Dividend swaps as synthetic equity

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Abstract

This paper asks the question: Can equity exposure be replaced by a dividend swap? The question is motivated by the observation that an equity contract is essentially a sequence of floating dividends exchanged for a fixed price. A fixed maturity dividend swap – paying or receiving dividends against a fixed swap rate – is closely related. The difference is that a dividend swap with a fixed maturity is only determined by *some* of the future dividend payments rather than all of them. From this perspective it seems plausible that an investment in an equity can be replaced by a dividend swap. We argue that this is the case and further that the dividend swap has several characteristics which make it more desirable than cash equities in some instances. The arbitrage and pricing theory to construct dividend swaps is developed and several possible trading strategies are explored. An example uses data on the EuroStoxx 50 to construct dividend swap rates and realized dividend rates and calculates the performance of the swaps from January 2000 to September 2012. For all maturities tested (1-5 months) the performance was substantially better than the underlying index.

1. Equity as a floating rate perpetuity

An equity contract has value because it provides a stream of dividends in the future. The value of the equity is the discounted value of these dividends, admitting the possibility that the company will stop paying dividends altogether and adjusted for risk preferences. The price of a particular equity is then the fixed leg of a swap where the floating leg is this uncertain stream of payments with unknown and possibly infinite maturity.

From an investment perspective there is no particular reason that the swap should be perpetual. For example an investor might wish to purchase the dividends of a company over the next year rather than forever. Such an arrangement is called a *dividend swap*. These swaps maintain the basic character of a traditional equity investment but add some flexibility.

Figure 1 contrasts a normal equity with a dividend swap. The top frame of figure one is a traditional equity: A stream of dividends extending into the indeterminate future (the dashed boxes) are exchanged for the upfront price of the equity. In the bottom frame a dividend swap exchanges a fixed number of floating dividend payments against the fixed swap rate

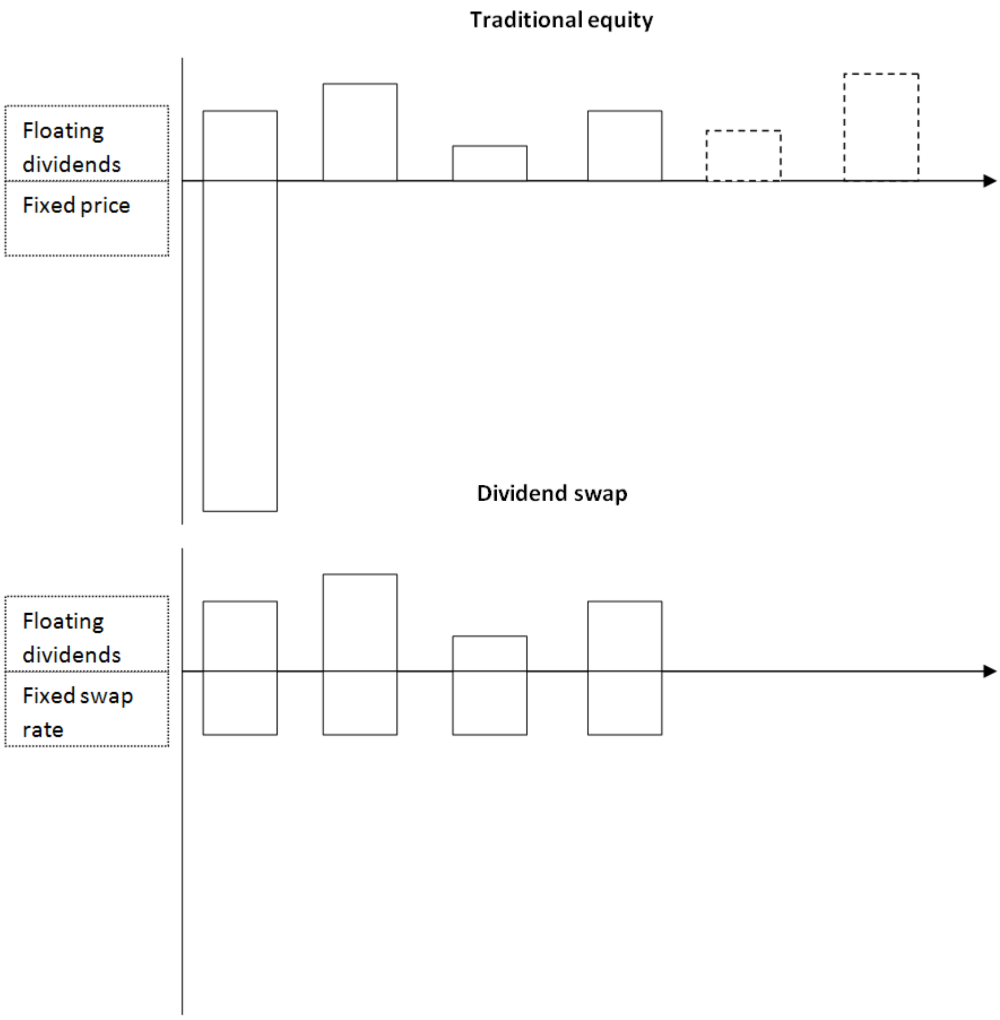

Figure 1: Traditional equity is a perpetual dividend swap

The analogy to fixed income is between a normal bond and a perpetuity. Most debt is issued at fixed maturities, usually paying a regular coupon and recovering the face value at maturity. Perpetuities pay a coupon forever (at least until default). One structure is not obviously better than the other but it is curious that perpetuities are rarely used in fixed income but almost exclusively used with equities.

This paper will explore the rationale for replacing traditional equity investment with dividend swaps. The basic argument is that a dividend swap is a more transparent and simple way to access the equity risk premium. It allows an investor to take a very specific view on the future performance and behaviour of a company in ways that may be more suited to the skill and information set of an equity investor.

We proceed in section 2 by showing the arbitrage portfolio for a dividend swap through cash-futures arbitrage. Section 3 develops a simple pricing model that shows how the equity risk premium is incorporated into the dividend swap rate. Section 4 makes a series of arguments that dividend swaps are a superior investment vehicle to normal cash equities. Section 5 explores implementation options. Section 6 uses data from the EuroStoxx 50 index to demonstrate the performance of a dividend swap against the index. The appendix provides some technical results.

2. Construction and arbitrage

A dividend swap is possible if an equity (or an equity index) has a liquid futures contract. Since futures contracts do not pay dividends the futures price discounts the market's expectation of the dividend rate: the *implied dividend* *rate.* This can be calculated given knowledge of the futures price, the underlying price, and the finance cost.

A dividend swap is created by holding an equity against a short future. The equity provides a long exposure to the price and to realized dividends and the future provides a short exposure the price with expected dividends removed. The remaining exposure is the difference between realized and implied dividends. Table 1 below shows the arbitrage portfolio for a dividend swap. For simplicity we'll assume that all rates are annual and that there is a single compounding period.

Table 1: The arbitrage portfolio for a dividend swap

Today	Borrow $S(0)$ @ rate r Buy equity @ $S(0)$	Sell one year future @ $F(0) = S(t)(1 + r - q_I)$
1 year	Repay loan for $S(0)(1 + r)$ Receive dividends: $S(0)q_R$ Sell stock @ $S(1)$	Buy equity @ $S(1)$ Sell equity @ $F(0) = S(0)(1 + r - q_I)$

Final cashflow	$S(0)(q_R - (1+r)) + S(1)$	$S(0)(1 + r - q_I) - S(1)$
Combined	$S(0)(q_R - q_I)$	

Where $S(t)$ and $F(t)$ are the values of the equity and the future at time t; r is the risk free rate, q_R and q_I are the realized and implied dividend rates. Holding $1/S(0)$ of this portfolio gives a dividend swap with $1 notional exposure.

3. Pricing

The value of implied dividend is determined implicitly through the futures price. This value is set so that the discounted value of the implied dividends is equal to the discounted expected value of the realized dividends. If we assume a simple form of risk aversion the investor discounts the expected value by adding an additional dividend risk premium (drp) to the discount rate[1]:

$$\frac{1}{1+r} q_I = \frac{1}{1+r+drp} E[q_R] \qquad (1.1.)$$

[1] See Manley and Mueller-Glissmann (2008)

where $E[.]$ is the expectation operator. If the risk premium is positive the implied dividend will be lower than the expected realized dividend. This must be true if market participants are weakly risk averse otherwise nobody would be willing to accept the uncertainty of the realized dividends (they would simply receive implied dividends with certainty).

This difference between the implied and expected realized dividend is an embodiment of the *equity risk premium*. To see the contrast equation 1.2 is a standard discounted expected value of the dividends. The stream of expected dividends are discounted at a rate higher than the risk free rate to compensate for the uncertainty. This is a continuous version of equation 1.1:

$$S(t) = \int_0^\infty \underbrace{E[q_R(t)]}_{expected\ divs} \underbrace{e^{-(r+erp)t}}_{discount\ rate} dt \tag{1.2.}$$

Where erp is the equity risk premium applied to the discount rate. An equity is just an infinite series of dividend swaps.

4. Why dividend swaps are better than cash equities

Dividend swaps are categorically similar to investments in cash equities; both involve exchange of a fixed amount for a set of uncertain future dividends, however dividend swaps have several advantages over cash equities. Here we discuss four:

1. Flexibility

Using dividend swaps allows an investor to take a view on the performance of a company over a specific timeframe. For example an investor might believe that a company will do very well in the short to medium term – say three years – due to a new product but have worse long term growth performance. The investor can buy a dividend swaps out to three years without being exposed to the longer term prospects. Increasing or decreasing the maturity of the dividend swap makes it more or less like the equity.

It is also possible to use dividend swaps in combination with equities to achieve particular objectives. For example a manager may have a strong long term view about a company but also be very uncertain about the next six months. The manager could short a dividend swap (pay realized dividends, receive implied) for the six months to partially immunise the portfolio from this uncertainty.

2. More transparent access to the equity risk premium

The equity risk premium is priced into the dividend swap rate in a simple and transparent way (see equation 1.1 and 1.2). The difference between the implied dividend rate and the subsequent realized dividend rate can be observed clearly after a trade. The average difference between these two can be used to construct an estimate of the dividend risk premium and its cousin the equity risk premium. For cash equities the comparable calculation is the change in price of the equity. However since prices adjust to accommodate changes in information about all future dividends it is difficult to use this difference as a reliable estimator of prices.

For example a company may have an objective expected value of $100 per share in one year and trade at $90 to compensate for risk and carry costs. After one year some information comes to light that the price should actually be $50 so the price moves to $50. A naive calculation of the equity risk premium would calculate that the risk premium was 50-90 = -$40 when in fact the ex-ante risk premium was +$10. If we had instead bought 12 one month dividend swaps with the same information about the company the difference between the realized and implied dividends would be very close to $10.

3. Lower correlation to market risk

The payoff for short duration dividend swaps will often be related to the broad market moves if increases in expected future dividends are reflected in increases in current dividends. This is because the dividend swap is only determined by the immediate period dividend, and not expectations of an infinite stream future dividends. In other words the equity has a much higher dividend duration than the dividend swap in the same way that a perpetuity has a higher interest rate duration than a fixed maturity bond. Additionally, the price of equities reflects not only market view on future dividends, but also views of some market participants on what other market participants will value in future; and further on views of what A will think B will think C will value and so on. This peculiar set of recursive beliefs that Keynes (1936) called a ‘beauty contest’ is not a feature of dividend swaps. The beliefs of others are completely irrelevant to the swap holder: all that matters is the difference between the realized and implied dividend.

To make matters worse an equity has a exposure to interest rate risk since the all the future dividends have to be discounted proportional to the interest rate. Depending on the level of interest and the expected structure of future dividends, a cash equity can comprise a substantial and unhedged exposure to interest rates.

In general there is no necessary connection between a dividend surprise today and a sequence of future dividend surprises. This reduces correlation between a dividend swap price change and the underlying price change.

4. Capital efficiency

A dividend swap requires no up-front capital: payment is either exchanged at maturity or else margined according to market prices. In either case this is a better use of capital than tying up 100% of capital in cash equities. Also the financing rate in the swap will reflect interbank rates whereas the opportunity cost for most borrowers includes the credit premium on their marginal borrowing rate. For a smaller investor this can be in the order of 200bps or more and so the saving is substantial.

5. Implementation options

Section 2 demonstrated the arbitrage portfolio for a dividend swap. Given the straightforward construction we will assume that dividend swaps are bid and offered across a large range of maturities. It may be that a particular dividend swap is not liquid however in that case the same exposure can easily be constructed with the arbitrage portfolio as long as a forward contract is available at that maturity.

Table 2 below has four basic implementation options:

Table 2: Implementation options for dividend swaps

Serial	Hold a T-maturity dividend swap to maturity. At maturity roll into a new T-maturity swap. This gives an exposure to each dividend in the same way as a traditional equity.
Overlapping	Roll into a new T-maturity swap each day. This gives a more even exposure to all points on the dividend curves.
Constant maturity	Buy a T-maturity swap each day and sell the (T-1)-maturity swap to maintain a constant exposure to a particular point on the dividend curve.
Forward	Trade long T-maturity dividend swap and short M-maturity (T<M) dividend swap to be exposed to forward dividend rate between T and M

Position sizing

The discussion so far has been in the context of comparing some investment in dividend swaps with the underlying equity. The obvious choice for position sizing is to hold $S(t)$ notional value in the swap. This strategy receives the same dividends as the underlying equity and so the positions are comparable. However as we discussed in the previous section the equity will most likely be riskier since it is exposed to expectations of *all* future dividends.

A simple solution is to increase the notional so that the dividend swap has the same sensitivity to its realized dividend payments as the equity has to all future dividends. This process is approximately comparable to holding 10 one year bonds to match the risk of one ten year bond. The sensitivity (dividend duration) at each future period is discounted by the risk free rate to ensure the series converges to a finite number.

A more direct method is to adjust the notional amount of the swap so that it matches some risk characteristic of the underlying equity. There are a number of ways to achieve this, collectively called *risk parity sizing*. The scaling can be done on any risk characteristic (variance, VaR, ETL) provided there is a model to generate the risk on both the equity and the dividend swap. Arguably the best risk parity method is to use the risk neutral distributions derived from options on the underlying equity and the dividend swaptions (assuming they exist). The advantage of this method is that it reflects market pricing of risk, rather than simply reflecting history or the biases of a risk model. The outcomes for the underlying and the equity can be calculated under the risk neutral distributions at the appropriate expiry. The notional amount of the swap can then be adjusted *in each period* to ensure the market expected risk of the strategies are equal.

Table 3: Dividend swap sizing to make comparable to equity

Hold $S(t)$ notional	Set the notional amount of the swap equal to the underlying price. Over the long run this will generate the same stream of realized dividends as the equity though the implied dividends will be different.
Hold notional to match dividend duration	Set notional of the swap so that the dividend duration (first order sensitivity to an increase in the dividend swap rate) is equal to the dividend duration for the equity. The equity dividend duration can be

	calculated given an estimate of the long term dividend rates which can be extrapolated from current dividend pricing. See appendix A2.
Risk parity	Set notional s of the swap so that some risk measure (e.g. variance, VaR, ETL, semi-variance) is equal under the risk neutral distributions for the equity price and the dividends.

6. Performance of synthetic equity positions

We use data on the EuroStoxx50 index and futures to calculate the performance of a simple serial dividend swap for 1-5 months for all contracts traded between January 2000 to September 2012. We take the total payoff from a dividend swap created on each future expiry using the spot index SX5E and the total return index SX5T. This makes a total of 31 swap results, one for each futures contract over the sample period. The risk free rate is proxied by an interpolated EURIBOR curve from 1 month to 1 year. The calculations are detailed in the appendix.

We find strongly and significantly positive returns to the dividend swap over the sample period. Figure 2 shows a histogram of the realized payouts from the dividend swaps between 1 and 5 months maturity and table 4 summarizes.

The dividend swaps substantially outperform the index. Although it is unlikely that such a marked pricing anomaly will persist in the data it is still striking that it has persisted for so long. As to the question posed in this paper – can equity exposure be replaced by a dividend swap? – the answer for this data set is an emphatic "yes".

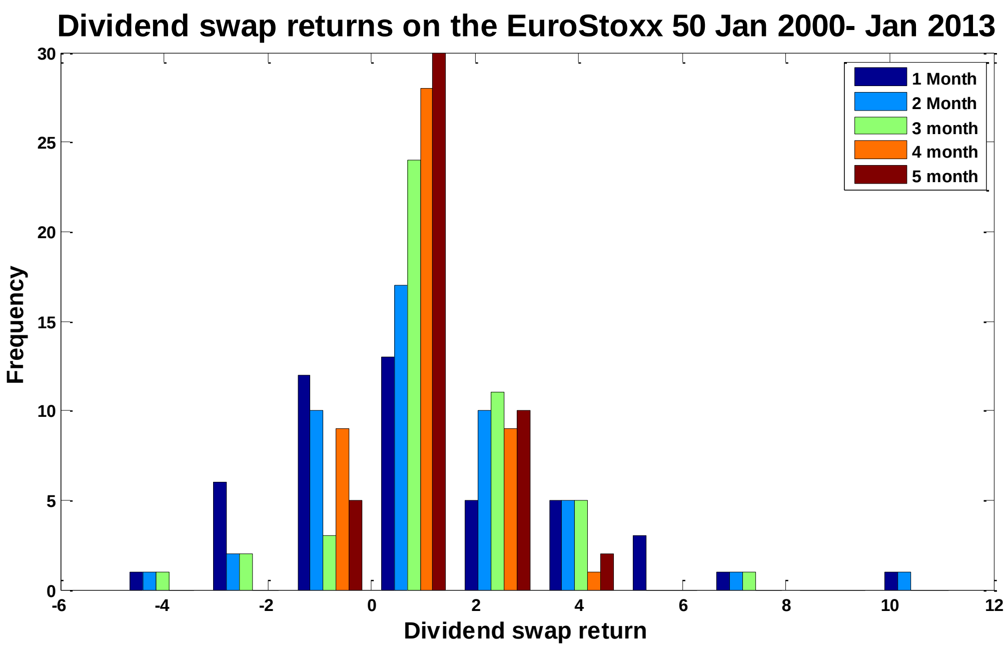

Figure 2: Dividend swap performance. Source: Bloomberg.

Table 4: Dividend swap performance statistics

	1 Month	2 Month	3 Month	4 Month	5 Month
Mean	1.01	1.36	1.23	0.92	1.1
Standard deviation	2.80	2.40	1.93	0.99	1.03
Skew	1.28	1.31	-0.06	0.43	0.40
p-value	0.02	0.00	0.00	0.00	0.00
5% lower tail	-2.29	-2.03	-2.06	-0.41	-0.39
1% lower tail	-3.36	-3.62	-4.84	-1.07	-1.25

Appendix

A1. Calculating implied and realized dividends from data

The implied dividend associated with any futures expiry can be calculated by noting

$$F_T(t) = S(t)e^{(r-q_I)(T-t)}$$

Then

$$q_I = r - \frac{\ln \frac{F_T(t)}{S(t)}}{T - t}$$

The realized dividends can be calculated by comparing the growth between the spot and total return indices

$$\mathrm{q_R} = \frac{\ln\left(\frac{TR(T)}{TR(t)}\right) - \ln\left(\frac{S(T)}{S(t)}\right)}{T - t}$$

Where $TR(t)$ is the total return index at time t

A2: Dividend duration for equity calculation

Start with

$$S(t) = \int_0^\infty \underbrace{E[q_R(t)]}_{expected\ divs} \underbrace{e^{-(r+erp)t}}_{discount\ rate}\ dt$$

If we substitute a long term expected dividend rate q^* for the expected dividend and an estimate of the equity risk premium erp^*

$$S(t) = q^* \int_0^\infty e^{-(r+erp)t} dt$$

Then the dividend duration of the equity is

$$\frac{\partial S(t)}{\partial q^*} = \int_0^\infty e^{-(r+erp)t} dt$$

A3: Risk parity and risk neutral calculations

The risk neutral distributions can be calculated by noting that the risk neutral cumulative distribution $F^Q(K)$ can be calculated with

$$F^Q(K) = 1 + \frac{dC(K)}{dK} e^{r(T-t)}$$

Where $C(K)$ is the price of a vanilla call option with strike K. Measures can be taken over the risk neutral distribution to ensure any desired risk parity between the dividend swap and the equity.

References

Keynes, John Maynard (1936). *The General Theory of Employment, Interest and Money*. New York: Harcourt Brace and Co.

Manley, R. & Mueller-Glissmann, C. 2008, 'The Market for Dividends and Related Investment Strategies', *Financial Analysts Journal,* vol. 64, no. 3, pp. 17-29, 1.