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Generalized financial ratios to predict the equity premium☆

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ABSTRACT

Empirical evidence for the price-dividend ratio to be a predictor of the equity premium is weak. We argue that changes in the economic conditions and market composition lead to a time-varying relationship between prices, dividends and the equity premium. Exploiting the information in the rolling window log-log regression of stock prices on dividends, we obtain the Generalized Price-Dividend Ratio (GPDR), that compares the price per share with a time-varying transformation of the dividend per share. The GPDR leads to economic and statistical gains when forecasting the equity premium of the S & P 500 at the 1, 3, 6 and 12 month horizon, as compared to using the classical price-dividend ratio or the prevailing historical average excess market return. Similar improvements are obtained for Generalized Financial Ratios based on the corporate earnings and book value.

"Clearly, Graham had found a good indicator of relative value over the near term. But he had also found yet one more indication of how valuation standards can change with the times." - Bogle (2005).

1. Introduction

Risk and reward go hand in hand when deciding to invest in equities. When used as an ex-ante concept, the equity premium expresses the reward (or premium) an investor requires for taking on additional risk by investing in a risky equity portfolio compared to investing in a risk-free asset, such as an AAA-rated government bond. It is also called the equity risk premium to emphasize that it is a compensation for the risk taken when investing in stocks. Graphically, it corresponds to the slope of the capital allocation line connecting the risk-free asset with the risky equity portfolio in the mean-standard deviation graph of investment opportunities. Ex-post, the realized equity premium is computed as the observed excess return of a stock portfolio over the risk-free rate. Welch (2000) refers to the equity premium as "perhaps the single most important number in financial economics". A reliable prediction of the equity premium is particularly important for asset allocation and the valuation of risky assets.

In this paper, we contribute to the literature that uses financial ratios to predict the equity premium over a horizon that is in between one and twelve months.[1,2] This horizon is relevant for the tactical component in market timing the asset allocation between the risky (equity) portfolio and the risk-free asset. It features prominently in both academic research (see e.g., Brennan et al., 1997; Faber, 2007; Neely et al., 2014) and in real-life asset allocation solutions such as the Hull Tactical US ETF (Hull and Qiao, 2017).

It is important to stress that the point-in-time value of a financial

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[1] Other strands of the literature study the forecasting of the equity premium at both shorter and longer horizons. We refer to the work of Chan et al. (1992) for an analysis of the equity premium at the daily horizon, to Duarte and Rosa (2015) for the monthly, quarterly and annual horizon (which overlap with the ones we consider), to Graham and Harvey (2005) and Welch (2000) for an overview of most of the relevant longer horizons, to Prat (2013) for a comparison between the short- and long-term equity premium, and to Damodaran (2009) for the determinants of the equity premium, different approaches to measure it, a comparison between the equity premium in different countries and the relationship between the equity premium and other risk premiums (i.e. in the bond market). The longer horizons are relevant for, among others, the valuation of equity investments and strategic asset allocation, while the short horizons can be used for market timing the investment decision.

[2] Another important part of the equity premium literature is the research on the existence of the so-called equity premium puzzle. Stocks should generate higher returns on average than bonds, because they are riskier. The puzzle is that the excess returns of stocks over bonds are too high to be explained by risk alone. For a recent overview of the equity premium puzzle, we refer the interested reader to Cochrane (2017) and the references therein.

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ratio is not designed to forecast the equity premium. Instead, it is a valuation tool to express the market value in relative terms compared to (functions of) accounting-based measures such as the dividend or earnings per share. We find that transformations of the financial ratios that properly account for the time-varying relationship between the variables at stake are better suited for predicting the equity premium at the intra-year horizon than the original financial ratios.

Within the large family of financial ratios, we focus on the price-dividend ratio since dividends play such a direct role in the formation of the equity premium. We then extend the approach to other well-known financial ratios, such as the (cyclically adjusted) price-earnings ratio, the price-earnings to growth ratio, the price-to-book ratio and the bond-equity yield ratios.

Historically, the aggregate price-dividend ratio, comparing the value weighted average share price with the corresponding dividend value, has been pivotal to obtain predictions of the equity premium. The intuition behind this is that, all other things being equal, a historically high (low) value of the price-dividend ratio implies that the stock (market) is likely to be (under-) overvalued and that a correction in its values is likely to follow (Cochrane, 1997).

Despite the intuitive appeal of the channel of mean-reversion through which the ratio between prices and dividends predicts the equity premium, there is only weak empirical evidence that the price-dividend ratio is effectively a good predictor of the US equity premium.[3] In early research, Fama and French (1988), Rozeff (1984) and Shiller (1984) find that the price-dividend ratio is significantly negatively correlated with the future US equity premium, on horizons varying from one month to four years. More recently, Goyal and Welch (2003) find that all the evidence for predictive power has disappeared since 1990, and that even before, the out-of-sample performance of the price-dividend ratio is rather poor. In particular, Goyal and Welch (2008) find that, for US equities over the period 1871–2005, the price-dividend ratio is unable to outperform the prevailing historical average equity premium as a predictor of the equity premium. However, Cochrane (2008) claims that the time-variation of the price-dividend ratio must contain some (excess) return predictability as he finds powerful statistical evidence that it does not predict dividend growth.

We conjecture that the weak predictive power of the price-dividend ratio for the equity premium comes from its failure to capture two important effects on the equity premium. The first failure is that the price-dividend ratio does not account for the time-varying economic conditions. This issue can be related to traditional pricing theory, such as Gordon (1959) dividend discount model. This model discounts the expected future dividends to calculate a present value for the stock. The discount factor includes the constant expected required rate of return (r) and the constant expected dividend growth (g). The price-dividend ratio fails to incorporate this discounting information. We illustrate this in Fig. 1 where we plot the monthly S & P 500 price-dividend ratio, the two-year simple moving average of the S & P 500 pay-out ratio and the long-term interest rate from January 1956 until December 2014. The long-term interest rate is the 10-year US Treasury constant maturity rate. As expected, we find a negative association between interest rates and the price-dividend ratio. This provides only a partial explanation of the price-dividend ratio. Note, e.g., that the price-dividend ratio is relatively stable in the sixties and the beginning of the seventies despite the increase in interest rates from 3.8 to 7.8%. Second, the price-dividend ratio at the end of sample is almost double the one at the beginning of the sample, notwithstanding that they have in common that for both periods the interest rate is historically low.

The second failure is that the price-dividend ratio does not account for the time-varying market structure. It has the implicit assumption that the composition of the prices and dividends and their relationship never changes. This is not true, specifically not for a value-weighted index like the S & P 500, since its composition changes daily. Using the same price-dividend ratio would imply comparing the market portfolio of 1980, consisting mostly of energy companies such as Shell Oil, Standard Oil of California and Standard Oil of Indiana, with the market portfolio of 2015, consisting mostly of IT companies such as Apple, Facebook and Google. The market changes and so should the dynamic properties of the ratio. This is connected to the observation in Fama and French (2001) that, due to the new listings of low profit/high growth opportunity firms, the average dividend paid by S & P 500 firms compared to the market value has reduced dramatically in the past decades. Moreover, a lot of companies pursue different dividend policies to maximize their market value (Al-Malkawi et al., 2014). Fig. 1 shows the declining long-term interest rate since the eighties which is one of the possible reasons for the recent changes in the composition of equity indexes, such as the S & P 500. It further shows the declining trend and the wide variability in the S & P 500 pay-out ratio. These changes in the market's dividend policy may affect the elasticity from prices to dividends. This elasticity can also be affected on the investor's side via changes (structural or not) in investors' attitudes towards dividends and taxes (Polimenis and Neokosmidis, 2016).

The methodological innovation of this paper consists of solving both failures by comparing the equity's market value with a non-linear transformation of the dividend per share, forming the Generalized Price-Dividend Ratio (GPDR). Importantly, the parameters in the GPDR's functional form are time-varying. We propose to capture this time-variation by the use of Nadaraya-Watson (Nadaraya, 1964; Watson, 1964) weighted parameter estimates of the log-log regression of the stock prices on its corresponding dividends over rolling estimation samples. We consider various weighting methods and relate these to the business cycle. Besides the univariate GPDR forecasting equation, we use two types of forecast combinations. The first one combines GPDRs computed over various estimation windows. It uses least squares optimized weights under the form of a Heterogeneous AutoRegressive, or HAR, forecasting equation to account for the heterogeneity in the market reaction to price changes (Corsi, 2009). The second approach combines the GPDR-based equity premium forecast with the prevailing historical average equity premium estimate by means of a switching forecasting equation. The switches are driven by past relative performance. All the proposed methods are in explicit form and thus are simple and fast to compute.

In an extensive out-of-sample evaluation for the period of January 1976 until December 2014, we find that the use of the GPDR leads to economic and statistical gains in predicting the monthly S & P 500 index equity premium compared to the classical price-dividend ratio, and the prevailing historical average, which has been shown to be a strong benchmark (Goyal and Welch, 2008). We further use Goyal and Welch's (2003, 2008) recursive residuals (out-of-sample) graphical approach to show that the good performance is not bounded to any specific subperiod. We also find that the relative forecasting out-performance holds at the quarterly, semi-annual and annual horizon.

We use the same economic intuition that motivates the use of the GPDR to generalize other financial ratios. Instead of dividends, we use other proxies for the fundamental characteristic of a stock, such as the corporate earnings and book value per share. The framework of generalizing financial ratios by including time-varying parameters is thus flexible and leads to the family of the Generalized Financial Ratios.

The bottom line of our research is that, for forecasting the equity premium at the monthly horizon, the generalized financial ratio leads to more accurate predictions than when the traditional financial ratio is used. This result is useful for both academics and practitioners who need an equity premium forecast when optimizing risk and reward of their investment portfolio.

[3] The US equity premium is defined as the total return on the US stock market minus the corresponding prevailing risk-free rate. The value-weighted Standard and Poor's Composite Stock Price Index (S & P 500) is most often used as a proxy for the US equity universe. As the risk-free rate, we use the total return of investing in the 3-month US Treasury Bill over the same horizon as the equity investment