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Dynamic betas for Canadian sector portfolios ☆

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Abstract

The dynamic betas for ten Canadian sector portfolios using the Kalman filter approach are estimated herein and are found to be best described by a mix of the random walk (trend) and mean-reverting (cycle) processes. The relative importance of the trend and cycle components of sector betas is related to different sensitivities of the corresponding sectors to business cycles. Dynamic betas significantly increase the explanatory power of the market model, and particularly for the utilities sector. A dynamic hedging strategy using the one-step-ahead beta forecasts as the hedge ratios produces smaller hedging errors for every sector compared with the hedge ratios calculated from the alternative beta specifications.

JEL classification: G100; G120; C110
Keywords: Dynamic betas; Sector portfolios; Kalman filter; Market model performance

1. Introduction

The market beta of a given asset is a widely used measure to determine the systematic risk of the asset, to calculate the cost of equity, and to evaluate the performance of managed investment funds. Early studies such as Sunder (1980), Kryzanowski and To (1984), Rahman, Kryzanowski, and Sim (1987) and others find considerable evidence that asset betas are unstable over time. To accommodate time-variation in betas, the literature has proposed a variety of approaches including the rolling regressions of Fama and MacBeth (1973), the GARCH-type conditional

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betas of Schwert and Seguin (1990), and the Kalman filter applied by Wells (1994) and others. Among these various approaches, recent literature finds overwhelming evidence that the Kalman filter is the best approach to capture beta dynamics.[2]

In this paper, we estimate the dynamic betas for ten Canadian sector portfolios using the Kalman filter approach. We make two contributions to the existing literature. First, previous studies have estimated beta dynamics for the U.S. (e.g., Jostova & Philipov, 2005), Australian (e.g., Faff, Hillier, & Hillier, 2000), and many European (e.g., Mergner & Bulla, 2005) stock markets. Compared to the U.S. and European markets where the various economic sectors are well represented, the Canadian market has a much larger proportional representation of resource and financial firms.[3] To our knowledge, similar work of estimating beta dynamics for the Canadian stock market is still missing, and this paper attempts to fill this void using the unique Canadian sample. Furthermore, given the proliferation of sector mutual funds in the Canadian stock market, our focus on the betas of sector portfolios is of particular interest to individual and institutional investors who practice passive and active sector-based investing. Since the risk characteristics of sector funds exhibit very different time-varying behaviors (as our results show), estimating the beta dynamics for each sector is crucial for fund managers to make asset allocations, to implement active management strategies (such as sector rotations), to evaluate portfolio performance, and to alter or hedge the market risk of sector investments. To illustrate the merits of estimating the beta dynamics, we describe a practical application of dynamic betas to hedge the market risk of a sector portfolio.

Second and more important, although the existing literature generally favors the Kalman filter approach, little agreement exists on what type of stochastic process is the most appropriate for the beta of a given portfolio. Specifically, while Adrian and Franzoni (2005) and Jostova and Philipov (2005) support a stationary mean-reverting process of asset betas, other studies such as Fama and French (1997) and Mergner and Bulla (2005) find that the betas of (at least) some industry portfolios follow a non-stationary random walk. As Fama and French (1997) clearly suggest, the supply and demand conditions of a particular industry group may be subject to permanent shocks, such as changes in monetary or regulatory policies, new information or production technology, or changes in consumer tastes, which permanently shift the risk characteristics of the sector over the long run.

In this paper, we do not take a stand on whether the beta of a sector portfolio should be considered as a random walk or a mean-reverting process. Instead, we consider a more general process in which the beta is modeled as a combination of a trend (random walk) and a cyclical (mean-reverting) component. In other words, the beta process is allowed to revert to a stochastic trend that is itself varying over time. By decomposing the beta process into a trend and a cycle, our dynamic beta model embraces the existing beta models as special cases, so that the empirical estimates of model parameters will determine what mixture of the trend and cycle is more appropriate for the beta of a particular portfolio. Furthermore, the relative importance of the trend and cycle components can be empirically examined by their respective contributions to the time-variation of sector betas.

We estimate the dynamic beta model using the Kalman filter and extract the trend and cycle components, which are combined to form the time series of sector betas. We provide strong evidence of time-variation of sector betas for the time period of 1991 to 2004. To assess the relative importance of the two components, we calculate the trend-to-cycle ratios. Based on these ratios, the sector betas

[2] A partial list of the studies that support the Kalman filter approach (or more generally, the Bayesian learning model) include: Adrian and Franzoni (2005), Jostova and Philipov (2005) for U.S. stocks and portfolios; Brooks, Faff, and Mckenzie (1998) and Faff et al. (2000) for Australian industry portfolios; and Mergner and Bulla (2005) for the Pan-European industry portfolios.

[3] At the end of 2004, the Energy, Materials, and Financials sectors, respectively, represent 20%, 18% and 32% of the S&P/TSX index, whereas the Health sector represents less than 5% of the index.