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Downside risk of international stock returns

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ABSTRACT

This paper investigates the downside risk exposure of international stock returns in 14 major industrialized economies around the world. For the period 1975–2010, we find that differences in returns on value and growth portfolios can be rationalized by assets' reagibilities to market's downside shocks. International value stocks are particularly sensitive to market's permanent downside shocks, while international growth stocks are particularly sensitive to market's temporary downside shocks. In line with recent evidence for the US, risk associated with unfavorable changes in market's cash-flow innovations carries a premium which is pervasive and statistically significant.

1. Introduction

The idea that investors care differently about downside losses versus upside gains dates back to Roy (1952) and Markowitz (1952). If investors are more sensitive to economic downturns than to periods of economic recovery, stocks that tend to do poorly in bear markets should have on average higher returns. This paper examines the downside risk exposure of the cross section of international value and growth portfolios. Value stocks receive a lot of attention by both financial analysts and academics on grounds of their high average returns compared to growth stocks.

Evidence suggests that value premium is pervasive in a large number of countries. In this paper, we focus on 14 industrialized economies including the United States (US), Canada and twelve major EAFE (Europe, Australia and the Far East) markets. In our country choice, we strictly follow Fama and French (1998) who show that value stocks have higher average returns than growth stocks in markets around the world. In addition, we study Canada given the evidence in Athanassakos (2009). The online data library of Kenneth R. French allows a comprehensive examination of the international value premium since 1975.

Ang et al. (2006) demonstrate that the cross section of US stock returns reflects a premium for bearing downside risk. Exploiting this insight, Botshekan et al. (forthcoming) show that cross-sectional differences in returns on stocks traded on the NYSE, AMEX and NASDAQ over the period from 1963 to 2008 can be rationalized by the exposure of these stocks to downside cash-flow risk. This result is striking in view of the seminal finding of Campbell and Vuolteenaho (2004) that value stocks have considerably higher cash-flow betas with high risk prices than their growth counterparts. Despite the fact that the value premium is a robust feature of international financial data, little research has been done on equity markets in the rest of the world.

In this paper, we study the exposure of international portfolio returns to the market's upside and downside fluctuations. We approximate the market by the Center for Research in Security Prices (CRSP) value-weight index. The empirical ability of US financial indicators to predict foreign excess returns is well documented since Bekaert and Hodrick (1992), Campbell and Hamao (1992), Ferson and Harvey (1993), and Cheung et al. (1997). To distinguish between cash-flow and discount-rate shocks in up and down markets we employ a four-beta decomposition constructed by Botshekan et al. (forthcoming).

Our results are easily summarized: First, we find that differences in returns on value and growth portfolios in 14 major industrialized economies around the world can be rationalized by assets' sensitivities to market's downside shocks. International value stocks are particularly sensitive to market's permanent downside shocks, while international growth stocks are particularly sensitive to market's temporary downside shocks. This result echoes Campbell et al. (2009) who argue that cash flows of US growth stocks are strongly sensitive to temporary movements in aggregate stock prices, while cash flows of US growth stocks are strongly sensitive to permanent movements in aggregate stock prices.

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Furthermore, risk associated with unfavorable changes in market's cash-flow innovations carries the largest premium which is pervasive and statistically significant. This finding supports recent evidence in Botshekan et al. (forthcoming) on the empirical success of downside cash-flow betas to capture the cross-sectional dispersion in returns on US stocks. Our results withstand a thorough sensitivity analysis.

We start with a vector autoregressive (VAR) model of Campbell and Vuolteenaho (2004) with four state variables—excess market return, term yield spread, 10-year price–earnings ratio and small-stock value spread—estimated over the full sample period from December 1928 to December 2010. To guard against the possibility that the "bad beta, good beta" decomposition is driven by the Great Depression market crash in the early 1930s (Bianchi, 2010), we reevaluate the asset pricing tests relying on a VAR model estimated over a shorter sample period.

We address the concern of Chen and Zhao (2009) and test the robustness of our results to a broad range of alternative state variables. In particular, we consider the dividend yield, real dividend growth, stock return variance, inflation, the short-run interest rate and different measures of value spread and price–earnings ratio. Moreover, we employ an alternative estimation technique which allows to calculate the cash-flow news directly as opposed to backing it out as a residual as is standard in the literature on macroeconomics and finance. Our conclusions support Engsted et al. (2012) who show that in a properly specified VAR model, there is little difference between backing out the cash-flow news or the discount-rate news when the respectively other component is directly modelled.

In order to reduce commonalities in value and growth portfolios due to the strong factor structure, we follow the recommendation of Lewellen et al. (2010) and include industry portfolios in test assets alongside with the benchmark international portfolios. In addition, we impose restrictions on risk premia directed by the economic theory by setting the zero-beta equal to the risk-free rate; we control for size and value effects, experiment with a lower and higher number of test assets, split up the sample of portfolio returns, change the specification of downside risk and vary the value of the coefficient of loglinearization.

Finally, we study the sensitivity of our results to upside and downside shocks originated on regional European markets. This exercise is motivated by a recent study of Baele (2005) who finds significant spillover effects of both the US and aggregate European markets' shocks on a large number of local European equity markets. Our findings confirm the importance of downside risk in stock market fundamentals for determination of asset's risk exposure and hold under a series of robustness tests.

The remainder is structured as follows. The next section briefly sketches the decomposition of the market returns into a cash-flow component and a discount-rate component and defines the upside and downside cash-flow and discount-rate betas. Section 3 describes the data. Section 4 presents our empirical results and Section 5 concludes.

2. Methodology

2.1. Campbell–Shiller decomposition

Changes in asset prices must be associated with unexpected changes in future cash flows or discount rates (Campbell and Shiller, 1988). Elaborating on this insight, Campbell (1991) extends the loglinear present-value approach to decompose the unexpected market return, η_t, into a sum of cash-flow and discount-rate shocks:

$$\eta_t = r_{M,t} - E_{t-1}(r_{M,t}) = \eta_{cf,t} - \eta_{dr,t}, \tag{1}$$

where $r_{M,t}$ is the market log return and E_{t-1} is the expectation operator at time $t-1$. The term $\eta_{cf,t} = (E_t - E_{t-1})\sum_{j=0}^{\infty}\rho^j \Delta d_{t+j}$ represents the revision in expectations of future discounted dividend growth rates and ρ is a constant[1] strictly less than 1. This expression is referred to as cash-flow news. Analogously, $\eta_{dr,t} = (E_t - E_{t-1})\sum_{j=0}^{\infty}\rho^j r_{M,t+j}$ represents the revision in expectations of future returns. It is typically referred to as discount-rate news.

We assume that the data are generated by a first-order[2] autoregressive rule of motion for a vector of state variables, z_t:

$$z_t = a + \Gamma z_{t-1} + u_t, \tag{2}$$

with $r_{M,t}$ as the first element of an m-by-1 state vector, z_t, and $r_{M,t} - E_{t-1}(r_{M,t})$ as the first element of an i.i.d. m-by-1 vector of shocks, u_t. In Eq. (2), a and Γ are an m-by-1 vector and m-by-m companion matrix of constant parameters, respectively.

It follows immediately that the discount-rate news can be extracted via

$$\eta_{dr,t} = e1'\lambda u_t, \tag{3}$$

where $\lambda \equiv \rho\Gamma(I - \rho\Gamma)^{-1}$ and $e1$ denotes an m-by-1 vector whose first element is unity and the remaining elements are all zero.

The cash-flow news can be further backed out as a residual

$$\eta_{cf,t} = (e1' + e1'\lambda)u_t. \tag{4}$$

Since market returns contain two components, two betas can be defined for each stock by projecting asset returns on the innovations in market's cash-flow and discount-rate news. Appropriate scaling leads to

$$\beta^i_m = \frac{Cov(r^i_t, \eta_{cf,t})}{Var(\eta_t)} + \frac{Cov(r^i_t, -\eta_{dr,t})}{Var(\eta_t)} = \beta^i_{cf} + \beta^i_{dr}, \tag{5}$$

where β^i_m denotes the traditional market beta of asset i, and β^i_{cf} and β^i_{dr} are its "bad" cash-flow and "good" discount-rate components in the sense of Campbell and Vuolteenaho (2004).

2.2. Downside and upside risks in cash-flow and discount-rate betas

The idea that investors care differently about uncertainty towards unexpected downside versus upside portfolio movements dates back to Roy (1952) and Markowitz (1952). In fact, an economic notion of compensation for high sensitivity to downside market movements has a lot of intuitive appeal. Ang et al. (2006) provide empirical evidence on significant reward for bearing downside risk on equity markets. Along the lines of Botshekan et al. (forthcoming), we measure the upside and downside risks by using conditional variances and covariances. For instance, the downside cash-flow beta

$$\beta^i_{cf^-} \equiv \frac{Cov(r^i_t, \eta_{cf,t} | \eta_t < 0)}{Var(\eta_t | \eta_t < 0)}, \tag{6}$$

is used to measure the sensitivity of asset i to market cash-flow news when unexpected market fluctuations are restricted to be negative. Conditioning on market news being positive or negative is natural, as it has a zero mean by construction. In the empirical analysis, we experiment additionally with other intuitive cut-off points for downside risk: We condition on the market news being below or above its one or two standard deviations. We also use

[1] The interpretation of the discount coefficient ρ should not necessarily be related to the time-series average of the log dividend yield but can be linked, for example, to the average log consumption-wealth ratio.

[2] As discussed by Campbell and Shiller (1988), the assumption that the VAR is first-order is not restrictive, since this formulation allows for higher-order VAR models by stacking lagged values into the state vector.