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# Determining what drives stock returns: Proper inference is crucial: Evidence from the UK

Jun Ma [a,1], Mark E. Wohar [b,*]

[a] Department of Economics, Finance and Legal Studies, Culverhouse College of Commerce & Business Administration, University of Alabama, Tuscaloosa, AL 35487-0024, United States
[b] Department of Economics, Mammel Hall 332S, University of Nebraska at Omaha, Omaha, NE 68182-0286, United States

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ABSTRACT

This paper employs a century of the UK stock market data to examine various sate-space model specifications and Vector Autoregression (VAR) models to investigate how much expected returns and expected dividend growth contribute to movements in the UK price–dividend ratio. We show that the results of the estimated state-space models and the estimated VAR return decomposition models that attempt to estimate the contribution of expected returns and dividend growth to movements in the price–dividend ratio provide different results when one corrects for proper inference for both models. The corrected inference indicates that the contribution of expected returns to fluctuations in the price–dividend ratio is found to be statistically insignificant according to the state-space model, however, expected returns are found to contribute significantly to movements in the price–dividend ratio when one employs the VAR model. We offer some important econometric insights about the reasons for why state-space models and VAR models may give different results.



## 1. Introduction

Asset pricing theory tells us that stock prices change because of variation in expected dividends and expected returns (discount rates). A large number of empirical studies have found that stock returns are predictable. It is common to attribute this predictability to systematic movements in expected returns. However, the low $R^2$ found in stock return predictability regressions implies that a large portion of stock price movements remain unexplained. Unexpected variations in stock prices must be due to investors' expectations about future dividends and/or expected returns.

As shown by Campbell (1991) at the aggregate level, if one assumes no speculative bubbles, then unexpected stock returns can be decomposed into changes in expectations of future dividends ("cash flow news"), real interest rates, and expected excess stock returns ("discount rate news"). Campbell (1991) and Campbell and Ammer (1993) find that news about future excess returns is the primary factor behind movements in the US stock returns, with news about future dividends, and real interest rates, contributing much less to movements in the US stock returns. Cuthbertson, Haves, and Nitzsche (1999) reports similar results for the UK. In particular, they employ annual data over the period 1918–1993[2] and find that the contribution of news about future discount rates contributes close to four times as much to movements in UK stock prices than do contributions of news about future dividends. Cuthbertson et al. (1999) show that persistence in expected returns as well as significant stock return

* Corresponding author. Tel.: +1 402 554 3712; fax: +1 402 554 2853.
*E-mail addresses:* jma@cba.ua.edu (J. Ma), mwohar@mail.unomaha.edu (M.E. Wohar).
[1] Tel.: +1 205 348 8985.
[2] Their data is taken from the Barclays de Zoete Wedd (BZW) Gilt Equity Study 1994.

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predictability is found to be important in explaining their results. This last point is consistent with Campbell (1991) who points out that the impact of revisions in expectations of future expected returns on current stock prices depends on the degree of return predictability as well as the time series properties of expected returns. In particular, even if stock return predictability is low, news about expected future returns can have a large effect on stock price movements provided that expected returns are persistent.

Recent work by Balke and Wohar (2002), and van Binsbergen and Koijen (2010) have applied state-space models to directly model and estimate the expectation processes of aggregate dividend growth and stock returns. The state-space framework has the advantages of modeling the expectations directly as latent factors and it has the advantage of capturing the long-run serial correlations that a VAR with a finite number of lags would have difficulty doing. The latter point comes from the fact that the state-space model typically results in a moving averaging term in the reduced-form.

The state-space/unobserved component modeling approach has been used in other areas as well, including, US economic output fluctuations (Clark, 1987), Forward Exchange Risk Premium (Wolff, 2000), and Permanent Income Hypothesis (Morley, 2007). One objective of this paper is to apply the state-space modeling approach as well as the vector autoregression (VAR) return decomposition approach (used in earlier UK studies)[3] to UK stock return data and then to compare the results to each other, using proper methods of inference, to examine what factor contributes most to fluctuations in the UK stock prices. This paper employs both the state-space methodology and the vector autoregression methodology to re-examine the UK experience. We employ the same data set that was used by Cuthbertson et al. (1999) and Engsted and Tanggaard (2004). Our sample is from 1901 to 2007 and covers a very long period of more than a century for the UK stock market. Ending the sample in 2007 is convenient as we do not want to include the financial crises period of 2008–2010. We will discuss the characteristics of the state-space model and discuss some of its limitations. We will then compare the results of our state-space methodology with that of the VAR return variance decomposition methodology.

Our results show that the state-space model, for stock returns and dividend growth, is generally subject to the Zero-Information-Limit-Condition (ZILC) concern. Under these conditions, we show that the standard inference procedures are likely to understate the uncertainty of the stock return decomposition. We apply a valid inference strategy proposed by Ma and Nelson (2012). The valid tests indicate that there is no statistical evidence to suggest that either expected returns or expected dividend growth contributes to movements in the price–dividend ratio using the state-space modeling technique. However, expected returns are found to contribute significantly to movements in the price–dividend ratio when one employs the VAR model. We provide an explanation for why this is the case. Interestingly, Ma and Wohar (2014) study the US equity market using similar methodologies but reach a different conclusion using the VAR approach.

The paper is organized as follows: Section 2 provides a literature of recent literature related to this paper. Section 3 presents the theoretical foundation of stock price decomposition. Section 4 discusses weak identification and spurious inference. Section 5 provides a section on robustness analysis. Section 6 presents VAR variance decomposition. Section 7 provides a conclusion.

## 2. Review of recent literature

van Binsbergen and Koijen (2010) employ an unobserved components framework using the US annual data within a present value model to estimate the expected return and expected dividend growth rates of the aggregate US stock market. The approach of van Binsbergen and Koijen (2010) aggregates information contained in the price–dividend ratio and dividend growth rates to extract expected returns and expected dividend growth rates. They treat conditional expected returns and expected dividend growth as latent variables that follow an exogenously specified time series process. They combine this model with the Campbell and Shiller (1988a, 1988b) present value model to derive the implied dynamics of the price–dividend ratio. They find that both expected dividend growth rates and expected returns are time varying and persistent but that expected returns are more persistent than expected dividend growth rates. Finally, they estimate a process for dividend growth and back out expected returns. They find that expected returns contribute more to fluctuations in the price–dividend ratio than do expected dividend growth rates.

In an earlier paper, Balke and Wohar (2002) model the dynamics of the log price–dividend ratio along with short-term and long-term interest rates, real dividend growth and inflation using a state-space model. One advantage of the state-space approach that they employ is that they can parsimoniously model the low frequency movements present in the data. They find that if one allows persistent changes, albeit small, in real dividend growth, interest rates and inflation (but not excess returns) then expectations of real dividend growth and real interest rates, become significant contributors to stock price fluctuations. They also show that stock price decompositions are very sensitive to assumptions about which market fundamental has a permanent component. When they allow excess stock returns to have a permanent component (but not real dividend growth) then it is excess stock returns that become the important contributor to fluctuations to stock price movements, while real dividend growth is not. They conclude that the data is not informative about which one of the above models is the appropriate model. This finding is an illustration of the weak identification problem discussed in Section 4. The important finding of Balke and Wohar (2002) that the factor with the largest degree of persistence is the factor that contributes most to movements in the price–dividend ratio is also consistent with the findings of this paper as well as those of van Binsbergen and Koijen (2010) who found that the persistent expected excess return factor explains most of the movements in stock prices.

[3] VAR return decompositions have been employed on US data (e.g. Campbell, 1991; Campbell & Ammer, 1993; Cochrane, 1992).