92 10 27

:

The Downside Risk and Equity Evaluation:

New Proposal for Risk Measures and Emerging Market Evidence

In this paper we employ several risk measures to evaluate the equity returns in emerging markets. The test results show that beta is not the only variable explaining cross section return variation and returns variance is important as well. The focus of this paper is based on a downside approach and, in particular, based on semivariance (semideviation) and downside frequency to measure risk. The evidence suggests that downside risk is a better measure than the total variance (deviation) measure. Furthermore, we find that downside frequency with respect to the mean proposed in this paper produces the best results compared with other downside risk measures such as semivariance or semideviation.

Keywords: downside risk, emerging market, semistandard deviation, CAPM, beta, modern portfolio theory, risk measure.

Conventional wisdom holds that rational investors will attempt to maximize their (expected) returns while minimizing their risk. Traditional financial economists (pioneered by Markowitz) make use of variance as a risk measure for investment portfolios and developed the Capital Asset Pricing Model (CAPM). But in recent years many empirical results have questioned the validity of this risk measure, as the financial markets did not perform as the theory predicted. There is no empirical evidence during the past three decades that supports the capital asset pricing model (Fama and French, 1992). Therefore, financial economists have begun to search for more appropriate risk measure(s).

The downside school of thought argues that variability is not an adequate measure of risk. Humans, they argue, will first secure their position by minimizing their downside risk before attempting to maximize their return of investment. There is no evidence that investor utility functions are irrelevant. Human behaviorists have found evidence that supports the downside risk view of utility. This paper proposes some new forms of downside risk measures.

In this paper the downside deviation is decomposed into downside frequency and downside altitude. The downside risk is also defined as either relative to mean return rate or absolute zero return rate. The paper has tested a total of seven downside risk measures on emerging equity market data. Emerging markets are generally believed as isolated and separated from most developed markets in their histories, so their historic performance provided a good test sample of market performance.

Our test results indicate that market returns do not compensate for the risk measured by variance, rather, they showed a significant risk premium measured by the downside frequency relative to their mean value, both in terms of concurrent return and future return.

The variance (or standard deviation) has widely accepted among practitioners and

academics as a measure of risk in financial markets but the accuracy of using beta to compute a firm's cost of capital or evaluate investment projects is very controversial. Although beta cannot be completely ruled out as a plausible measure of risk in developed markets, Estrada (2000) argues that the use of CAPM to estimate the cost of equity in emerging markets has far more serious problems. The beta and stock returns in emerging markets are largely uncorrelated (Harvey (1995) or the capital market is segmented so the international CAPM is not as applicable. Indeed, the traditional CAPM used in developed countries cannot be employed in developing countries and a misuse of methodology could underestimate or overestimate the cost of equity in developing countries representing 20% of world GDP and 85% of world population.

Thus, Erb, Harvey, Viskanta (1996a, 1996b) develop a simple model to establish a hurdle rate for emerging countries by using *Institutional Investor's* country credit ratings. They find that the country risk ratings contain valuable information about future expected stock returns. Diamote, Liew, and Stevens (1996) confirms that rating changes help explain returns in emerging markets but only marginally help explain them in developed markets. However, their method can only be applied at estimating a countrywide cost of equity but not at the company level and the numerical value of ratings are highly subjective. Bekaert and Harvey (1995) incorporate a time-varying measure of market integration to estimate the cost of equity but his method suffers from the criticism of difficulty in the estimation procedure.

Recognizing the problems of beta, especially the difficulty of applying CAPM in emerging markets, Estrada (2000) suggests that an intuitively-plausible downside risk measure, i.e., midevation or semivariance, perform much better than the tradition deviation to capture expected returns in emerging markets. Moreover, recent studies in behavioral finance describe how investors tend to behave and dispute the assumption of modern portfolio theory that investors are rational. Even Markowitz (1959), the founder of modern portfolio theory, himself doesn't support the idea of mean-variance optimization and states "*semideviation produces efficient portfolios somewhat preferable to those of the standard deviation.*" So investors do not necessarily dislike volatility. What they want to be exposed to is the upside volatility and what they dislike is the downside volatility. Sortino and van der Meer (1991) show that a mean-downside variance optimizer outperforms a mean-variance optimizer. For a complete review of downside risk measure, see Nawrocki (1999).

Further supports are provided by Harvey (2000) who reports that the semideviation with respect to the mean has a strong correlation to mean returns in his sample countries. Estrada (2001a) strengthen the robustness of semideviation as an appropriate risk measure by testing the relationship between downside risk and stock returns on a cross section of industries in emerging markets. Estrada (2001b) also reports results showing that the semideviation explains the cross section of Internet stock returns.

We have no good reason to reject the thought that required return be composed of two parts, namely, a risk-free rate and a risk premium. The first part is the compensation required for the expected loss of purchasing power, which is demanded even for a riskless asset. The second part is an extra compensation for bearing risk. The problem is how many types of risk are evaluated in the market performance and how to measure each of these risk factors. The widely used Markowitz theory indicates that the market risk factor is the only element evaluated in a well-performed asset market and it is measured by the variance of its return rate. Based upon this risk measure, portfolio theory and CAPM was introduced.

Recent empirical results have discredited the CAPM and raised new questions about appropriate risk measures, that is, what are the appropriate risk measures compensated in market return? The

next-step search for the answers could be explored in two directions:

     i). If variance is not an appropriate measure, what is?

     ii). If one risk measure is not enough, how many are and what are they?

The objective of this paper is designed to answer the first questions (We are not rejecting any answer to the second question). Therefore, we propose several downside-risk measures and empirically test them to see if the market returns involve some kind of compensation for the measures.

Many recent literatures try to answer the second question and the results are usually some forms of multi-factor models with new risk measures introduced. There are many works supporting the downside-risk approach. As Markowitz (1959) has discussed, beyond his well-known expected return/variance consideration, he proposes the downside risk where assets returns are not normally distributed and investor behaviors are such that they are concerned with only the downside risk:

$$SV = \frac{1}{N}\sum_{t=1}^{N}(Max[0,(T-R_t)])^2 \qquad (1\text{-}a)$$

or

$$SD = \frac{1}{N}\sum_{t=1}^{N}Max[0,(T-R_t)] \qquad (1\text{-}b)$$

where SV is semi-variance, SD [1] is semi-deviation, N is the number of samples, T is the target return, and R_t is the return in time t. The target returns could be the expected return E(R) or any other values (e.g., zero).

The market risk premium is a kind of investors' reaction in their investment behaviors, and their tolerance of the risk should be reflected in the market risk premium. If the total downside risk measure takes the form of equation (1-a) or (1-b), we can further divide the risk measure into two components, downside frequency (DFR) and downside depth (DPV for depth in variance term and DPD for the depth in deviation term) as the following equations (2-a, 2-b and 2-c)

---

[1] The semi-deviation definition is not the same as the square root of the semi-variance, as is true for the definition of Estrada (2000). Out definition could be interpreted as the true average value on the downside.

show:

$$DFR = \frac{n}{N} \qquad (2\text{-}a)$$

$$DPV = \frac{1}{n}\sum_{t=1}^{N}(Max[0,(T-R_t)])^2 \qquad (2\text{-}b)$$

or

$$DPD = \frac{1}{n}\sum_{t=1}^{N}Max[0,(T-R_t)] \qquad (2\text{-}c)$$

where n is the number of observation when $T\text{-}R_t > 0$, the return rate is less than the target.

With these definitions, we can express the downside risk measures as:

$$SV = DFR \times DPV$$
$$SD = DFR \times DPD$$

The empirical test can answer the following:

1). Is the downside risk is a better measure than the total deviation measure?

2). If the answer is yes to the first question, which component (frequency vs. depth) of the downside measure is more important in explaining the risk premium?

If we believe a risk measure is the only factor evaluated in asset return rate, we can have the following formula:

$$E(R_i) = R_f + (RP)(RM_i) \qquad (3)$$

where E(R) is the expected return, R_f is the risk-free rate, RP is the market risk premium and RM_i is the risk measure of asset i (the risk measure candidates are DFR, DPV, SV, DPD and SD). Recent studies tend to use more than one factor to explain equity market return. If one factor model is not acceptable, a multi-factor model could be used instead, that is:

$$E(R_i) = R_f + \sum_{j=1}^{F}[(RP_j)(RM_{ij})] \qquad (4)$$

for F-factor model.

If we are interested in testing one of the risk factors (RM_k for example), the return rate for asset i could be

$$E(R_i) = R_f + (RP_k)(RM_{ik}) + ROF_i \quad (5)$$

and ROF_i stands for the risk premium on other ($j{\neq}k$) risk factor(s) of asset i.

Recent reported studies [(Erb, Harvey, and Viskanta (1996), Patel (1998), and Estrada (2000)] use cross sectional regression to estimate the coefficient of the measure to see if the risk measure is important in

explaining the variation of the return across different assets such as:

$$R_{it} = \gamma_0 + \gamma_1(RM_{it}) + \varepsilon_{it} \qquad (6)$$

The above regression is based upon the assumption that the coefficient γ_0 and γ_1 are constants. This is equivalently to say that equation (3) is acceptable and the other risk factors in equation (5) are not important (or the same in these equity markets and relatively stable over the sample period).

If the assumption of constant intercept is released, equation (6) should be replaced by the following model:

$$R_{it} = \gamma_{i0} + \gamma_1(RM_{it}) + \varepsilon_{it} \qquad (7)$$

The intercept is unique for each individual market (country) and stable over sample period. The only assumption left is that γ_1 is constant, which is the common market risk premium coefficient. Equation (7) is estimated with panel data in the study. A reasonable further step is to release the assumption of constant risk premium coefficient and the equation becomes

$$R_{it} = \gamma_{i0} + \gamma_{i1}(RM_{it}) + \varepsilon_{it} \qquad (8)$$

The coefficient γ_{i1} is the risk premium for equity index i (country i). Equation (8) is also estimated with panel data.

Different risk measures (including the traditional risk measures and downside risk measures discussed in the paper) are tested with the models (equations 6, 7, and 8). The estimates of γ_1 (or γ_{i1}) with the models described above are used to test the general hypothesis, that is, if the risk factor is important in explaining market return:

Null hypothesis: γ_1 (or γ_{i1}) $= 0$
Alternative hypothesis: γ_1 (or γ_{i1}) > 0

The validity of beta, which the CAPM is based, as an appropriate risk measure for the purposes of project valuation and company valuation has been strongly questioned due to its inadequate and controversial explanatory power. Applying CAPM in emerging markets is more problematic because of its unique characteristics from the developed markets. The international version of CAPM implicitly assumes perfect world market integration, but the existing evidence on emerging market integration is contrary to this assumption. So the search for alternatives to the CAPM continues to elude academics and practitioners.

Following Estrada (2000, 2001a, 2001b), in this paper we employ several risk measures to evaluate the equity returns in emerging markets. The test results show that beta is not a good variable explaining cross section return variation and returns variance is better. The focus of this paper is based on a downside approach and, in particular, based on semivariance (semideviation) and downside frequency to measure risk. The evidence suggests that downside risk is a better measure than the total variance (deviation) measure. Furthermore, we find that downside frequency with respect to the mean proposed in this paper produces the best results compared with other downside risk measures such as semivariance or semideviation and the risk premium estimated accordingly has greater that 50 percent correlation with previously used indices.

Bekaert, Geert and Campbell Harvey (1995), "Time-Varying World Market Integration", Journal of Finance, 50, pp. 403-444.

Bekaert, Geert, Claude B. Erb, Campbell R. Harvey and Tadas E. Viskanta (1997), "What Matters for Emerging Equity Market Investments", Emerging Markets Quarterly, Summer, pp. 17-46.

Claessens, Stijn, Susmita Dasgupta and Jack Glen (1998), "The Cross-Section of Stock Returns: Evidence from the Emerging Markets", Emerging Markets Quarterly, Winter, pp4-13.

Chui, Andy C. W. and K.C. John Wei (1998), "Book-to-market firm size, and the turn-of-the-year effect: Evidence from Pacific-Basin emerging markets", Pacific-Basin Finance Journal, 6, pp. 275-293.

Diamonte Robin L., John M. Liew, and Ross L. Stevens (1996), "Political Risk in Emerging and Developed Markets", Financial Analysts Journal: May/June, pp.71-76.

Erb, Claude B., Campbell R. Harvey, and Tadas E. Viskanta (1996a), "Expected Returns and Volatility in 135 Countries", The Journal of Portfolio Management, Spring, pp. 46-58.

Erb, Claude B., Campbell R. Harvey, and Tadas E. Viskanta (1996b), "Political Risk, Economic Risk, and Financial Risk", Financial Analysts Journal, November/December, pp. 29-46.

Estrada, Javier (2000), "The Cost of Equity in Emerging Markets: A Downside Risk Approach", Emerging Markets Quarterly, Fall, pp. 19-30.

Estrada, Javier (2001a), "The Cost of Equity in Emerging Markets: A Downside Risk Approach (II)", IESE Business School (Barcelona, Spain) Working Paper.

Estrada, Javier (2001b), "The Cost of Equity of Internet Stocks: A Downside Risk Approach", IESE Business School (Barcelona, Spain) Working Paper.

Fama, Eugene F. and Kenneth R. French (1992) "The Cross-section of Expected Stock Returns," Journal of Finance, 47, no. 2, pp.427-465.

Harvey, Campbell (1995), "Predictable Risk and Returns in Emerging Markets", Review of Financial Studies, Fall, pp. 773-816.

Harvey, Campbell (2000), "Drivers of Expected Returns in International Markets", Emerging Markets Quarterly, Fall, pp. 32-48.

Markowitz, Harry (1959), "Portfolio Selection", Yale University Press, New Haven and London.

Nawrocki, David (1999), "A Brief History of Downside Risk Measures", Journal of Investing, Fall, pp. 9-25.

Patel, Sandeep A., "Cross-Sectional Variation in Emerging Markets Equity Returns January 1988-March 1997", Emerging Markets Quarterly, Spring, pp.57-70.

Serra, Ana Paula (2000), Country and industry factors in returns: evidence from emerging markets' stocks, Emerging Markets Review 1, pp 127-151.

Sortino and van der Meer (1991), "Downside Risk." The Journal of Portfolio Management, Summer, pp. 27-31