



Regime switches between dividend and bond yields

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ABSTRACT

The relation between bond and equity returns serves as a proxy for estimating the premia investors' demand on their equity portfolio holdings and assessing the substitution effects between the two markets. With this in mind, we examine empirically the co-movements and the underlying information between equities and bonds. Our approach relies on the comparison between bond and dividend yields – a relation better known as the gilt-equity yield ratio–GEYR – by examining the characteristics of the cointegration relation between the bond and equity yields. In this context, this paper's contribution is that it lifts the restrictions of linearity both in the long-run cointegration relations and in the underlying short-run relations presented in the VECM. Specifically, we apply the regime-switching framework of Gregory and Hansen (Gregory, A. W. & Hansen, B. E. (1996). Residual-based tests for cointegration in models with regime shifts. *Journal of Econometrics* 70, 99–126) for the long-run equilibriums and the Markov Switching VECM, established by Krolzig (Krolzig, H.M., 1997. Markov switching vector autoregressions. Modelling statistical inference and application to business cycle analysis. Springer, Verlag) for the short run ones. Our aim is to examine the allocation of capital among the UK bond (or else, gilt) and stock markets for the period of 01-1987 to 01-2007, in a fashion that better reflects the structural breaks and regime shifts of the underlying market conditions. Our findings confirm the substitution effects among stocks and bonds in the long run and highlight the importance of market conditions for the allocation of capital among stocks and bonds.

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1. Introduction

The aim of this paper is to investigate the relationships between stock index prices, dividends and interest rates. Specifically, empirical and theoretical literature on stock price valuation always incorporates, directly or indirectly, a substitution effect among stocks and bonds, namely the assets compensating for different states of the market. The examination of the relationship between stock prices, dividends and government bond yields has been the focus of many research studies over the last two decades.

An extensive literature exists studying the relation between the bond and stock markets. Lim, Gallo, and Swanson (2000) provide evidence for strong interrelations among the international bond and stock market. Cowan and Joutz (2004) find that equity returns reflect macroeconomic variables, well known to affect bond markets as well, such as industrial production and unanticipated inflation movements. Furthermore, Jones, Lin, and Masih (2004) find cointegration relations among the UK's short rates, gilts and equities.

However, the most prominent model for this investigation is the so-called gilt-equity yield ratio (GEYR)¹, which, according to Mills (1991), has been a very efficient tool for market practitioners in the UK

in order to forecast future movement in prices. Clare, Thomas, and Wickens (1994) use GEYR as a guide for investment decisions and evaluate three separate trading rules over the period 1990–1993. The authors conclude that the GEYR is a useful predictor of equity returns. However, Levin and Right (1998), extending the work of Clare et al. (1994), find that the GEYR alone cannot possibly provide a profitable asset allocation decision criterion. Finally, Harris and Sanchez-Valle (2000) and Brooks and Persand (2001) suggest that the gilt-equity yield ratio has substantial explanatory power for UK equity returns.

Giot and Petitjean (2007) apply the bond-equity yield ratio in order to investigate the long-term relationship between stock index prices, dividends and bond yields. By using an extensive sample of seven countries (Germany, Belgium, France, Japan, Netherlands, UK and the USA) for the time period 1973–2004, they investigate their assumptions by first using cointegration analysis and then by adopting Brooks and Persand's regime switching approach whereby they add another trading rule, thus providing evidence that a long-term cointegrating relationship exists between stock index prices, stock index earnings and government bond yields.

Over the last few years, special attention has been allotted to a valuation method similar to the GEYR, the so-called Fed-model. The Fed-model assesses stock markets by comparing stock and bond yields. According to this model, the stock market's earnings yield should be compared to a 10-year government bond yield. According to the Fed-model, if the earnings yield exceeds the bond yield then stocks are cheap. In contrast, when a 10-year government bond yield

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¹ The gilt equity yield ratio is defined as the ratio of the coupon yield on long-term UK government bonds to the dividend yield on the stock index.

exceeds an earnings yield, stocks are deemed expensive. The main difference between the two models is that in the GEYR framework researchers use dividends while in the Fed-model, they use anticipated earnings.

The organisation of this paper is as follows: [Sections 2 and 3](#) present the theoretical and methodological frameworks respectively, while in [Section 4](#) we present the empirical results. Finally, [Section 5](#) concludes the paper.

2. Theoretical background

The GEYR is defined as the ratio between the coupon yield of long government bonds and the dividend yields. Financial literature indicates that there is a strong relationship between stock prices, dividends and interest rates. A simple theoretical illustration of this relation can be based on the dividend discount model developed by [Gordon \(1962\)](#). According to this model, the fundamental stock price of a given company is:

$$P_0 = \frac{D_{t+1}}{k_e - g} = \frac{kE_{t+1}}{r_f + \pi - g} \quad (1)$$

Where D_{t+1} is the expected dividend for the following year, k is the payout ratio, E_{t+1} is the expected earnings, k_e is the cost of equity, g is the growth rate for dividends, π is the risk premium and r_f is the risk-free rate.

From the above model, the reverse relation between stock prices and bond yields is derived, implying a relation between downturns in the equity markets in the case of increasing bond yield conditions. More specifically, because the cost of equity, k_e depends on the prevailing interest rates, falling bond yields lead to higher stock prices, based on the assumption that the risk premium stays constant over time. In addition to that, [Durre and Giot \(2005\)](#) support the notion that "except for the pure mechanical relationship implied by Eq. (1), market participants constantly arbitrage the stock and bond markets". The authors strongly support the existence of a substitution effect between stocks and bonds. The basis for this substitution effect is the relationship of the dividend yield to the bond yield.

In order to avoid theoretical manoeuvres around Eq. (1), aiming to state the relation between stocks and bonds, we proceed to some transformations of the initial relation. Specifically, based on the assumption that the risk premium is assessed in a time-consistent fashion, we are able to simplify the examination of the bond-equities relation by taking the logarithms of the right hand side of Eq. (1), resulting in the relation under investigation as referred to in the empirical literature whereby:

$$\log(D_{t+1}) - \log(r_f + \pi - g) = d_{t+1} - [\log(r_f) + \log(C)] \equiv d - r - c \quad (2)$$

where r stands for the log of the discount factor of Eq. (1) and d for the dividend yield. As is illustrated, r is formulated by the risk-free rate incorporated in government bonds while a constant factor c , captures the premium investors request to balance risk while being compensated for the dividends' growth. In order to formulate the investigation framework for our analysis, we rely upon the examination of stationarity characteristics of relation (2). Specifically, we examine the hypothesis stating that the bond yields and stock dividend yields are cointegrated, resulting in stationary differentials, while allowing for a constant factor to capture risk premiums and other factors.

$$[(d - r) + c] \sim (0, \sigma) \quad (3)$$

However, the risk premium investor remuneration for allocating capital between government bonds and stocks is not constant over time and varies with economic and financial market conditions.

Similar time-varying features are found to characterise the dividend policies of the companies listed on a stock exchange. Of course, idiosyncratic factors for both roots of non-linearities are aggregated in the case where the figures of stock market indices are examined, resulting only in systemic factors altering overall the dividend yield policies and the risk-variation of listed companies. This effect results in the levelling out of the respective variations. As a result, one should expect that the underlying relation incorporated in the GEYR will not stay constant for the entire sample examined, especially in cases where the investigated period contains more than one market condition.

Under this concept the regime switching econometric methodology, first formulated by [Hamilton \(1989\)](#), is valuable in revealing economic relations that do not permanently stay in their initial state. This methodology, further enhanced by [Gregory and Hansen \(1996\)](#) for cointegrating relations, and [Krolzig \(1997\)](#) for the VECM, permits one to examine the underlying relations in a non-linear fashion. Following the aforementioned econometric papers, the present analysis incorporates non-linear methodology in examining both the long-run equilibrium relation and the short-run adjustment mechanism of the relation among bonds and stocks. Our results indicate that significant effects are exercised by market conditions on the decision of capital allocation among the two alternative investments.

3. Data and methodology

The data set used for the purposes of this study is comprised of yields using UK government bonds (gilts) with a term to maturity of ten years, and dividend yields of the FTSE index for the UK stock market². The period we examine ranges from 01-1987 to 01-2007 and encompasses 240 monthly observations for each series. The specific period was chosen in order to examine in depth the alterations brought about by the different market conditions experienced during the twenty years of our sample. Specifically, it contains turbulent conditions for the financial markets, such as 'Black Monday', the sterling devaluation, the LTCM, the Russian crisis and the (dot).com bubble, while it also contains long periods of positive equity returns. As a result, it provides a basis for investigation of the effects shifting market conditions have on the examined relation between stocks and bonds through the BEYR.

Initially, in order to investigate the existence of significant interactions among the bond yields and the stock market's dividend yields, we apply cointegration analysis aiming to estimate the formulation of stationary long-run equilibrium relations and the resulting VECM in order to approach the short-run adjustments. Additionally, in both the long-run and short-run structures, we take into account the regime switching properties of the underlying relations.

Although our analysis consists of a bivariate cointegration relation, applying Johansen's technique enables the more thorough examination of the cointegration relations by examining exogeneity effects, the tracing of the long-run decomposition, and the running of a recursive analysis. Thus, relations (2) and (3) are investigated by initially applying [Johansen's \(1988, 1992\)](#) cointegration analysis for the I(1) series. We begin our investigation by tracing the existence of stationary equilibrium relations among the two variables, by applying Johansen's cointegration rank tests λ_{trace} and λ_{max} . In order to support the relation presented in (2), a precondition is that there will be a linear combination of the two series eliminating a common stochastic trend. As a result, since the present examination contains only two

² The cases of the US and the German markets have also been examined but the authors have chosen not to present the respective examination, as reporting non-significant findings was deemed as less important than space saving. However, the results are available upon request.

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