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Switching equilibria: the present value model for stock prices revisited

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Abstract

This paper analyzes the dynamic features displayed by alternative rational expectations equilibria in the context of the present value model for stock prices with feedback. In particular, it shows that there exists a unique equilibrium implying cointegration and that equilibrium is characterized by either the fundamental or, alternatively, the backward solution depending on the size of the feedback parameter. It is shown analytically that the existence of switching equilibria induces large stock market swings. Using US data and structural estimation, the hypotheses of feedback and switching equilibria are tested. The empirical results provide evidence of both switching equilibria and feedback.

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1. Introduction

The present value (PV) model of stock prices assuming rational expectations (RE) was extensively tested during the 1980s (Campbell and Shiller, 1987; Chow, 1989; West, 1988, among others). Many of these studies find US stock prices to be more volatile than implied by the PV model. These studies share two common assumptions. First, they assume a unique RE equilibrium for stock prices. Second, they consider that the dividend process has remained unchanged over the whole sample period. The

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relaxation of either of these assumptions provides a potentially good approach to explaining the excess volatility found in the literature.¹

Following the first approach, Froot and Obstfeld (1991) propose the first parsimonious PV model of stock prices that has found empirical support. They characterize stock prices using a rational *intrinsic* bubble which depends exclusively on dividends. Recently, Ackert and Hunter (1999) have shown that Froot and Obstfeld's model is observationally equivalent to a PV model of stock prices that in addition explicitly includes control over dividends by managers. Also following the first approach, Timmermann (1994) shows that the existence of feedback in a PV model generates multiple (bubble-free) RE solutions. Moreover, Timmermann provides evidence that stock prices appear to Granger-cause dividends, which he interprets as evidence of feedback from stock prices to dividends.² Furthermore, he suggests that the excess volatility observed in stock prices may be explained by switches among the set of RE equilibria. However, Timmermann neither explains what effects the switching between RE equilibria may induce nor empirically studies the existence of switching equilibria.

The second approach is followed by Driffill and Sola (1998) and Evans (1998). Using the PV model of stock prices, the two articles provide evidence that a regime-switching model describing the evolution of dividends accounts for much of the variation of US stock prices. However, neither of them considers the effects of switching equilibria.

This paper builds upon these two approaches. We analyze a simpler version of Timmermann's (1994) model in order to fully characterize how changes in the dividend process alter the dynamic features displayed by the alternative (bubble-free) RE equilibria. We first show that the presence of the feedback mechanism produces three alternative RE equilibria.

Secondly, it is shown that there exists a unique (bubble-free) RE equilibrium implying cointegration between stock prices and dividends. This equilibrium is characterized by a different equilibrium solution depending on the dividend process parameters. Finally, this paper illustrates that the existence of switching equilibria induces large changes in the variance of the *spread* (i.e., the stationary linear combination between stock prices and dividends as defined by Campbell and Shiller, 1987) and large changes in the response of stock price variation to the spread. These results imply that large stock market swings are feasible, even with a constant discount factor, when switching equilibria occur.

We assume cointegration between stock prices and dividends in the empirical analysis. We believe it is the relevant case based on the empirical evidence reported by Campbell and Shiller (1987). Moreover, the error-correction structure implied by the

¹ As reviewed by Cochrane (1991), numerous attempts at improving the PV model of stock prices have been made. Thus, the implications of a time-varying discount rate have been investigated at length. However, as pointed out by Froot and Obstfeld (1991), there is little positive empirical evidence that discount factor variation alone can explain the excess volatility of stock prices.

² Timmermann (1994, p. 1109) recognizes that Granger-causality does not necessarily constitute proof of a feedback relation. However, in the light of a model with imperfectly and heterogeneously informed agents, Timmermann argues that the evidence of stock prices Granger-causing dividends can be interpreted as evidence of feedback from stock prices to dividends.

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