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The term structure of returns: Facts and theory[☆]

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ABSTRACT

We summarize and extend the new literature on the term structure of equity. Short-term equity claims, or dividend strips, have higher average returns and Sharpe ratios than the aggregate stock market. The returns on short-term dividend claims are risky as measured by volatility, but safe as measured by market beta. These facts are hard to reconcile with traditional macro-finance models and we provide an overview of new models that can reproduce some of these facts. We relate our evidence on dividend strips to facts about other asset classes such as nominal and corporate bonds, volatility, and housing. We discuss the broader economic implications of our findings by linking the term structure of returns to real economic decisions such as hiring and investment. We conclude with an outline of empirical and theoretical extensions that we consider interesting avenues for future research.

1. Introduction

The discounted value of future cash flows plays a central role in financial and real investment decisions. As initially pointed out by Brennan (1998), observing assets that pay off a single dividend of a stock index at a future point in time could help to promote rational pricing. Building on these insights, a literature has developed in recent years to measure the term structure of equity. In this paper, we review and extend this literature and discuss both the empirical facts as well as the theoretical explanations that have been proposed. We also connect the properties of the term structure of equity to term structures in other asset classes such as nominal and corporate bonds, volatility, and housing.

Initial measurements of the term structure of equity are based on portfolios of stocks with different cash-flow growth rates and risk properties, see Cornell (1999), Dechow, Sloan and Soliman (2004), Bansal, Dittmar and Lundblad (2005), Lettau and Wachter (2007), Hansen, Heaton and Li (2008), and Da (2009). An important motivation for this literature is the value premium, which refers to the empirical fact that stocks with low market-to-book ratios have higher average returns than stocks with high market-to-book ratios, despite having similar Capital Asset Pricing Model (CAPM) betas. If the cash flows of value stocks have different average growth rates and risk expo-

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sures than the cash flows of growth stocks, then comparing the returns on value and growth stocks can indeed be informative about the term structure of equity.

Instead of relying on the cross-section of stock returns and additional assumptions about the dynamics of cash flows and preferences, Binsbergen, Brandt and Koijen (2012, BBK) provide the first direct measurement of dividend strip prices using options data. Binsbergen, Hueskes, Koijen and Vrugt (2013, BHKV) extend this evidence using dividend futures, which were introduced around the turn of the millennium for the Standard and Poor's (S&P) 500, Eurostoxx 50, and the Nikkei 225 indexes. A long position in a dividend futures contract implies that in exchange for a known payment due in n years from now, one receives the dividends paid on the underlying index over the year leading up to the settlement. For the Eurostoxx 50 index, dividend futures are exchange traded since 2008. They allow for direct measurement of dividend strip prices without the need for high-frequency data for options and the stock index. A second important advantage is that dividend futures have longer maturities of up to ten years, although the liquidity declines for the longest maturities. The maximum maturity for options is about three years.

BHKV use dividend futures prices to define equity yields as:

$$ey_{t,n} \equiv \frac{1}{n}\ln(D_t/F_{t,n}) = \theta_{t,n} - g_{t,n}, \qquad (1)$$

where $F_{t,n}$ is the $n-$period dividend futures price and D_t the level of dividends at time t. The equity yield, $ey_{t,n}$ contains a risk premium component $\theta_{t,n}$, which equals the expected log return on a dividend futures contract with maturity n, and a component that reflects expected log dividend growth, $g_{t,n}$. BHKV show that both risk premia and expected growth rates fluctuate over time, and that risk premia are countercyclical. The expected growth component $g_{t,n}$ is useful for predicting future dividends, gross domestic product (GDP) growth, and consumption growth, over and above the predictive power of nominal and real bond yields.

In this paper, we first extend the sample of BHKV in the time series dimension as well as cross-sectionally by adding evidence from the UK (the FTSE 100 index). Using this extended sample, we document three key facts in the data:

1. Both risk premia and Sharpe ratios are higher for short-maturity claims than for the aggregate stock market. If we form a world portfolio of dividend strips by averaging across the four markets for which data exist, the difference in risk premia between this portfolio and a portfolio of index returns is statistically significantly positive at conventional significance levels. The results are strongest for the most liquid market, which is the Eurostoxx 50. The difference is statistically insignificant for the Nikkei 225, the FTSE 100, and the S&P500 individually, the latter of which is consistent with the findings in BBK.
2. The returns on short-term dividend claims are risky as measured by volatility, but safe as measured by market betas. The volatility of dividend strip returns is as high, if not higher, than the volatility of market returns. However, the market betas are well below one and increasing with maturity.
3. The volatility of equity yields is downward-sloping with maturity.

The high volatility of dividend strip returns and the low correlation with the market implies that we have relatively little power to reject the null that dividend strip returns are on average higher than market returns. To gain power, we pool data across indexes and across short-term maturities, leading to statistically significant outperformance of short-maturity dividend strips over index returns.

In the second part of this paper, we discuss tests of the leading macro-finance models that have been successful at explaining many facts about asset markets, including the equity risk premium, excess volatility, and both the level and volatility of the risk-free rate. We propose new tests of these models.[1]

In particular, we compute the average return of dividend strips minus the average return on the aggregate stock market in the data. Next, for each of the models, we simulate samples of the same length as our data and we compute the same statistic for each of the samples. We then plot the distribution of this statistic under the Null that a model is correctly specified. This test shows that it is unlikely that the data are generated by these models.

As a second test, we compute the volatility of equity yields in the data and we provide a comparison to the Campbell and Cochrane (1999) model for illustration. The volatility of equity yields is much higher in the data than in the model. As we measure volatilities more precisely than average returns, this provides a powerful rejection of the model. We also consider an extension of the Campbell and Cochrane (1999) model by allowing dividend growth to be predictable. However, given that short-term risk premia are virtually constant in the model, all variation in equity yields has to be due to expected growth rates. Given the amount of (excess) volatility in short-term equity yields, this implies that dividend growth is almost perfectly predictable, which is counterfactual; see, for instance, Cochrane (2008) and Binsbergen and Koijen (2010).

The third part of the paper extends the empirical evidence across different asset classes, such as Treasuries, corporate bonds, and options (straddles). The idea to use data from multiple asset classes as "out-of-sample" evidence has been used recently by Asness, Moskowitz and Pedersen (2013), Mowkowitz, Ooi and Pedersen (2012), and Koijen, Mowkowitz, Pedersen and Vrugt (2017) in the context of other asset pricing anomalies such as value, momentum, and carry. We find in all asset classes that Sharpe ratios decline with maturity, consistent with the first fact for the term structure of equity. These facts may help in thinking about the credit spread puzzle as well as the determinants of term and variance risk premia.

[1] Lettau and Wachter (2007) provide evidence inconsistent with the Campbell and Cochrane (1999) model, while BBK provide additional evidence that challenges the models of Campbell and Cochrane (1999), Bansal and Yaron (2004), and the rare disaster models of Gabaix (2012) and Wachter (2013).