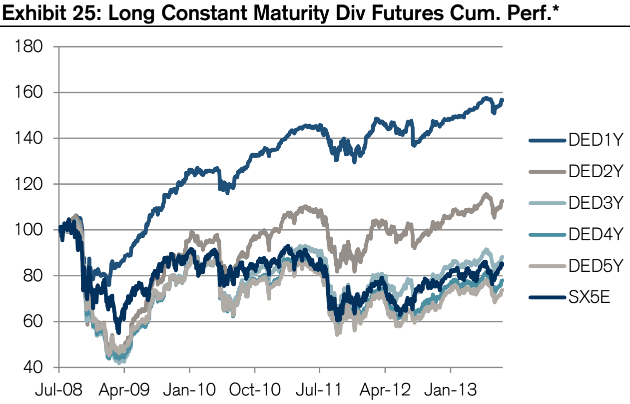
- **Risk allocation**: the volatility of the aggregate position does not go to zero as the Pull-to-Realised effect of the front future kicks in. The benefit is that we also keep constant exposure to the dividend risk premium.
- **Liquidity**: instead of having to roll out 100% of the front future into 100% of the back future on just one specific day of the year (with corresponding market impact), the trade size is split over more than 250 trading days throughout the year

In the below we use the following nomenclature: the hypothetical 1-year constant maturity dividend future is referred to as DED1Y, 2-year as DED2Y etc…

Pure Long Div Strategies

We first test strategies that go naked long constant maturity dividends without hedging the indirect equity exposure (the "dividend delta"). Every day, the quantity of dividend futures held is rebalanced to match the cumulative performance of the strategy. As one would expect from the previous discussion, and since the dividend risk premium is mainly located in the immediate dividend futures, the 1-year strategy significantly outperforms, benefiting from both a higher annualized performance and a lower realized volatility. Actually outside of the 1-year and to a (far) lesser extent the 2-year dividend strategies, we see little difference between the longer-term dividend strategies and simply holding the SX5E index.

Exhibit 25: Long Constant Maturity Div Futures Cum. Perf.*



Source: Credit Suisse Equity Derivatives Strategy

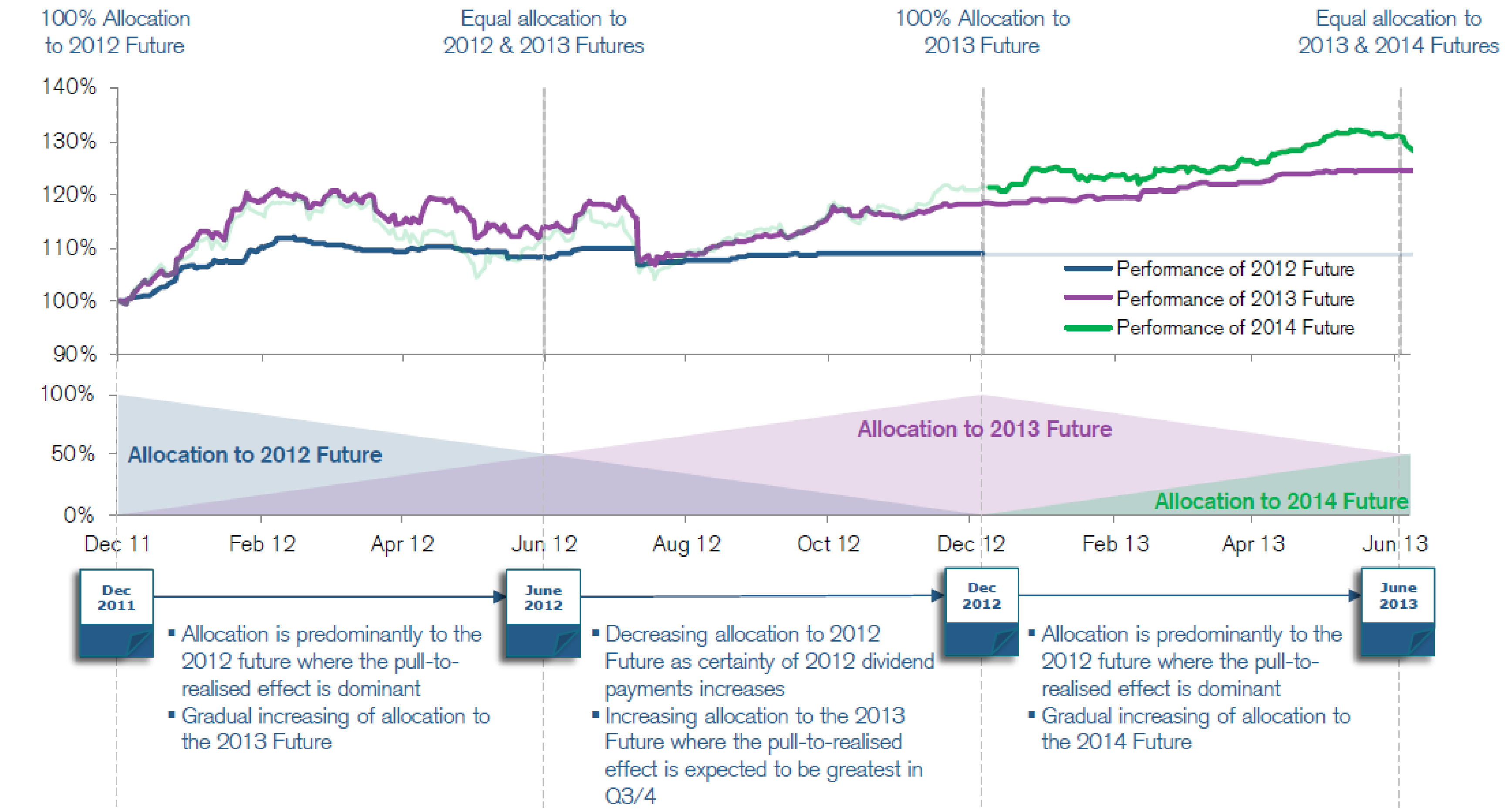
Exhibit 26: Long Constant Maturity Div Futures Perf. Summary

	DED1Y	DED2Y	DED3Y	DED4Y	DED5Y	SX5E
Annualised Return	**9.2%**	2.3%	-2.4%	-4.8%	-5.8%	-3.2%
Volatility	**11.7%**	21.1%	22.2%	22.9%	23.6%	28.0%
Sharpe Ratio	**0.71**	0.07	-0.15	-0.24	-0.28	-0.14
Max Drawdown	**-32.4%**	-57.7%	-59.8%	-57.7%	-56.2%	-47.5%
Best month	**9.0%**	24.2%	27.4%	24.4%	20.8%	14.7%
Worst Month	**-22.5%**	-34.7%	-36.3%	-32.3%	-27.7%	-14.7%
Average Month	**0.8%**	0.5%	0.2%	0.0%	-0.2%	-0.1%
Pct Positive Montl	**70.0%**	60.0%	55.0%	55.0%	55.0%	51.7%

Source: Credit Suisse Equity Derivatives Strategy

.

Exhibit 24: Numerical Example, Allocation to Dividend Futures from Dec 2011 to June 2013

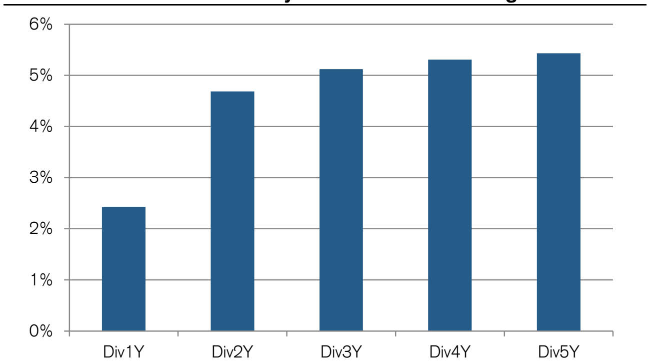


Source: Credit Suisse Equity Derivatives Product Management

Hedging with SX5E

However, the "constant maturity" strategies also capture the varying delta of dividend futures discussed on pages 10 and 11 of this report. As shown on Exhibit 27, the delta of the hypothetical DED1Y dividend future (2.4%) corresponds roughly to what would be expected from the analysis on Exhibit 21 page 11, one year prior to expiry.

Exhibit 27: Constant Maturity SX5E Dividend Strategies Delta*

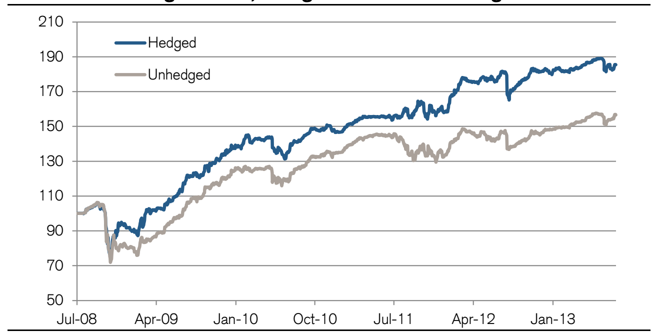


Source: Credit Suisse Equity Derivatives Strategy
* Estimated through linear regression starting July 2008

In order to extract a pure dividend risk premium, we test strategies that go long "constant maturity" dividend futures and hedge the indirect equity exposure by going short the SX5E index against it. Every day, the hedge ratio is calculated using a linear regression of the dividend futures returns versus the SX5E returns over the preceding two weeks.

On Exhibit 28, we compare such a strategy going long the hedged "constant maturity" DED1Y dividend future, to the previous strategy simply going long DED1Y. Implementing the SX5E hedge improves annualized return by 5.7% for the 1-year constant maturity strategy, almost doubling the Sharpe Ratio of the strategy to 1.0 vs 0.7.

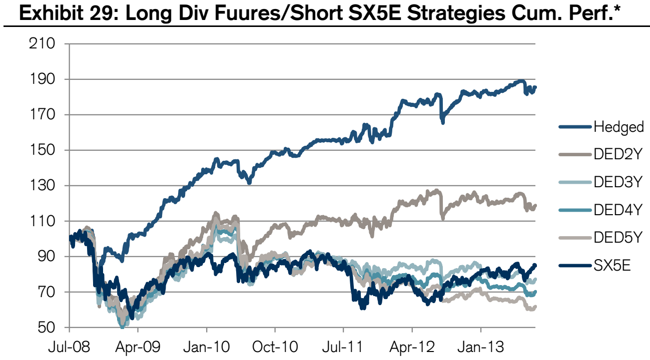
Exhibit 28: Long DED1Y, Hedged versus Not Hedged



Source: Credit Suisse Equity Derivatives Strategy

On Exhibits 29 and 30 we show the performance of strategies going long "constant maturity" futures hedged with SX5E. Although the 2-year strategy is also improved versus the non-hedged version, we actually see little change for longer maturities apart from a decrease in realized volatility.

Exhibit 29: Long Div Fuures/Short SX5E Strategies Cum. Perf.*



Source: Credit Suisse Equity Derivatives Strategy

Exhibit 30: Div Futures/Short SX5E Strategies Perf. Summary

	Hedged	DED2Y	DED3Y	DED4Y	DED5Y
Annualised Return	**12.9%**	3.4%	-5.0%	-6.7%	-9.0%
Volatility	**11.6%**	18.5%	18.8%	18.4%	18.3%
Sharpe Ratio	**1.03**	0.14	-0.30	-0.41	-0.53
Max Drawdown	**-28.8%**	-49.9%	-53.1%	-52.0%	-49.5%
Best month	**12.6%**	17.5%	19.8%	18.2%	16.8%
Worst Month	**-19.2%**	-33.9%	-35.5%	-30.2%	-24.7%
Average Month	**1.1%**	0.5%	-0.1%	-0.3%	-0.6%
Pct Positive Montl	**60.0%**	63.3%	51.7%	46.7%	46.7%

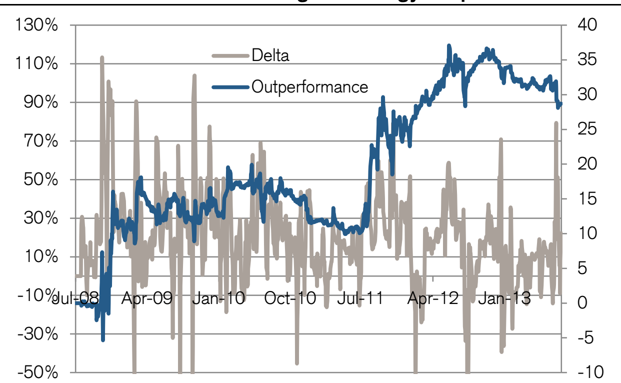
Source: Credit Suisse Equity Derivatives Strategy

We draw the following conclusions from the above:

1. **<u>The 1-year strategy significantly dominates strategies investing in longer maturities</u>**. It is also the only systematic strategy on SX5E dividends providing clean exposure to the SX5E dividend risk premium according to discussions in section 2 of this report. We will refer to it as the Dividend Risk Premium (DRP) strategy.
2. **<u>Hedging the remaining SX5E sensitivity is a key element of the strategy</u>**.

We look in more details into point 2). The beta of dividends, calculated over a relatively short period of time (10 working days), is strongly reactive to market conditions. Although it tends to be positive (on average 20.5%, see Exhibit 31), it sometimes falls down to zero or even negative numbers. It also peaked at 113% during the Lehman crisis of 2008.

Exhibit 31: 1Y Div Beta and Hedged Strategy Outperf. since 2008



Source: Credit Suisse Equity Derivatives Strategy

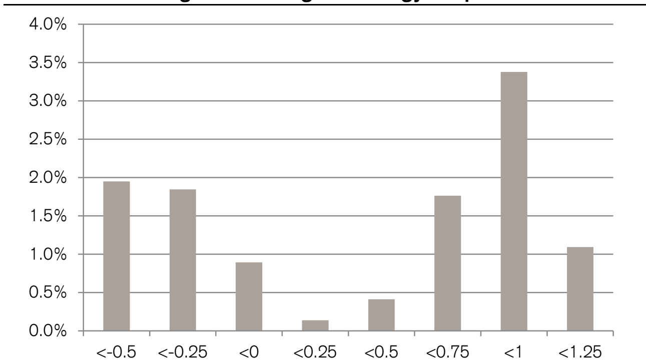
Exhibit 32 plots, for each value of the dividend beta during the backtest history, the average outperformance achieved by the DRP strategy versus the unhedged version, over the following two week period.

Strongly positive beta: hedging the beta of dividends seems to be of particular value-added at times when the beta is 75% or higher. Such a high beta reading would indicate a re-correlation of assets and a high level of stress in financial markets, a situation in which the short SX5E hedge is expected to perform strongly. On those occasions (2.4% of observations), the outperformance of the hedged strategy can reach up to 3.5% over the following two weeks.

Negative beta: hedging the beta of dividends also adds value at times when the beta is negative (15% of observations).

Outside of those two specific cases, the DRP strategy moderately outperforms its unhedged alternative.

Exhibit 32: Average 2-wk Hedged Strategy Outperf vs 1Y Div Beta



Source: Credit Suisse Equity Derivatives Strategy

Last point: delaying the re-hedging of the dividend futures position following a change in the beta by a day or two can improve performance and Sharpe ratio by up to 5% and 0.5, respectively (see Appendix 1 page 20). We attribute this to mean-reversion characteristics of the SX5E index: a large drop in the SX5E index value would typically cause the beta of dividends to increase, causing you to increase your short SX5E hedge. However the SX5E would tend to momentarily rebound over the next few days after such a drop, so delaying the re-hedging by a couple of days would indeed increase performance.

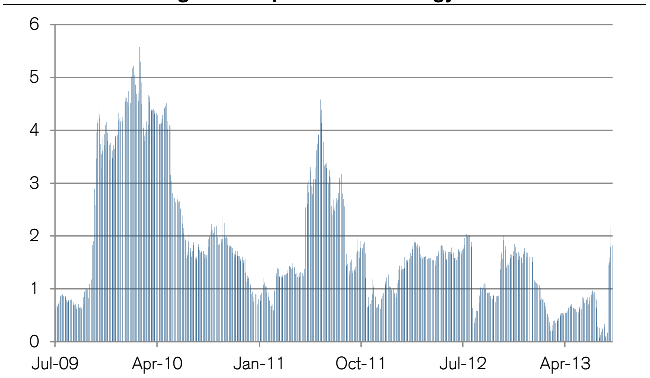
Is the DRP Strategy Sustainable?

We investigate the following two aspects: sustainability of performance and investibility of the strategy.

Sustainability of performance

Exhibit 33 next page shows that the rolling 1-year Sharpe Ratio of the strategy since 2008 has never been negative. Despite a strong start and Sharpe ratios of over 4 achieved in 2009/2010, the strategy's risk adjusted performance has established itself around 1.1 since the beginning of 2012 when financial markets returned to lower levels of volatility.

Exhibit 33: Rolling 1Y Sharpe of DRP Strategy



Source: Credit Suisse Equity Derivatives Strategy

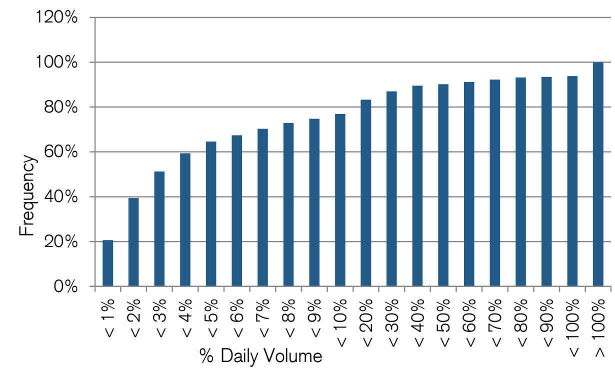
This level is also consistent with Sharpe ratios achieved when we change some of the parameters of the strategy, such as the window used for calculating the dividends' beta or the dividend futures bid-ask spreads (see sensitivity analysis in Appendix 2). This suggests that a Sharpe ratio of over 1.0 may be sustainable in the long run.

Investibility

Liquidity is not an issue for the SX5E leg of the strategy despite the strong variability in the delta of dividends as we calculate it. However, the dividend futures leg could face more liquidity pressure.

In order to test for liquidity we assumed a EUR 100mio investment in the strategy and calculated every day the trades corresponding to the daily roll from the front to the back future. We compared both theoretical trades to the number of contracts actually traded on the relevant future on that day (the % daily volume) and picked the worst of the two numbers every day. The distribution of this liquidity metric is provided on Exhibit 34. The size of the dividend futures trades represented less than 20% of the daily volume on 80% of the days during the backtesting period.

Exhibit 34: % Daily Volume for DRP Strategy, div leg



Source: Credit Suisse Equity Derivatives Strategy

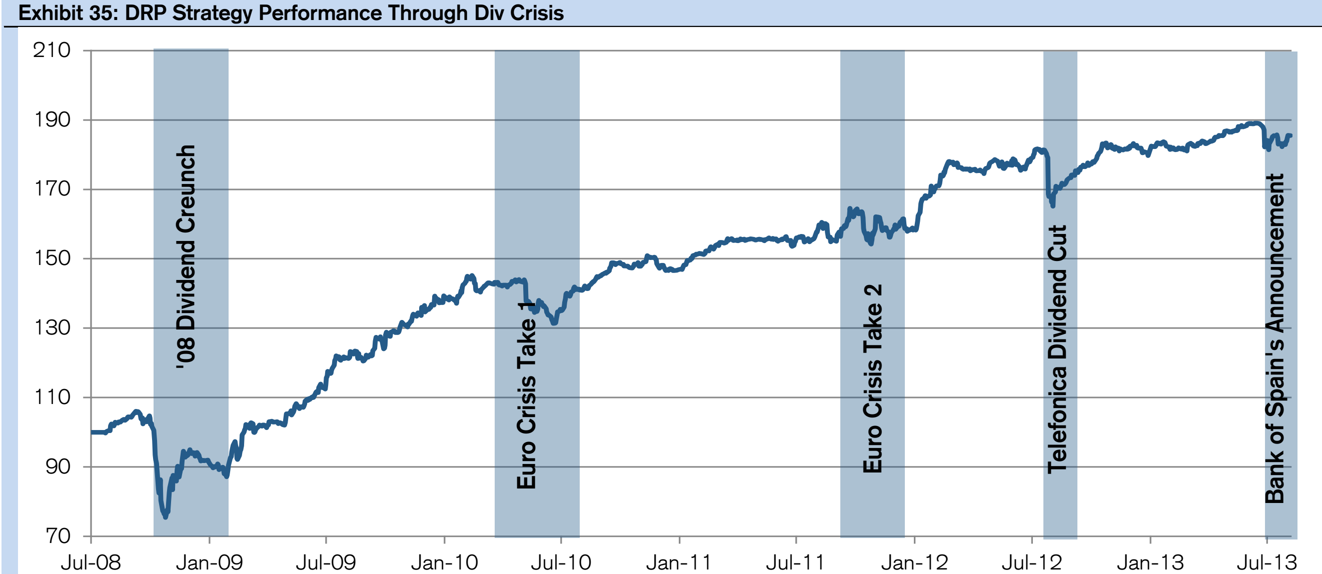
On 20% of days the strategy's trades would represent more than 20% of the daily volume, which could result in market impact and higher transaction costs. However we see two mitigating factors: according to sensitivity analysis, delaying a trade by one day or more appears not to affect the strategy's performance. Additionally, the performance seems relatively robust as regards to trading costs: quadrupling the dividend futures bid ask spread from 0.5% to 2% would result in only a 2.2% change in annualized performance, and a Sharpe ratio still over 0.8 net of costs.

A Recent History of SX5E Dividends through the Lens of the DRP Strategy

An interesting application of the DRP Strategy is that analyzing its performance allows us to spot specific dividend events since the launch of the SX5E dividend futures market. In particular:

- **2008 Dividend Crunch (Autumn 2008-Winter 2009)**: although SX5E dividend futures held out well in the first leg of the market drawdown that followed the Lehman bankruptcy, the impact of large trade unwinds by some hedge funds caused div futures to underperform the SX5E index by up to 15% between October 2009 and January 2009. The good standing of dividends in the second leg of the drawdown in January and February 2009, and the large rebound in dividends that followed market recovery after March 2009, led to the most profitable period for long dividends and the DRP strategy since dividend futures started trading on Eurex.
- **Euro Crisis Take #1 (Spring 2010)**: concerns over the quality of Sovereign credit in the Eurozone quickly spilled over to corporate credit, causing the iTRAXX IG credit index to jump from 75 bps to up to 140 bps. The consecutive fall in dividend futures (in a Credit crisis, the first thing corporates would cut before default is dividends) outpaced that of the SX5E index by up to 10% by mid June 2010. The gap was only closed by the end of August after which dividend futures and the SX5E index re-correlated.
- **Euro Crisis Take #2 (Summer 2011)**: the loss of its AAA rating by the US on 5 August (although this was somewhat anticipated after S&P had put the US on negative watch in April) reignited the Euro crisis, this time extended to Italy on top of Greece, Ireland, Spain and Portugal. Again the iTRAXX index jumped from a little over 100 bps to 210 bps. However this time, dividends tracked the SX5E better than in 2010, outperforming the SX5E by 7% by the end of September. The gap was closed by mid October. The DRP strategy shows this behaviour, rebounding strongly in the initial phase of the crisis, before abandoning its gains in the normalisation phase.
- **Telefonica's Dividend Cut (26 July 2012):** on that date, Telefonica who back then was among the largest contributor to SX5E dividends, announced a surprise cut of their EUR 0.4 interim dividend (ex-div 7th November 2012) and EUR 0.9 final dividend (ex-div 20th May 2013). On this dividend specific event, the 2012 dividend future DEDZ12 fell 3.4 index points and DEDZ3 by 6.9 points (a little over Telefonica's actual contribution to SX5E dividends), while the SX5E was unaffected and actually rebounded.
- **Bank of Spain's Announcement (27 June 2013):** on that date, Bank of Spain announced that Spanish banks may be limited in their ability to offer cash dividends in the future. The announcement immediately knocked 5% off Santander's 2013 dividend futures. Based on this number and Santander's contribution of 9.5 index points to SX5E 2013 dividend futures, the impact on the latter should have been limited to 0.5 index points. It actually fell 1.1 points, the difference coming from fears that other European banks may be forced to curb dividends as well – in other words, correlation. This risk failed to materialize and SX5E dividend futures eventually regained all of the loss.

Exhibit 35: DRP Strategy Performance Through Div Crisis



Source: Credit Suisse Equity Derivatives Strategy

Appendix 1: Sensitivity Analysis

We check the robustness of the backtest risk adjusted performance to changes in the parameters that govern the construction of the dividend strategy. Ideally a small change in the parameter should not materially affect the annualized return, volatility, Sharpe ratio or max drawdown of the strategy.

Changes in the Div Future maturity

Increasing the maturity of the long futures position does change materially the strategy's performance, however this is expected since the dividend risk premium is mostly carried by the front dividend future and absent from longer-term dividend futures.

Exhibit 36: Performance Statistics vs Div Future Maturity

Maturity	Annualised Return	Volatility	Sharpe	Max Drawdown
1	**12.9%**	**11.6%**	**1.0**	**-28.8%**
2	3.4%	18.5%	0.1	-49.9%
3	-5.0%	18.8%	-0.3	-53.1%
4	-6.7%	18.4%	-0.4	-52.0%
5	-9.0%	18.3%	-0.5	-49.5%

Source: Credit Suisse Equity Derivatives Strategy

Changes in the Beta Calc Window

The calculation window corresponds to the number of past observations used in the linear regression of dividend futures returns versus SX5E returns. The optimal performance is obtained with a 10-day calculation window. Changing it to 5 or 15 days decreases annualised performance to 12.5% and 11.8%, respectively, although with similar Sharpe ratio.

Exhibit 37: Performance Statistics vs Beta Calculation Window

Window	Annualised Return	Volatility	Sharpe	Max Drawdown
5	12.5%	11.7%	1.0	-29.9%
10	**12.9%**	**11.6%**	**1.0**	**-28.8%**
15	11.8%	11.4%	1.0	-25.8%
20	12.0%	11.5%	1.0	-25.0%
40	8.5%	11.6%	0.7	-24.8%
60	8.1%	11.6%	0.6	-23.3%

Source: Credit Suisse Equity Derivatives Strategy

Changes in the Trading Lag

The trading lag corresponds to the lag between the day when the futures position and corresponding SX5E hedge is calculated, and the day the trades are implemented. Performance of the strategy seems to increase with the lag, which could be linked to some mean-reversion in the SX5E index level following an increase in dividend beta. We picked 1 day in order to keep a clean exposure to dividend exposure and remove any side exposure to SX5E mean-reversion. However trading lags of up to 4 days would increase the Sharpe ratio to 1.3 and over.

Exhibit 38: Performance Statistics vs Trading Lag

Trading Lag	Annualised Return	Volatility	Sharpe	Max Drawdown
1	**12.9%**	**11.6%**	**1.0**	**-28.8%**
2	15.0%	11.0%	1.3	-24.8%
3	17.8%	11.1%	1.5	-19.6%
4	17.0%	11.5%	1.4	-21.7%
5	11.6%	11.5%	0.9	-25.0%

Source: Credit Suisse Equity Derivatives Strategy

Changes in Transaction Costs

The typical bid ask spread for SX5E front dividend futures is 50bps, at which level the Sharpe ratio of the strategy is 1.0. However even a 1.5% spread allows for a Sharpe Ratio of over 0.9.

Exhibit 39: Performance Statistics vs Futures Bid Ask Spread

Futures BidAsk Spread	Annualised Return	Volatility	Sharpe	Max Drawdown
0.50%	**12.9%**	**11.6%**	**1.0**	**-28.8%**
0.75%	12.5%	11.6%	1.0	-28.9%
1.00%	12.2%	11.6%	1.0	-29.0%
1.25%	11.8%	11.6%	0.9	-29.1%
1.50%	11.4%	11.6%	0.9	-29.1%
1.75%	11.1%	11.6%	0.9	-29.2%
2.00%	10.7%	11.6%	0.8	-29.3%

Source: Credit Suisse Equity Derivatives Strategy

Changes in Return Lag

The return lag corresponds to the lag in days used for calculation of the dividend future and SX5E returns used in the Beta calculation. We used 5 days which corresponds to one full week. Using daily returns instead would increase the Sharpe ratio to 1.2.

Exhibit 40: Performance Statistics vs Return Lag

Return Lag	Annualised Return	Volatility	Sharpe	Max Drawdown
1	12.7%	10.0%	1.2	-27.2%
2	12.2%	10.2%	1.1	-28.7%
3	13.4%	10.6%	1.2	-27.8%
4	14.1%	11.0%	1.2	-24.5%
5	**12.9%**	**11.6%**	**1.0**	**-28.8%**
10	11.7%	12.5%	0.9	-29.0%
15	6.0%	12.6%	0.4	-30.1%
20	6.4%	12.8%	0.4	-28.3%

Source: Credit Suisse Equity Derivatives Strategy

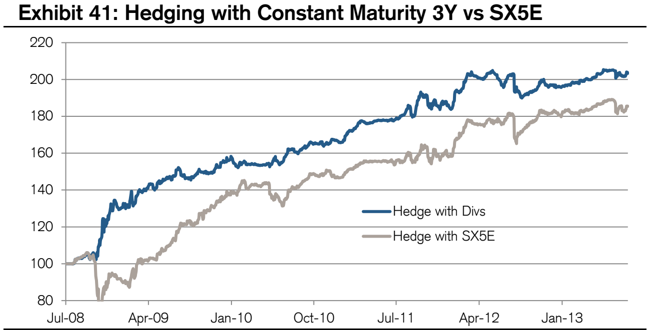
Appendix 2: Hedging with Longer-term Dividend Futures

Instead of hedging the long position in the DED1Y dividend futures with SX5E, it seems reasonable to hedge it with longer term futures instead in order to cancel out more risk dimensions. However the resulting strategy would be difficult to implement for liquidity reasons.

This variation would differ from a traditional dividend flattener trade (long short-term dividends vs short long-term dividends in expectation of a flattening of the term structure of dividends) because, instead of applying the same notional on both legs, we calculate a hedge ratio based on the beta of long-term dividends versus short-term.

As shown on Exhibit 41, the performance would be improved, with annualized return of 14.9% versus 12.9% and Sharpe ratio of 1.7 versus 1.0. The main improvement comes from a max drawdown of 7.3% only versus 28.8%, as hedging with longer-term dividend futures allows the strategy to be very profitable in 2008.

Exhibit 41: Hedging with Constant Maturity 3Y vs SX5E

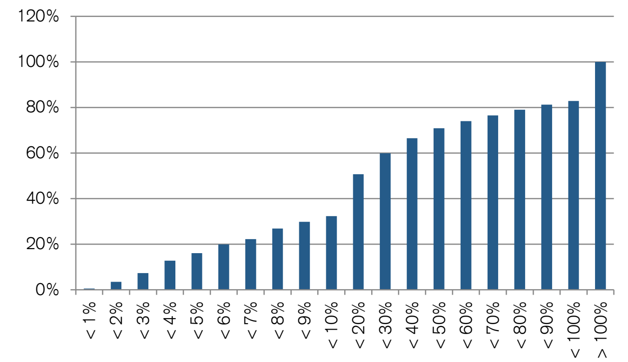


Source: Credit Suisse Equity Derivatives Strategy

However this strategy would be difficult to implement because of liquidity constraints. While front dividend futures are reasonably liquid, liquidity becomes sketchy at best for longer maturities. This is complicated by the fact that the hedge ratio (the beta of longer term div futures versus short term) tends to be very volatile.

As shown on Exhibit 42, an investor willing to put EUR 100mio at play on this strategy will represent more than 20% of the daily volume on more than 50% of trading days.

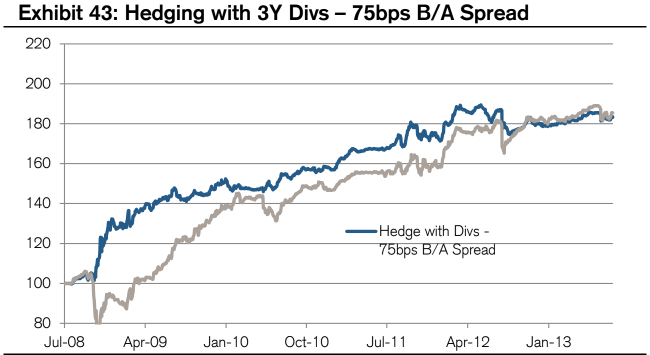
Exhibit 42: % Daily Volume for Div Future Hedge



Source: Credit Suisse Equity Derivatives Strategy

Implementing the strategy would therefore result in large transaction costs, when increasing the bid ask spreads on dividend futures from 50bps to 75bps is enough to eat up all of the strategy's outperformance in the long run.

Exhibit 43: Hedging with 3Y Divs – 75bps B/A Spread



Source: Credit Suisse Equity Derivatives Strategy

Exhibit 44: Performance Statistics – Hedge with 3Y Divs

	Hedge with 3Y Divs	Hedge with 3Y Divs - 75bps B/A Spread	Hedge with SX5E
Annualised Return	**14.9%**	12.6%	12.9%
Volatility	**9.0%**	9.0%	11.6%
Sharpe Ratio	**1.56**	1.30	1.03
Max Drawdown	**-7.3%**	-7.9%	-28.8%
Best month	**17.5%**	17.0%	12.6%
Worst Month	**-3.1%**	-3.2%	-19.2%
Average Month	**1.2%**	1.0%	1.1%
Pct Positive Months	**66.7%**	63.3%	60.0%

Source: Credit Suisse Equity Derivatives Strategy

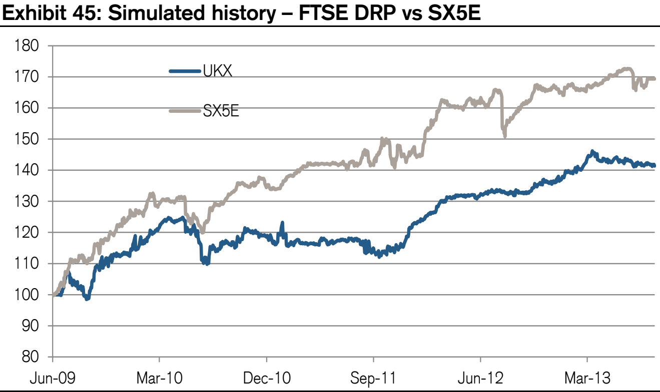
Appendix 3: FTSE Dividend Risk Premium Strategy

We apply the methodology developed for the SX5E Dividend Risk Premium strategy to the FTSE 100 index, which has the second most liquid, listed dividend futures market – although liquidity is very faint, meaning this strategy is unlikely to be implementable in real life.

As shown on Exhibits 45 and 46, the annualized return of the dividend risk premium strategy for the FTSE is 4.7% lower than the SX5E, while at the same time volatility is larger, resulting in a Sharpe ratio which is only a fraction of that of the SX5E strategy over the same period. We attribute those disappointing results to the below:

- A less active single stock dividend market for FTSE constituents
- A less pronounced Pull-to-Realised effect because dividends are more evenly distributed throughout the year on the FTSE
- A smaller overhang of structured products on the FTSE than on the SX5E, resulting in a lower risk premium on FTSE dividend futures

Exhibit 45: Simulated history – FTSE DRP vs SX5E



Source: Credit Suisse Equity Derivatives Strategy

Exhibit 46: Performance Statistics – FTSE DRP vs SX5E

	FTSE	SX5E
Annualised Return	**8.6%**	13.3%
Volatility	**9.3%**	7.8%
Sharpe Ratio	**0.87**	1.65
Max Drawdown	**-12.1%**	-9.5%
Best month	**10.5%**	7.4%
Worst Month	**-9.5%**	-7.0%
Average Month	**0.6%**	1.0%
Pct Positive Months	**65.3%**	61.2%

Source: Credit Suisse Equity Derivatives Strategy

Appendix 4: A Guide to Dividend Investing

Here we examine how dividends, which have all the characteristics of an independent asset class, can be traded on their own through specific vehicles. We start by providing a few, key definitions on what constitutes an eligible dividend, how single stock dividends are aggregated into index dividends, before discussing how index dividends are priced and traded independently on Equity derivatives markets.

Ordinary, Cash Dividends

Although the generic definition of a dividend is that of a payment made by a firm to its shareholder, this payment can take a number of forms. A dividend can indeed be paid in cash (most common), but also shares or even hybrid forms such as scrip dividends. Dividends can also be ordinary, when dividends are paid off relevant year earnings, or special, when the firm or the exchange declares it so or when they consist of "cash distributions that are outside the scope of the regular dividend policy" (STOXX Calculation Guide). In the remainder of this report we will concentrate only on ordinary, cash dividends. Typically, other dividends are subject to adjustments that cancel out the effect of the dividend payment, either on the firm's market capitalization, or on the value of the Equity index which the firm's stock is a constituent of. They therefore are normally excluded from dividend index calculations.

From Single Stock to Index Dividend

Similarly to how individual share prices are aggregated in order to compute an equity index price, dividend indices can be calculated by adding up qualifying dividends paid out by constituents of the underlying equity index. Each individual dividend is weighted according to the number of shares of the relevant constituent in the reference basket.

In order to calculate its dividend points (DVP) indices, STOXX performs the below calculations on a daily basis:

Calculation of the Dividend Amount:

$$DA_t = \sum_{i=1}^{n} d_{it} s_{it} ff_{it} cf_{it} X_{it-1}$$

Where:
t = Time the amount is computed
n = Number of companies in the index
i= Individual company being a member of the index
d_{it} = Includes ordinary, unadjusted gross cash dividends and withholding tax amounts applied to special cash dividends and capital returns in respect of each share of company i which is a constituent of the index at day t
S_{it} = Number of shares eligible for dividends in company I at time t
F_{it} = Free-float factor of company i at time t
cf_{it} = Weighting cap factor of company I at time t
X_{it-1} = Exchange rate from local currency into EUR for company t at time t-1

Calculation of the Dividend Points:

$$DP_t = \frac{DA_t}{D_t}$$

Where:
t = Time the value is computed
d_t = Divisor of the price index at time t

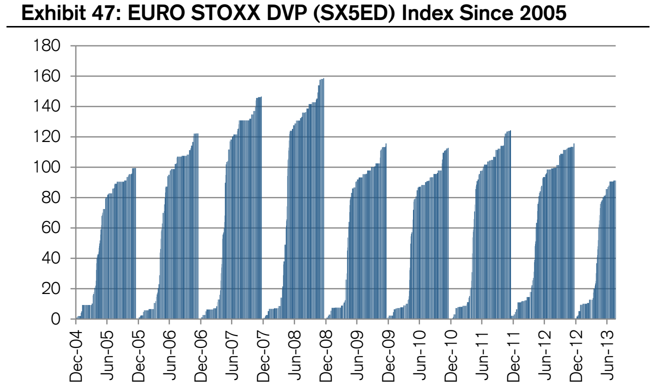
Calculation of the DVP Index:

The STOXX DVP ongoing value is the sum of the STOXX Dividend Points at time t, DPt excluding the third Friday of December and including the third Friday in December of the settlement year, ie:

$$DVP_t = DVP_{t-1} + DP_t$$

The EURO STOXX 50 DVP index (SX5ED), which we use in the remainder of this report, is calculated in this fashion and reset to zero each year after the third Friday in December, as shown on Exhibit 47.

Exhibit 47: EURO STOXX DVP (SX5ED) Index Since 2005



Source: STOXX, Credit Suisse Equity Derivatives Strategy

Implied versus Realized Dividends

While the above calculation provides an estimate of dividends actually paid out by an equity index over a given, past period (realized dividends), an estimate of the dividends expected to be paid over a future period can be derived from the market price of financial derivatives such as index futures or options.

While it is theoretically possible to infer implied dividends from the price of a future or a forward, this is only possible for short maturities due to liquidity constraints. Instead, market practitioners use Put Call parity, deriving implied dividends from put and call option prices which are available even for long maturities: SX5E options trade (at least in theory) for maturities up to 10 years on the EUREX exchange.

The underlying index can be replicated by a synthetic forward, that is going long a put and short a call with identical strike K:

$$Call(t,K,T) - Put(t,K,T) =$$
$$Index_t - ImpliedDividends(t,T) - Ke^{r(T-t)}$$

From which:

$$ImpliedDividends(t,T) =$$
$$Index_t - Ke^{r(T-t)} + Put(t,K,T) - Call(t,K,T)$$

Where:
t = Time the implied dividend is computed
Call(t,K,T), Put(t,K,T) = price of a call and put option written on the underlying index at time t, with strike K and expiry T
Indext = value of the underlying price index at time t
r = continuous interest rate

Exhibit 48: SX5E Implied Dividend Calculation (ref 20 Aug 2013)

	Dec-14	Dec-15
Days to maturity (actual)	1.33	2.33
Spot	2787.98	2787.98
Strike	2800	2800
Accounting Rate	0.38%	0.54%
Borrow rate	-0.46%	-0.55%
Put	313.95	433.79
Call	208.49	263.91
Implied Dividends	***124.65***	***228.18***

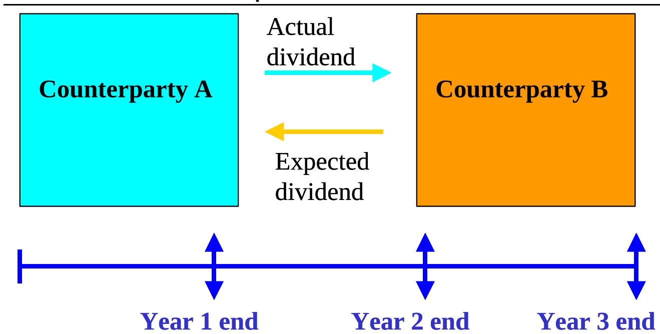
Source: Credit Suisse Equity Derivatives Strategy

From Dividend Swaps to Dividend Futures

Dividend trades are implemented through two main products: dividend swaps and futures. Dividend swaps were historically the first dividend trading vehicle before being partially replaced by dividend futures.

In a dividend swap, one counterparty makes a fixed payment (the quoted bid or ask "strike" in the dividend swap) against the other party's floating payment (the actual dividends paid on the index according to the calculations explained above) – see Exhibit 49. The net difference is settled annually, and is equal to the difference in index points times the appropriate multiplier, i.e. x euros per index point.

Exhibit 49: Dividend Swap Flow Chart



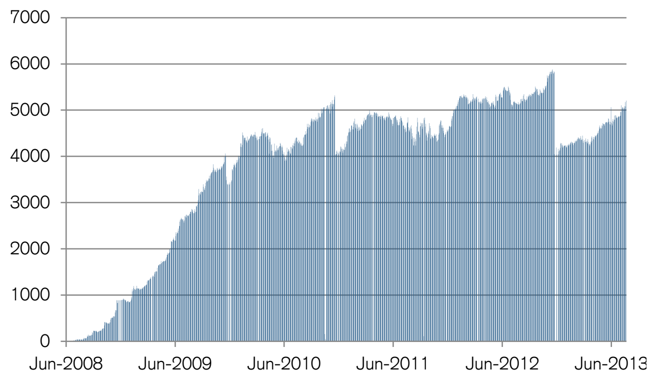
Source: Credit Suisse Equity Derivatives Strategy

However, on 30 June 2008, Eurex launched a range of futures benchmarked on the SX5ED Index, which specifications are detailed on Exhibit 46 on page 21. EURO STOXX dividend futures have annual expiries, set to be the third Friday of December. On expiry, the future settles at the final value of the SX5ED index calculated over the relevant year. The future has a value of €100 per index point.

For example: assume that, following a 3.5 point fall in the future the previous day, an investor decides to go long 10 units of the Dec12 dividend future on 26 July 2012, at a price of 113.2. On 21 December 2012, the SX5ED index is calculated as 115.64, the settlement price for the future, landing the investor with a P&L of 10 * 100 * (115.64 – 113.2) = €2,440. Note that between inception and expiry, the mechanics of daily margining on the Eurex exchange, which aim at minimizing the credit exposure of the investor, is exposing him to daily changes in the futures' price, that is changes in the market expectations for 2012 dividends but also the dividend future's basis.

Despite a difficult start due to market turmoil in Q4 (see our February 2009 report A Window of Opportunity in Dividends), SX5ED dividend futures rapidly found a stable investor base beyond trading desks and hedge funds who were the main investors in the previous dividend swap market. Open interest on the futures reached EUR 4bio in early 2010 and up to EUR 6bio in 2012 (Exhibit 50).

Exhibit 50: SX5ED Futures Aggregate Open Interest



Source: Credit Suisse Equity Derivatives Strategy

Comparatively, FTSE dividend futures, launched by LIFFE in May 2009, exhibit far less liquidity, with an aggregate open interest of GBP 700mio, unchanged since 2010. Other dividend futures (Nikkei, DAX, CAC) are illiquid.

Outside of SX5E, it is fair to say that dividend futures liquidity is sketchy at best (FTSE), or continues to concentrate on OTC products such as div swaps (S&P and Nikkei).

Exhibit 16: SX5ED Dividend Futures Specifications

Proposed Contract Specifications – Index Dividend Futures

Version 24 April 2008

Contract Standard

Contract	Product ID	Underlying
Dow Jones EURO STOXX 50® Index Dividend Futures		Dow Jones EURO STOXX 50® Index Annual Ordinary Dividend - Index Point Equivalents

Contract Value
EUR 100 per 1.0 index dividend points of the underlying.

Settlement
Contract is cash settled, all values payable on the first exchange day following the Final Settlement Day.

Price Quotation and Minimum Price Change
The Price Quotation is in points with two decimal places rounded to the nearest 0.0
The Minimum Price Change is 0.1 points.

Contract	Contract Value	Minimum Price Change	
		Points	Value
Dow Jones EURO STOXX 50® Index Dividend Futures	EUR 100	0.1	EUR 10

Contract Years
7 annual contracts are to be available at any time. All contracts are based on the Dow Jones EURO STOXX 50® Index December cycle.

Last Trading Day and Final Settlement Day
Last Trading Day is the Final Settlement Day. Final Settlement Day is the third Friday of December of each maturity year if this is an exchange day; otherwise the exchange day immediately preceding that day. Close of trading in the maturing futures on the Last Trading Day is at:

Contract	Close of Trading
Dow Jones EURO STOXX 50® Index Dividend Futures	12:00 CET

Daily Settlement Price
Daily Settlement Price for the current maturity year is derived from the volume-weighted average of the prices of all transactions during the minute before 17:30 CET (reference point), provided that more than five trades transacted within this period.

Final Settlement Price
The Final Settlement Price is established by Eurex on the Final Settlement Day according to the following rules:

Contract	Final Settlement Price
Dow Jones EURO STOXX 50® Index Dividend Futures	Calculation of the Final Settlement Price is based upon the final value of the underlying Dow Jones EURO STOXX 50® Index Dividends as calculated by STOXX for that annual period. Final Settlement Price is the summation of the unadjusted ordinary dividends declared and paid in the contract period, on the individual constituents of the underlying Dow Jones EURO STOXX 50® Index, calculated in terms of index points, commercially rounded to the nearest 0.05 index points. The contract period, for purposes of dividends declared and paid, will be from, but excluding, the 3rd Friday of December of the year preceding the maturity year if this is an exchange day; otherwise from and excluding the exchange day immediately preceding that day, up to and including the 3rd Friday of December of the maturity year if this is an exchange day; otherwise up to and including the exchange day immediately preceding that day. The calculation of an individual constituents unadjusted ordinary dividends is in terms of index points : $\frac{\text{(gross ordinary dividends per share) x (free-float adjusted market cap)}}{\text{official index divisor}}$ The gross ordinary dividends per share are the unadjusted cash dividends declared and paid on that individual equity constituent of the index. This amount excludes special dividends, extraordinary dividends and return of capital payments etc. The free-float adjusted market capitalisation for an individual constituents is the number of shares outstanding multiplied by the free-float factor used in the calculation of the index as at final settlement day multiplied by the equity price corresponding to the value used in the calculation of the Dow Jones EURO STOXX 50® Index at settlement. The index divisor is settled free-float adjusted market capitalisation of the Dow Jones EURO STOXX 50® Index at settlement divided by the DJ EURO STOXX 50® Index settlement level. All data inputs and corporate actions are as per the underlying Dow Jones EURO STOXX 50® Index as used for the Dow Jones EURO STOXX 50® Index Future.

Source: EUREX

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