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Nonlinear earnings persistence

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ABSTRACT

This study employs panel smooth transition regression (PSTR) models with different lagged variables of earnings components as regressor to evaluate earnings persistence effects. The models can resolve collinearity problems between predictors, reflect firms' volatile or irregular earnings streams that are likely derived from long-run investments, and provide more useful information for improving forecasting performance. Most importantly, they can describe differential earnings persistence effects between different regimes that have not been verified by previous studies. Our empirical results support these arguments.

1. Introduction

Recently, the topic of earnings persistence has attracted the attention of investors and researchers. The evaluation of earnings persistence is a crucial instrument to measure a firm's financial health and value (Aboody, Hughes, & Liu, 2002; Dechow & Dichev, 2002; Dechow, Sloan, & Sweeney, 1996; Jones, 1991; Kothari, Leone, & Wasley, 2005; Schipper & Vincent, 2003). Equity valuation models, such as the real option approach, the discounted cash flows, and the Ohlson valuation model, are heavily dependent on the prediction of earnings and are referred to as evaluations of earnings persistence.

Kormendi and Lipe (1987) first determine that the magnitude of the relationship between stock returns and earnings depends on the persistence of earnings. Dechow (1994) shows that current cash flows provide information about future cash flows and future earnings and also demonstrates that earnings are superior to cash flows at summarizing information about future cash flows and future earnings. Sloan (1996) elaborates on this research by showing that the accrual component of earnings is significantly less persistent than the cash component of earnings. Subsequent studies have extended Sloan's work by providing more detailed analyses of the persistence and the pricing of the accrual component of earnings (e.g., Fairfield, Whisenant, & Yohn, 2003; Richardson, Sloan, Soliman, & Tuna, 2005; Xie, 2001). Dechow and Ge (2006) argue that earnings persistence is influenced both by the magnitude and the sign of accruals. In addition, the accrual components of earnings improve their persistence relative to cash flows in high accrual firms, but reduce their persistence in low accrual firms. Oei, Ramsay, and Mather (2008) find that a

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broad measure of total accruals in Australian companies is less persistent than cash flows. Moreover, the persistence of accrual components is positively associated with the reliability of those components; however, the least reliable accrual component has the greatest persistence. Recently, Bali, Demirtas, and Tehranian (2009) argue that firm-level earnings are affected by firm-specific and macroeconomic events. To investigate the importance of firm-specific information in forecasting the time-series of stock returns, they decompose earnings into a firm-specific and systematic part by regressing firm-level normalized earnings on aggregate normalized earnings. That is, decomposing firm-level earnings into systematic earnings and unsystematic earnings is crucial for researchers and investors to evaluate the persistence of earnings and the fair prices of common stocks.[1]

Previous studies on earnings persistence have experienced at least three obvious constraints in empirical applications. First, most studies subjectively have adopted one-period lagged earnings or one-period lagged cash flows and accruals to determine the properties of earning persistence (e.g., Dichev & Tang, 2009; Frankel & Litov, 2009; Sloan, 1996). This treatment may be inadequate for companies with volatile or irregular earnings streams. Because companies can have volatile earnings streams, their earnings persistence may be insignificant if only one-period lagged explanatory variables are employed. However, this flaw can be avoided by considering more the lag lengths for explanatory variables to trace earnings persistence. Tsay, Lin, and Wang (2009) find that using one- or three-period lagged abnormal earnings generate indifferent earnings persistence effects, whereas Pan, Huang and Wu (2011) argue that in addition to one-period lagged cash flows, two- and four-period lagged cash flows also have a significant effect on current cash flows. Therefore, the optimal lag length of earnings or cash flows to evaluate earnings persistence is divergent and should be determined by appropriate econometric methods.

Second, previous studies on earnings persistence have mainly employed linear models, either using time series models or structural models, to measure persistence effects. However, the structural change of earnings persistence may occur as firms encounter obvious adjustments in external economic environment, public policy, and an internal policy. For example, the occurrence of fatal economic and non-economic events and the changes in accounting principles and a firm's operating policy all likely create differential earnings persistence effects within different switching regimes.[2]

To illustrate the regime-switching process of earnings persistence, specific nonlinear models have been introduced in previous studies. There are well-known regime switching models that can describe the nonlinear dynamics of economic variables, such as the Threshold Autoregressive (TAR) model, the Markov Switching (MS) model, the Smooth Transition Autoregressive (STAR) model, the Smooth Transition Autoregressive model with exogenous variables (STARX), and the Neural Networks (NN) model. Sarno (1998), Skalin and Teräsvirta (1999), Öcal and Osborn (2000), Holmes and Maghrebi (2004), Teräsvirta, Dijk, and Medeiros (2005), Basyah and Hartigan (2007), and Baharumshah, Liew, and Chowdhury (2010) all verify that STAR and STARX models can capture the nonlinear adjustment of economic variables within different regimes. Pan et al. (2011) find that STAR and STARX models can provide superior goodness-of-fit, compared with that of linear models, in estimating cash flows. As a result, STAR and STARX are proper models to trace the nonlinear time path of economic and financial variables. However, Bali (2008) and Bali and Engle (2010) indicate that in presence of cross-sectional heterogeneity, assuming a common impact of a variable on a specific variable within panel data framework may be misleading. One solution dealing with the nonlinearity and heterogeneity problems is to specify a panel smooth transition regression (PSTR) model, recently developed by González, Teräsvirta, and van Dijk (2004).[3]

Third, most prior studies on earnings persistence simultaneously used one-period lagged cash flows and one-period lagged accruals to measure earnings persistence effects (Dechow & Ge, 2006; Sloan, 1996; Xie, 2001). This may neglect collinearity problems originating from the high linear correlations between cash flows and accruals. It is understood that collinearity seriously distorts the significance and the sign of estimated parameters, i.e., the earnings persistence effect, and further influences earnings forecasting performance. Therefore, the exclusion of collinearity between cash flows and accruals is necessary for researchers to evaluate earnings persistence.

To resolve the above constraints in the previous literature, we employ nonlinear PSTR models to evaluate earnings persistence effects. The models have three main traits. In the first stage of estimating the nonlinear models, we adopt a stepwise regression method to select the optimal lag length of earnings, systematic earnings, unsystematic earnings or cash flows and construct more proper linear earnings persistence evaluation models. This may avoid collinearity problems, and it also allows us to detect whether longer lag periods of variables (including earnings, systematic earnings, unsystematic earnings or cash flows) can provide useful information to improve the estimation performance. Second, through the linearity test in the PSTR model proposed by González, Teräsvirta and van Dijk (2005), we further determined whether earnings had a dynamic regime-switching process and whether the nonlinear estimation results generate more accurate predictability. This is especially important for investors who utilize the equity valuation models to evaluate target firm value in their investment strategy. Additionally, the use of PSTR model can deal with the nonlinearity and heterogeneity problems simultaneously, as highlighted by Bali (2008). We adopt the component companies in the Dow Jones Industrial Average (DJIA) to verify these statements.

The remainder of this paper is organized as follows: Section 2 outlines the empirical models and methodology, Section 3 presents the empirical results, and Section 4 summarizes the study and provides conclusions.

[1] We deeply appreciate the anonymous reviewer's suggestion to decompose firm-level earnings into systematic earnings and unsystematic earnings for assessing earnings persistence.

[2] For a more detailed explanation see Teräsvirta (1994).

[3] Again, we appreciate the anonymous reviewer's suggestion to consider the estimation of earnings persistence in panel data context.