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The term structure of implied dividend yields and expected returns

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HIGHLIGHTS

- We propose a return predictor: the implied dividend yield term structure (IDYTS).
- The IDYTS is constructed from index options data using put–call parity.
- Expected returns can be characterized by a linear function of the IDYTS.
- The IDYTS outperforms the dividend price ratio (DP) in predictive regressions.
- The IDYTS outperforms the DP in out-of-sample portfolio tests.

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ABSTRACT

This paper proposes a new dividend-based S&P 500 Index return predictor, the implied dividend yield term structure (IDYTS). We show that the IDYTS is a "cleaner" predictor than its conventional counterpart, the dividend price ratio (DP), in that the expected return is a linear combination of the level and slope of the term structure. Exploiting non-arbitrage relationships and the forward-looking nature of the options market, we estimate the IDYTS and investigate its index return predictability. The IDYTS outperforms the DP in predictive regressions, and the optimal IDYTS portfolio, constructed by using the IDYTS in a predictive regression, stochastically dominates and yields a higher Sharpe ratio than the DP portfolio.

1. Introduction

The dividend price ratio (DP) has been long recognized as a predictor for S&P 500 Index returns, yet the empirical evidence is mixed. In addition, the validity of the DP's return predictability has been criticized for two reasons. First, the DP is a noisy predictor in that it reflects the difference between the expected return and the expected dividend growth (Campbell and Shiller, 1988); when such two variables are positively correlated, the predictive power of the DP deteriorates. Second, the DP, defined as the 12-month tailing sum of paid dividends divided by a price, is highly persistent. Stambaugh (1999) points out that the bias in predictive regression coefficients increases with the persistency of the predictor. Moreover, the DP may have the local-to-unity property since its AR(1) coefficient is close to one (Campbell and Yogo, 2006). Because the DP cannot pass standard unit-root tests, a predictive regression using the DP is questionable.

In this paper, we ask the question: is there an alternative dividend-based predictor less subject to the aforementioned drawbacks? We argue that the implied dividend yield term structure (IDYTS), exploiting non-arbitrage relationships and the forward-looking nature of the options market, is a superior dividend-based predictor. First, the IDYTS is "cleaner" than the DP: as we will show within Campbell and Shiller's (1988) dividend ratio model, the expected return can be fully characterized by a linear combination of the expected dividend yield level and the expected dividend yield growth. Second, because the IDYTS that we calculated from S&P 500 Index options is stationary and has a much lower persistency than the DP, the IDYTS suffers from less econometric problems when used in a predictive regression. Empirically, we document that the IDYTS has stronger index return predictability than the DP. Furthermore, trading strategies using the IDYTS stochastically dominate and yield a higher Sharpe ratio than those using the DP.

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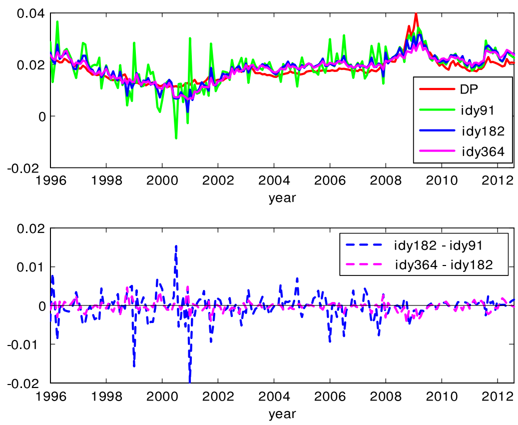

Fig. 1. Time series of the implied dividend yields and the DP.

Our work complements Golez (2014) who extracts the implied dividend yield from index options of fixed maturity to correct for the "noisy" portion in the DP, and documents improved return predictability. Differently from Golez, we discard the DP, propose a cleaner predictor, the IDYTS, and show that not only the level but also the slope in the IDYTS enhances return predictability.

This paper also relates to recent works exploring implied dividend information from derivatives markets. Binsbergen et al. (2012) measure the implied price of dividend strip, and find that a short-term strip contributes more to the equity risk premium than a long-term strip. Binsbergen et al. (2013) analyze a novel data set of dividend derivatives, and find that the term structure of the expected dividend growth rates (dividend risk premia) is countercyclical (pro-cyclical).

2. Implied dividend yield term structure (IDYTS)

By the no-arbitrage principle, the put–call parity holds for European options on the S&P 500 Index:

$$C(t,\tau,K) - P(t,\tau,K) = S(t)\,e^{-y(t,\tau)\tau} - Ke^{-r(t,\tau)\tau} \tag{1}$$

where $C(t,\tau,K)$ and $P(t,\tau,K)$ are prices of a call and a put option price pairs with the same maturity τ and the same strike K; $r(t,\tau)$ is the risk-free rate; and $y(t,\tau)$ is the implied dividend yield (annualized) for maturity τ. Rearranging (1):

$$y(t,\tau) = \frac{1}{\tau}\ln\left[\frac{S(t)}{C(t,\tau,K) - P(t,\tau,K) + Ke^{-r(t,\tau)\tau}}\right]. \tag{2}$$

We calculate forward-looking $y(t,\tau)$s using S&P 500 Index option prices from Jan 1996 to Oct 2013. At the beginning of each month, we estimate the implied dividend yields for maturities of 91 days (*idy*91), 182 days (*idy*182), and 364 days (*idy*364). (See Appendix B for details.)

The top panel in Fig. 1 indicates that, in general, the implied dividend yields move in the same direction as the DP, while they tend to be lower than the DP during the recession period (2001–2002, 2008–2009) and higher in the non-recession period. The bottom panel shows that the implied dividend yields exhibit a time-varying term structure.

Table 1 presents the AR(1) coefficients and unit-root test results for monthly returns of S&P 500 Index, the DP, and the IDYTS. The results indicate that the DP is highly persistent and cannot rule out a unit root, whereas the IDYTS has a much lower persistency and rejects the null of unit root at the 1% level. Thus, the IDYTS is less likely to suffer from econometric problems when used in a predictive regression.

Table 1
AR(1) coefficient and Augmented-Dickey–Fuller test.

	Monthly ret	DP	idy91	*idy*182 − *idy*91	*idy*364 − *idy*182
AR(1)	0.0773	0.9593	0.5322	−0.0073	0.153
p_value for ADE test	0.0001	0.4341	0.0179	0.001	0.001

3. Theoretical justification

Campbell and Shiller (1988) derive a multi-period dividend ratio model:

$$dp_t = \theta_0 + E_t\sum_{N=0}^{\infty}\rho^N \times r_{t+1+N} - E_t\sum_{N=0}^{\infty}\rho^N \times dg_{t+1+N} \tag{3}$$

where $dp_t = \ln\left(\frac{D_{t-1,t}}{P_t}\right)$ is the log DP; $r_{t+N} = \ln\left(\frac{P_{t+N}+D_{t+N-1,t+N}}{P_{t+N-1}}\right)$ is the one-period return from $t+N-1$ to $t+N$; $dg_{t+N} = \ln\left(\frac{D_{t+N-1,t+N}}{D_{t+N-2,t+N-1}}\right)$ is the log dividend growth rate; $D_{t+N-1,t+N}$ is the dividend paid in this period; P_t is the index price, $\rho < 1$ is a positive constant. Let $y_{t,t+N} \equiv -\frac{\ln\left(1-\frac{D_{t,t+N}}{P_t}\right)}{N}$ be the annualized dividend yield for maturity of N.

Proposition 1. *The expected return $\mu_t = E_t(r_{t+1})$ is a linear function of $E_t(y_{t,t+1})$ and $E_t(y_{t,t+N} - y_{t,t+N-1})$:*

$$\mu_t \cong \alpha + \beta \cdot \left[E_t(y_{t,t+1}) + \sum_{N=1}^{\infty}\rho^N(N+1-\rho N) \cdot E_t(y_{t,t+N+1} - y_{t,t+N})\right] \tag{4}$$

where α, β and $\rho < 1$ are constant.

Proof. See Appendix A. ■

According to (4), the expected return can be fully characterized as a linear combination of the expected dividend yield level and the expected dividend yield growth. We use the proxy of IDYTS discussed in Section 2 to obtain a reduced form of (4) for empirical purposes:

$$\mu_t \cong \alpha + \beta_1 \cdot idy91_t + \beta_2 \cdot (idy182_t - idy91_t) + \beta_3 \cdot (idy364_t - idy182_t) + \varepsilon_t. \tag{5}$$

4. Empirical results

4.1. Predictive regression

We run predictive regressions of S&P 500 Index returns on lagged predictors:

$$ret_t^{t+h} = \alpha + \sum_{i=1}^{K}\gamma_i X_{i,t} + \beta_1 idy91_t + \beta_2(idy182_t - idy91_t) + \beta_3(idy364_t - idy182_t) + \varepsilon_t \tag{6}$$

and

$$ret_t^{t+h} = \alpha + \sum_{i=1}^{K}\gamma_i X_{i,t} + \beta_1 DP_t + \varepsilon_t \tag{7}$$

where ret_t^{t+h} is the logged index return of S&P 500 over horizon h. We control other standard predictors denoted by $X_{i,t}$, including PE_t (the logarithm of the price earnings ratio), $RELVOL_t$ (the realized volatility estimated from past one-month prices), VRP_t (VIX_t minus $RELVOL_t$), IR_t (the 1-month T-bill yield), and $TMSP_t$ (the yield