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The tail risk of emerging stock markets

Xiao-Ming Li^{a,*}, Lawrence C. Rose^b

^a Department of Economics and Finance (Albany), Massey University, New Zealand

^b College of Business, Massey University, New Zealand

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ABSTRACT

We investigate tail risk in emerging stock markets at the country, regional and world levels, by comparing the investable and non-investable segments in terms of the expected shortfall of standardized returns and tail dependence on the world market. Employing the skewed Student-*t* GJR-GARCH model and the SJC copula, we show that most investable portfolios have lower tail risk but higher tail dependence than non-investable ones; emerging markets are likely more dependent on the world market during large joint losses than large joint gains; and tail dependence of the aggregate and investable markets on the world market varies across countries and regions.

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1. Introduction

Tail risk is the additional risk which fat-tailed return distributions, widely reported in the literature, have in relation to normal distributions. The foremost motivation of our study on the tail risk of emerging stock markets stems from the consequences of ignoring tail risk and the inability of volatility to capture tail risk.

To illustrate, consider the Peruvian stock market from our sample. The (conditional) standard deviation and (conditional) mean of the Peruvian stock market returns for August 16, 2007 are estimated as 1.618% and -1.081% respectively. Use of the normal distribution indicates a stock market typically will not fluctuate beyond three standard deviations, as 99.73% of the probability lies within three standard deviations. So, on August 16, 2007 there was only a 0.135% chance the Peruvian stock market would fall by more than 5.935%. Yet, the market fell by 8.457%. Further, it fell by more than three (conditional)

* Corresponding author. Department of Economics and Finance (Albany), Massey University, Private Bag 102 904, North Shore Mail Service Centre, Auckland 1311, New Zealand. Tel.: +64 9 414 0800x9471; fax: +64 9 441 8177.

E-mail address: x.n.li@massey.ac.nz (X.-M. Li).

standard deviations for 22 out of 3211 days (0.69%), which is 5.11 times the probability implied by the normal distribution (0.135%). In other words, the chance for a mutual fund holding the Peruvian stock index to suffer a given loss would be 5.11 times as great as a normal distribution estimate of volatility predicts. The consequence of using volatility to predict extreme market movements could be the misforecast of the October 1987 stock market crash as well as other financial events like the demise of Long Term Capital Management. This explains why the [BIS Committee on the Global Financial System \(2000\)](#) points out variance disregards the risk of extreme loss, and why “financial firms and regulators are in fact very concerned with the possibility that their risk models do not adequately account for fat tails” ([Berkowitz, 2001](#)). Thus, as an attempt to fill the gap in the literature, we probe into the neglected issue of tail risk for emerging stock markets.

In the literature on emerging capital markets, studies have so far investigated the effects of market integration, increased foreign investment activity and liberalization on three variables: volatility, correlations and the world beta. With respect to volatility, earlier studies, such as [Holmes and Wong \(2001\)](#), [Froot et al. \(2001\)](#), [Bekaert and Harvey \(2000\)](#), [Choe et al. \(1999\)](#) and [Levine and Zervos \(1998\)](#), provide mixed evidence that emerging stock markets have a higher or lower or unchanged return volatility after they become more integrated with the world market. More recently, [Bae et al. \(2004\)](#) find that in emerging economies, investable stocks have a higher volatility than non-investable stocks, and [Cunado et al. \(2006\)](#) document that financial liberalization has generally reduced the levels of six emerging market volatilities and their sensitivities to news. Concerning correlations, [Bailey and Lim \(1992\)](#) and [Bekaert and Urias \(1996\)](#) pioneer the research and suggest correlations may increase after emerging markets open up and become more integrated with the world market. This finding is confirmed in [Bekaert and Harvey \(2000\)](#) who also report an increase in beta with the world market. In a recent paper, [De Jong and De Roon \(2005\)](#) model the world beta of emerging stock markets as a function of market segmentation. They show the segmentation variable has a significant, negative effect on the world beta of investable stocks from emerging markets of all but the Mideast/Africa region; and an increase in beta due to a decrease in segmentation in turn implies higher expected returns.

The above brief review of some selected studies and the importance of tail risk as illustrated by the example of the Peruvian market suggest several further questions worth exploring for emerging economies. Our main focus is the following two: Do the more integrated stock markets have (i) higher or lower tail risk (analogous to volatility) and (ii) higher or lower tail dependence on the world market (analogous to correlations or world beta) than the more segmented markets? As noticed in [Bae et al. \(2004\)](#) and [De Jong and De Roon \(2005\)](#), a typical characteristic of emerging stock markets is that some stocks are eligible for purchase by foreigners (i.e., investable) while others are not (i.e., non-investable). Like the two studies, we treat the investable submarket as integrated, and the non-investable submarket as segmented. This existent division provides an ideal laboratory for examining the two questions posed above. Many previous studies have compared emerging stock market volatilities before and after liberalization, controlling for other variables than liberalization. We compare tail risks between *concurrent*, opened and unopened segments of an emerging stock market during its liberalization process. This way, we too are able to attribute the difference in tail risk, if any, to the difference in market integration.

We believe Question (i) is largely an empirical one, just as whether market opening would lead to increased, decreased or unchanged volatility. Investable markets can, while non-investable markets cannot, access foreign investors. The increasing presence of foreign investors should induce a greater flow of information shocks to the former than the latter; and the 1997 Asian crisis witnessed that shocks were transmitted through investable rather than non-investable stocks ([Boyer et al., 2006](#)). These would suggest higher tail risk of investable relative to non-investable markets. On the other hand, however, some researchers believe that increased foreign participation can improve liquidity, and reduce sensitivity of prices to large, temporary surges in the volume of buy and sell orders ([Hargis and Ramanlal, 1998](#)). Foreign investors are mostly institutional investors from already developed markets, and base their decisions and investment strategies more on rational investment analyses and fundamental valuation factors ([Jayasuriya, 2005](#)). These considerations would lead one to expect lower tail risk of investable than non-investable markets. In addition, [Jayasuriya \(2005\)](#) argues that a fully integrated market is influenced by world factors rather than local factors such as political risk and unstable macroeconomic policies that are prevalent in countries with poorly developed stock markets. A logical inference from this argument is that investable markets, being integrated, should again possess less tail risk than non-investable markets which are

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