European Journal of Operational Research 242 (2015) 182–187

Contents lists available at ScienceDirect

European Journal of Operational Research

journal homepage: www.elsevier.com/locate/ejor

Decision Support

A new approach to estimating value–income ratios with income growth and time-varying yields

Peijie Wang[a,*], Steven Brand[b,1]

[a] University of Plymouth, UK and IÉSEG, France
[b] Plymouth Business School, University of Plymouth, Plymouth PL4 8AA, United Kingdom

ARTICLE INFO

Article history:
Received 6 September 2013
Accepted 22 September 2014
Available online 23 October 2014

Keywords:
Value–income ratio
Time-varying yield
Income growth
Present value model

ABSTRACT

Value–income ratios, such as dividend yields in finance and price–rent ratios in housing and real estate markets, impact society in a variety of ways. This paper proposes a new type of the present value model that features income growth with time-varying yields. It offers a new risk perspective, which may alleviate timid investor behavior in market downturns while cooling down the market in seemingly booming times. A binding relationship, the value–income ratio adjusted by yields of the asset and growth in income, is revealed. This has notable implications for empirical research, which examines value–income ratios time and again. Incorrectly perceived market behavior distorts the formation of investor behavior, and vice versa, which has serious consequences to the functioning of the market and beyond.

© 2014 Published by Elsevier B.V.

1. Introduction and background of the study

The present value model is one of the most used financial models in daily life for corporations and individuals alike. The present-value model states that the present value of an asset is derived from all its future cash flows that are discounted by appropriate discount rates to their present values. This crucially depends on the expectations about future income and the discount rate at which people sacrifice a portion of their current income for future consumption, after adjusting for risk. Campbell and Shiller (1987) are among the first to propose empirical tests of the validity of present value models based on cointegration relations between the present value of an asset and its future income, with the discount rate being constant. They subsequently rework the model to incorporate time-varying discount rates (Campbell & Shiller, 1988).

Price–income relationships in present value models have been scrutinized all the time. Recent examples include Riddel (2011), Lai and Van Order (2010) and Himmelberg, Mayer, and Sinai (2005). They are all concerned with high house prices and phenomenal growth in house prices in the US, and examine the fundamental relationships and the presence of bubbles. Nevertheless, while such ratios or prices themselves cannot prove whether the prices are too high or modestly low, they may convey some widespread concerns or reliefs, at the wrong time and in the wrong place. These have to be adjusted by pertinent factors.

We accordingly propose a new type of income growth model with time-varying yields to maturity in this study. Several new developments are featured in the paper. Firstly, unlike Campbell and Shiller (1988), no approximation has been resorted to, except for the logarithmic expression for income growth which is conventional in financial analysis. Then, the discount rate is the rate for the life of holding the asset or yields to maturity, not the one period rate in almost all empirical studies that follow Campbell and Shiller (1988). Further, the time-varying discount rate is a variable in the fundamental relationship of cointegration in our model. Whereas the time-varying discount rate in Campbell and Shiller (1988) is included in short-term analysis but it is not an element in the cointegration relationship.

The rest of the paper progresses as follows. The next section makes a brief literature review. Section 3 introduces the basic present value model. Section 4 presents the new model, while Section 5 discusses the implications of the relationship revealed by the model. Section 6 provides examples of application. Finally, Section 7 concludes.

2. Studies in the area

Timmermann (1995) has carried out extensive econometric tests on the present value model of Campbell and Shiller (1987) and the model augmented by Campbell and Shiller (1988) that incorporates time-varying discount rates. He claims that the latter version is more appropriate while the original present value model performs unsatisfactorily. Wang (2003) suggests the use of a Gordon dividend growth type specification for the present value model, which helps explain

* Corresponding author. Tel.: +441752585705.
E-mail addresses: Peijie.Wang@plymouth.ac.uk, p.wang@ieseg.fr (P. Wang), Steven.Brand@plymouth.ac.uk (S. Brand).
[1] Tel.: +441752585674.

http://dx.doi.org/10.1016/j.ejor.2014.09.046
0377-2217/© 2014 Published by Elsevier B.V.

the discrepancy between the estimated 3.2 percent discount rate in the empirical part of Campbell and Shiller (1987) for the US broad stock market index and the usually assumed estimated mean rate of return of 8.2 percent for the period from 1871 to 1986. He claims that the difference in the two estimates implies a certain growth in dividends, which have been rightly taken into account by Campbell and Shiller (1988). While Wang (2003) has proposed the use of a Gordon dividend growth type specification for the present value model, the discount rate is not time-varying in the model.

Most recently, Cornell (2013) has another look at dividend–price ratios and stock returns in history. He argues that the "predictability" of stock returns based on regressions of future returns on dividend–price ratios is consistent with the original version of the efficient market hypothesis, which holds that expected returns are unpredictable. Indeed, returns are derived from an asset's income-generating abilities. In his case, the income is dividends. This highlights the importance of avoiding mixing a necessary fundamental relationship with return predictability. Cochrane (2011) elaborates on the importance of a time-varying yield or discount rate in his American Finance Association Presidential Address: "Now it seems all price–dividend variation corresponds to discount-rate variation". He contrasts asset-pricing research 40 years ago with contemporary finance research, while agreeing with Fama on that asset prices should equal expected discounted cash flows. He is quoted as saying: "Fama (1970) argued that the expected part, 'testing market efficiency', provided the framework for organizing asset-pricing research in that era. I argue that the 'discounted' part better organizes our research today". This is echoed in Cornell (2013). While we seek and may have found better explanations for returns, the findings do not contradict market efficiency and do not make stock returns more predictable.

Empirically, McMillan (2007) investigates whether there are bubbles in the dividend–price ratio by implementing an asymmetric exponential smooth-transition model. He finds that the log dividend–price ratio is stationary only in a non-linear form fitted with an asymmetric exponential smooth transition model. Therefore, use of this non-linear asymmetric model tends to reject rational bubbles that can otherwise be mistaken to exist. McMillan (2006) has communicated the above ideas earlier in a short paper. Following Campbell and Shiller (1988) in defining holding period returns, Harrison and Zhang (1999) further incorporate conditional variances in the form of ARCH into the price–dividend ratio model. They employ the semi non-parametric method to estimate the conditional density function, as the method allows for heterogeneity that is typical in financial data. They find a positive risk and return relation at long holding intervals, but such a relation does not exist at short holding intervals. They attribute these findings to their model specification that arguments the price–dividend ratio model with conditional variances. Observing that a number of papers apply different statistical methods to study the relation among dividend yields, earnings growth and stock returns in different markets along different time horizons, Pang, Yu, Troutt, and Hou (2008) study the statistical properties of dividend yields. They propose that it is more appropriate to assume that dividend yields follow a beta distribution. With a VAR framework, Goddard, McMillan, and Wilson (2006) examine the dynamic relationships between share prices, dividends and earnings for UK manufacturing and service companies. They find that there is strong evidence of a contemporaneous relationship between prices, dividends and earnings, and little evidence of independence between these variables. This justifies the adoption of price–dividend ratios in estimating stock returns.

Whether the value–income relationship holds in housing and real estate markets is also a hot topic. For example, Fraser, Hoesli, and McAlevey (2008) test whether there are bubbles in house prices in New Zealand by studying real house prices in relation to the fundamentals that make up house values for the period between 1970 and 2005. Their results indicate that there are significant deviations from fundamental values in New Zealand's residential housing prices. Wang (2000) applies the present value model to UK office, retail, and industrial property markets for scrutinizing the data characteristics of capital value and rental income and their relationships. The results suggest that the existence of rational bubbles in the UK property market can be largely ruled out in that capital values and rents do not tend to depart away in the long-run in the aggregate, office, and retail property markets. However, the UK property market appears to be inefficient. Riddel (2011) investigates whether housing bubbles are contagious with a case study of the house prices in Las Vegas and Los Angeles. It is claimed that contagious prices and income growth from the Los Angeles market compounded by naïve expectations contributed to the formation of a bubble in the Las Vegas market.

The above review shows that many empirical studies have been conducted within the analytical framework put forward by Campbell and Shiller (1988). Some have improved the model fit by resorting to different estimation methods. The new developments in the paper are fundamental rather than technical, as briefed at the beginning. These will be demonstrated in Section 4 while our models with income growth and time-varying yields are presented. Prior to that, the next section introduces the basic model.

3. The basic model

The present value of an asset is its all future income discounted:

$$V_t = \sum_{\tau=1}^{\infty} \frac{E_t I_{t+\tau}}{(1+r_t)\cdots(1+r_{t+\tau-1})} \tag{1}$$

where V_t is the present value of the asset, I_{t+1} is income derived from possessing this asset in period $(t, t+1]$, E_t is expectations operator, and r_t is the discount rate in period $(t, t+1]$. When the discount rate is constant, Eq. (1) becomes:

$$V_t = \sum_{\tau=1}^{\infty} \frac{E_t I_{t+\tau}}{(1+r)^{\tau}} \tag{2}$$

Subtracting $V_t/(1+r)$ from both sides with rearrangements yields:

$$V_t - \frac{I_t}{r} = \frac{1+r}{r} \sum_{\tau=1}^{\infty} \frac{E_t \Delta I_{t+\tau}}{(1+r)^{\tau}} \tag{3}$$

Eq. (3) suggests a cointegration relation for V_t and I_t. If V_t and I_t are $I(1)$ series, then ΔI_t is an $I(0)$ series. This provides a tool for testing rationality in financial markets – the price or the present value of an asset and the income it generates should be cointegrated if expectations are formed rationally and the present value model is to hold. The cointegration vector is $(1, -1/r)$ in this case.

4. Models with income growth and time-varying yields

The seeming stationarity of the right hand side in Eq. (3) is unrealistic. The growth in income in Eq. (3) is an absolute term, $I_t - I_{t-1}$, not a relative term, $(I_t - I_{t-1})/I_{t-1}$ or $\ln(I_t) - \ln(I_{t-1})$. This absolute change in income will on average becomes greater and greater over time, and cannot be assumed stationary. Let us now adopt a version of the Gordon dividend growth model, in which income grows at a rate of g: r is greater than g for incurring risks more than that incurred and compensated by growth.

$$\begin{aligned} I_{t+\tau} &= (1+g) I_{t+\tau-1} e^{\varepsilon_{t+\tau}} = (1+g) I_{t+\tau-2} e^{\varepsilon_{t+\tau-1}} e^{\varepsilon_{t+\tau}} \cdots \\ &= (1+g)^{\tau} I_t e^{u_{t+\tau}} \end{aligned} \tag{4}$$

where

$$u_{t+\tau} = \varepsilon_{t+1} + \varepsilon_{t+2} + \cdots + \varepsilon_{t+\tau}, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2) \tag{5}$$

and

$$\begin{aligned} \varepsilon_{t+\tau} &= \ln(I_{t+\tau}) - \ln(I_{t+\tau-1}) - \ln(1+g) \approx \ln(I_{t+\tau}) - \ln(I_{t+\tau-1}) - g \\ &= \Delta \ln(I_{t+\tau}) - g \end{aligned} \tag{6}$$

Download English Version:

https://daneshyari.com/en/article/476590

Download Persian Version:

https://daneshyari.com/article/476590

Daneshyari.com