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Co-movement in the price of risk of aggregate equity markets

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Abstract

This paper examines the issue of co-movement in G7 equity markets. Earlier research in this area has focussed on the first or the second moment of the return process from different markets. The approach in this paper takes the analysis to a finer level to examine the co-movement between these markets. The price of risk from the equity market is inferred in an unobserved component modelling framework to study the co-movement using a non-parametric measure of association, concordance. The findings of this paper also indicate that the price of risk is more important than volatility in explaining movements in excess return.

JEL classification : C22; G12

Keywords: Price of risk; Risk premium; GARCH; Unobserved component

1. Introduction

A thorough understanding of the nature of the risk premium in asset markets is an integral part of financial decision making. This is particularly so in equity markets. Most researchers have focussed on the beta risk of stocks or stock portfolios in different experimental settings. The beta is now well established to be time-varying, and different models have been proposed to capture its time variation. Groenewold and Fraser (1999) find significant structural breaks in betas using data from the Australian industry sector. They capture the time variation of the betas using three different approaches: recursive regression, rolling regression, and the Kalman filter. Faff et al. (2000) suggest that if the Kalman filter-based approach incorporated the information contained in

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the GARCH type models, it would provide a more efficient estimate of the time-varying systematic risk. Choudhry (2002) employs an MA-GARCH type model to capture the time-varying beta for several UK companies. In doing so, he investigates the stochastic structure of the betas and finds that most are covariance stationary and mean-reverting.

Merton (1980) provides the basis for an alternative approach to the analyses of the stock market risk premium. Merton's model of inter-temporal capital asset pricing demonstrates that a risk-averse investor demands a risk premium to compensate for the market risk. Assuming that the variance of the market return is a sufficient statistic for the market risk, this risk premium is proportional to the market risk. In the case of a representative investor, this proportionality constant is also equal to the investor's relative risk aversion. This multiplier can also be used to measure risk by providing the unit price of risk. There is no evidence to suggest that the unit price of risk should remain constant over time. This, in fact, is the approach adopted by Jochum (1999). Jochum shows that the time variation in the price of risk can be estimated using an unobserved component model that also allows the measure of risk to vary with time as an ARCH process. Chou et al. (1992) apply a similar methodology and relate the inferred price of risk to the risk aversion parameter of the investor.

The notion of time variation of the unit price of risk is by no means limited to the framework outlined above. The derivative contracts written on the market indices of many countries offer another potential source of data for inferring the time variation of the market price of risk. The concept is embedded in the rich theory of derivatives pricing, a theory which requires a relation between risk-neutrality and historical probability distributions. Bhar et al. (2004) demonstrate how the model can be set-up and estimated using the state-space structures. This approach allows us to infer the time variation of the market price of risk quite efficiently.

This paper adopts the concept of time variation in the price of risk and applies it to the G7 markets. Our methodology is similar to that of Jochum (1999) and can be used without relying on complete data from the derivatives markets of all countries over long periods. The price-of-risk series inferred from our model thus allows us to further investigate the comparative behaviour between these markets.

World stock markets have become more integrated over the last three decades, chiefly as a consequence of financial deregulation and advances in computer technology. Financial researchers have traced the evolution of this trend from different perspectives, applying diverse methodologies and databases to elucidate the linkage phenomenon. Fundamentally, however, most have taken the common approach of modelling return series from similar asset markets and analysing feedback mechanisms through the first or the second moments of the distributions. Malliaris and Urrutia (1992, 1997) show that certain global events tend to move national stock markets in unison. McCarthy and Najand (1995) also provide a good account of the literature in stock market linkages.

After inferring the price of risk, we extend the study of stock market linkages to a deeper level by investigating the co-movement of the market price of risk in these G7 markets using concordance, a non-parametric test recently suggested by Harding and Pagan (1999). The concordance measure has been extended by McDermott and Scott (1999) for its distributional properties and successfully applied in studies of co-movement of prices in seemingly unrelated commodities (e.g., Cashin et al., 1999). This approach lets us explore whether investor perceptions of the price of risk move together in these markets over the sample period. In doing so, the notion of total risk premium in the market is divided into two components: the measure of risk and the price of risk. Through this approach we can study the stock market linkages using more sensitive information than the equity return and/or return volatility itself.