# Downside Risk in Emerging Markets

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**Abstract**

There is growing evidence that the CAPM may not provide an appropriate model for estimating returns on equity, in the emerging share markets. Inefficiencies in these markets will impact on investor ability to fully diversify their investments, thereby invalidating assumptions regarding return distributions. Against this background is a separate recognition that investors place different weightings on downside losses, compared to upside gains. Using individual equities in a range of developing markets, this paper offers an investigation on the potential contribution of downside or negative beta in these markets. Considering related evidence regarding emerging markets, we also allow for the potential contribution of idiosyncratic risk measures. Empirical evidence indicates that negative beta offers some improved explanatory power, however its contribution is less than that reported for larger developed markets. This empirical investigation is based on Asian emerging markets; however we believe that similar patterns are likely in other regional markets.

## 1. Introduction

The purpose of this paper is to explore whether downside beta may provide a more appropriate explanation of the risk / reward relationship in less developed markets. For many years, there has been a widespread assumption that, in many capital markets, beta is the most appropriate measure of risk. Much of the examination on this issue has been empirical, and has focused on the ability of beta to explain the cross-section of company returns. Implicit in this approach is the assumption that investors seek to maximise a utility function that depends on the mean and variance of returns in their investment portfolio. The variance of returns may however not always be an appropriate measure of risk. It is dependent on the assumption that the distribution of returns is symmetric. Further, it should only be applied when this underlying distribution is normal. Research evidence to date does however offer significant indications that either or both of these assumptions are always realistic.

It is highly likely that most investors are more sensitive to downside losses, relative to upside gains. They will require an extra premium for holding assets that vary strongly with the market, when the market declines. They will not equally value assets that behave in a similar manner when markets increase in value. This point is well established, for example Markowitz (1959) proposes that semi-variance be used as the measure of risk, rather than variance. Semi-variance measures downside losses rather than upside gains. Further, semi-variance is more useful than variance when the underlying distribution of returns is asymmetric, but it remains useful in periods when the distribution is symmetric. In a behavioural framework, Kahneman and Tversky's (1979) loss aversion preferences imply that investors who dislike downside losses will demand greater compensation, in the form of higher expected returns, for holding shares with high downside risk. Markowitz (1991) also further develops this approach.

In order to define a measure of downside risk, a decision must be made regarding the level of benchmark return. Returns below this level will be of interest. Two major suggestions appear in the literature, the risk-free rate of return and mean excess market return. Bawa and Lindenberg (1989) propose a down-side risk framework that should explain company returns at least as well as the Capital Asset Pricing Model. The risk-free rate is the benchmark return. Harlow and Rao (1989) develop this framework for any benchmark return. Their empirical tests reject the CAPM, but interestingly do not reject a down-side risk framework. They also propose that the mean of the distribution of returns is a more appropriate benchmark than the risk-free rate.

In this paper, we explore the issue of downside risk in developing markets. These markets require separate examination, as there is considerable evidence that their asset returns are not normally distributed. For example, Bekaert, Erb, Harvey, and Viskanta (1998) report that emerging market equity index return distributions are highly non-normal, in comparison with market returns in developed markets. In particular, they identify significant skewness and kurtosis in emerging market returns, and they observe the persistence of skewness over time. They suggest that investors will have a preference for positively skewed investments, and will wish to avoid negatively skewed distributions. It is reasonable therefore to expect that the downside losses could play a role in explaining the cross section of returns in these markets. Given this evidence, we expect that models which include measures of downside risk may be relevant for developing markets, because of the distortions that are likely to exist in these markets. When asset returns are asymmetric, investors would factor in a measure of skewness of the distribution of returns when assessing risk return tradeoffs.

For beta and the Capital Asset Pricing Model to offer an adequate explanation of returns, a key assumption is that investors will hold a market portfolio of risky assets. Based on this assumption, the CAPM proposes that the market will only compensate investors for bearing market risk. This may be less likely in underdeveloped markets, where a small number of shares dominate the market. Investors may only be prepared to include this small number of shares in their portfolios, as they will have concerns regarding the marketability of most other shares quoted on these markets. This could result in a reduction in overall levels of diversification. Further, closely held companies are more likely to be a feature of less developed markets, and there again may be concerns regarding their marketability. If concerns regarding marketability are a feature of a market, there will be a tendency for investment portfolios to be concentrated in a limited number of liquid assets, giving rise to the presence of unsystematic risk[1]. In this situation where a full diversification is not possible, investors may have relatively greater concerns about downside risk, and risk / return relationships in these markets may reflect this.

Also, if a market includes significant numbers of shares that attract little institutional interest, it is reasonable to assume that individual shareholders will dominate the overall total shareholding of these companies. These shareholders are more likely to have undiversified portfolios, and may also have non-symmetric concerns regarding risk exposure. For example, Xu and Malkiel (2003) decompose total volatility of individual shares into its systematic and idiosyncratic components. They propose that if there are factors causing investors not to hold fully diversified portfolios, these investors will be concerned about specific risk. They also show (Malkiel and Xu, 2006) that this type of measure of risk can be useful in explaining individual company returns. It is appropriate therefore to address the question as to whether the inclusion of other explanatory factors, including downside risk measures, may provide a better description of returns. If excess sensitivity to downside losses is present in a market, an interesting investigation is whether investors are actually rewarded for any exposure to this risk.

Further, in developed markets, derivatives are widely used for hedging systematic risk, or for the management of capital budgeting risk. They may however also be less frequently used by portfolio managers as a hedging instruments, to reduce excess exposure to downside risk. For this to be successful, it is clearly necessary that there be an active market in options and futures. If an active derivative market is not available, portfolio managers may not be able to manage this exposure. Clearly, it is difficult either to construct or to price appropriate derivatives, in the absence of an active market. Risk levels associated with all shares, including those that are actively traded and attract investor interest, may therefore be greater than the levels indicated only by a measure of systematic risk.

[1] Following a survey of the main characteristics of emerging markets, Feldman and Kumar (1995) note the lack of liquidity of all but a small proportion of actively traded stocks, in a large number of these markets.

We therefore present a series of empirical examinations of whether downside risk is independently priced in emerging markets. In an earlier investigation, Estrada (2002) uses emerging market indices to provide evidence on the predictive power of downside beta at an aggregate level. He reports better results than for beta. As pricing at individual company level will be of greater concern, this issue is examined at the level of individual markets, and the shares quoted on these markets. In effect, we examine the proposal that, at the level of individual capital markets, company returns will be related to measures of downside risk. For this investigation, we employ daily data from five developing Asian markets, and we test for relationships with average annual returns generated by individual companies on these markets. This investigation is limited to the larger companies traded on these markets, as we expect that trading in the smaller stocks will be so inefficient that it may not be possible to identify any reliable relationship between company returns and the normal measures of risk. Test results indicate strong evidence that negative beta is priced in these markets. It also captures aspects of the distribution of returns that are not related either to other measures of beta related risk or to measures of idiosyncratic risk.

The rest of the paper proceeds as follows: Section 2 presents outline data from the Asian equity markets under investigation. Section 3 provides a discussion on the methodology that is employed. Section 4 presents initial test results, based on simple linear regressions. Section 5 contains portfolio based examinations of the importance of various beta related measures, as explanatory indicators of company returns. Individual twelve month period are considered, as is the full study period. Section 6 details control test on the explanatory power of negative beta, and negative co-skewness. Control tests are desirable, considering the strong similarities between the aspects of risk captured by these two measures. Section 7 provides the results of Fama-MacBeth regression tests on whether negative beta remains significantly related to company returns, in the presence of a combination of measures of idiosyncratic risk. This test is important, as there is evidence that idiosyncratic risk is priced in emerging markets. Section 8 concludes.

## 2. Data and Markets.

Data from five developing equity markets in the Asia Pacific region is included in this study. They are the Indian Stock Exchange, Sri Lanka Stock Exchange, the Malaysian

Stock Exchange, the Thailand Stock Exchange, and the South Korean Stock Exchange. Daily prices for the largest 100 firms on each market are gathered over the period from June 1st 2003 to May 31st 2006, and dividend adjusted daily returns are calculated. Market capitalization is taken as the measure of company value, and annual values also are gathered for all firms. The daily inter-bank rate provides a measure of short-term interest rates in Thailand, and the Thailand DS Market Index is used to estimate daily market returns. For India, the overnight call rate provides short-term interest rates, and the Indian DS Market Index represents daily market returns. For Korea, the daily overnight rate provides a measure of short-term interest rates, and the Korean DS Market Index provides a measure of daily market returns. In the case of the Kuala Lumpur Stock Exchange, daily measures of short-term interest rates come from the daily inter-bank rate, and the Malaysian DS Market Index is used to estimate daily market returns. For Colombo, the Sri Lanka DS Market Index provides a measure of daily market returns, and daily inter-bank rate again provides the estimate of short-term interest rates. All market indices are DS indices, prepared by Data-stream. This index has been selected in all cases, as an index estimate of dividend adjusted market returns is available. This is designated as a 'return index'[2]. All DS indices are value weighted, and they cover a minimum of seventy-five percent of total market value. Company value and availability of data determines inclusion in an index, and the largest value companies in each market are selected. All data described above comes from Thompson Data-stream.

Table 1 presents outline summary information on these markets. Values are from June 1st 2003, the earliest date from which data has been gathered. Market capitalization of all listed companies provides the measure of total market value. Total market values in each exchange, and also average and median company market values, are detailed in the local currency and in US $s, using currency exchange rates at the same date.

-Table 1 approximately here-

[2] Details on the construction of DS (Data-stream) Indices are available in 'The Data-stream Global Equity Indices User Guide, Thompson Financial Limited 2003. The return index represents the theoretical growth in value of a notional stock holding, the price of which is that of the selected price index. This holding is deemed to return a daily dividend, which is used to purchase new units of the stock at the current price. The gross dividend is used. Full details on the construction of DS return indices are available in the user guide (page 20).

Using either total market value or market value of the average quoted company as a measure; the Sri Lanka stock market clearly is smaller than all other markets in this study. Median company values also are considerably smaller. Of the other markets, South Korea clearly is the largest. Total number of companies and their combined market value is in excess of eighty percent larger than the measures in either Malaysia or Thailand. Median company market value for the Korean market however is lower than the corresponding values for Malaysia and Thailand. This indicates the existence of a large number of companies with relatively smaller market values. The Indian market also is relatively large; however a low median market value again indicates the existence of a large number of relatively small companies. It is clear that, in all five markets, the largest 100 firms represent a highly significant proportion of total market value. With the exception of Sri Lanka, proportions are surprisingly similar. The largest 100 firms in Sri Lanka represent a represent a relatively larger proportion of total market value because they also represent a considerably higher proportion of the total number of shares quoted in this market.

Because beta values and other risk measures will vary depending on the time horizon over which they are estimated, and also because true company risk exposures will alter over time, the approach of Kothari, Shanken and Sloan (1995) is adapted. All risk measures are estimated over a twelve month horizon, using daily observations. They are compared with company returns experienced over exactly the same period. Very long time intervals may cause beta estimates to be noisy, so a twelve month horizon is preferred. Also, risk exposures may vary, if a longer period is chosen. Fama and French (2005) also advocate estimating betas with a one year horizon. This period represents a reasonable compromise, as a relatively long time horizon must be employed to ensure that both periods of down-markets and periods of up-markets will be included.

Because of the large number of small thinly traded shares in developing markets, the study population is restricted to the largest 100 firms in each market. This restriction should reduce the influence of very small companies, and should therefore curtail the impact of excessive non-synchronous trading on the estimated risk measures. As indicated in Table 1, in all markets, the largest 100 firms represent a very sizable proportion of total market value. They will also be those firms that are of most interest to the vast majority of investors.

In order to identify the largest 100 firms in each market, all firms are ranked by total market capitalization, and the top 100 are selected. Recorded values at the start of the study period, June 1st 2003, are used. The use of market values at the start of the study period as the selection method may cause bias, as the selected firms may not remain the top 100 in each market. Each group will include firms that perform well, and perform badly, over the study period. Some firms may do poorly and fall out of this group. Other firms may perform strongly, and thus should be included. Some firms may de-list. Newly listed firms may also gain a significant presence on these markets, during the three year period. As a robustness check, we therefore also select the largest 100 firms in each market, using recorded market values on the last study date, May 31st 2006. All tests described in the latter parts of this paper were replicated using these second selections of the largest 100 firms. Estimated input values and test results are largely unaffected[3].

## 3. Methodology

The cross-sectional relationship between downside risk measures and return is under investigation. Assuming a symmetrical return distribution, the CAPM implies that shares with high beta values in a particular period will experience high average returns over the same period. Assuming that a skewed return is more likely, any model that includes measures of downside risk may be more appropriate, as it will implies a pattern between average company returns and sensitivity to this type of risk measure, over the same period.

All risk measures employed in this study are initially estimated over the same one year period as average daily company returns. Risk measures are therefore estimated over a twelve month horizon, using daily observations. Individual estimates are prepared for the largest 100 companies in each of these five markets. Estimates are prepared on an annual basis, for 2003/2004, 2004/2005, and 2005/2006, using individual daily market returns for each company.

[3] These results are available from the authors.

Downside or negative betas ($\beta^-$) are computed over periods where excess market return is below its mean. As a further test, upside or positive betas ($\beta^+$) also are computed over periods where excess return is above its mean. In initial tests, we look for evidence of a downside risk premium. We therefore directly test if individual shares with higher downside risk also offer higher returns. We also compute relative negative or downside and relative positive or upside betas. These extra measures are included, as by construction, beta downside beta, and upside beta, are not independent of each other. These measures should differentiate the effect of downside risk from upside risk, and vice versa. Using the concept of downside risk introduced by Bawa and Lindenberg (1979), each measure is computed as follows:

Downside beta: a measure of the covariance of a stock's returns with the market when the market is declining:

$$\beta^- = \frac{Cov(r_i, r_m \mid r_m < \mu_m)}{Var(r_m \mid r_m < \mu_m)} \tag{1}$$

Relative downside Beta: $$Rel(\beta^-) = \beta^- - \beta \tag{2}$$

Upside Beta: a measure of the covariance of a stock's returns with the market when the market is rising.

$$\beta^+ = \frac{Cov(r_i, r_m \mid r_m > \mu_m)}{Var(r_m \mid r_m > \mu_m)} \tag{3}$$

Relative Upside Beta $$Rel(\beta^+) = \beta^+ - \beta \tag{4}$$

In all cases, $\mu_m$ is defined as the average market excess return. Beta ($\beta$) is computed in the conventional way.

Risk estimates are evaluated over each individual year. The individual national markets are not separately considered, because our analysis is limited to the largest 100 firms in each market. As this total number is relatively small, we combine all markets, to provide a study population of 500 firms in each year of the study period. Further, as all markets under consideration are generally considered to be emerging markets, we assume that they will share similar attributes, and that the influences on return distributions and there relationships with risk will be similar. In effect, we view these five markets as being part of particular category of market, and we assume that they are representative of this category. However, we recognize that individual companies are traded on a particular market, in the sense that when all beta and beta related measures are estimated, daily company returns are compared with daily returns on a market index representing the market on which that company is listed.

In a further series of tests, a portfolio based approach is adapted to further investigate the strength of relationship between betas, negative betas, positive betas, and company returns. Since coskewness may capture some aspects of downside risk, separate investigations control for a potential relationship, and offer an investigation of the continuing importance of negative beta. In a final series of investigations, we offer a series of tests of whether, when in combination, individual risk measures continue to offer a significant explanation of company returns. A series of Fama-McBeth regressions test the explanatory power of Beta related measures of risk, when in combination with a number of idiosyncratic risk measures.

**4. Initial Results**

Initial results provide an indication of the significance of individual measures of risk. Simple linear regressions are performed to evaluate the explanatory power of each individual risk measure, as they are regressed on company returns. Regression coefficients are presented in Table 2; Panel A. We separately present results for each twelve month period. Separate results are not reported for each individual market, as the number of observations would be limited to 100. Every estimate of beta or of a derivative of beta comes from the regression of individual company returns on contemporary measure of market returns as represented by the appropriate national market index.

- Table 2 approximately here-

Estimated coefficients confirm that beta offers an important explanation of company returns, as they are significant in most cases. This is particularly true for overall beta, and for negative beta. Surprisingly, relative negative beta only is related to company returns in 04/05, this is an interesting exception. A lack of significance of beta and its related measures may be because many firms in the study population experience negative returns during this period. Average market returns, representing an average of annual returns experienced by the 100 firms in each market during this period, is negative in three of the five markets under investigation. It is probable therefore that a large proportion of stocks in this study experience negative annual returns in 04/05, and that beta measures therefore do not offer a good explanation of them.

We separately present tests on the explanatory power of Dimson (1979) Betas. Relevant regression coefficients are in Table 2; Panel B. Although only the largest 100 firms in each market are under consideration, it is likely that many of them will not have been traded during every session. In emerging markets, even relatively large companies suffer from a lack of liquidity (note: Feldman and Kumar, 1995). As a result, many beta estimates may be subject to estimation error, as a result of non-synchronous trading. A thin trading correction therefore is applied, to minimize the impact of any related estimation error. In Panel B we present regression coefficients, when corrected betas and related betas are individually regressed on annual company returns, in each twelve month period. Results are similar to those in Panel A, and they tend to confirm the continued importance of beta and of negative beta.

## 5. Portfolio Based Tests

In this section, the results of tests on equally weighted portfolios are presented. This approach is adapted because estimation error in beta and beta related measures of risk may invalidate any test of their ability to explain the level of company returns. This is a common approach, frequently used when a relationship between factor sensitivities and company returns is evaluated.

At the beginning of any time period t, stocks are ranked depending on estimated beta for that twelve month period (from t to t + 12 months). All 500 firms are included, representing the top 100 in each of five markets. They are then sorted into five quintiles. The first will contain shares with the largest beta value, and they descend to the final quintile portfolio containing shares with the smallest beta values. Within each portfolio we report equally weighted measures, of average excess return over the twelve month period, of average beta values, of average positive beta values, and of average negative betas values. We also present two measures of idiosyncratic risk, variance of returns and co-skewness of returns. They also are estimated over same the twelve month period. In each portfolio, average equally weighted values of these measures are again reported. Table 3 presents results for each portfolio, for 2003-2004. In Panel A, results are for quintile portfolios, ranked by relative beta values. As expected, average portfolio betas decline as we move from portfolio 1 to portfolio 5. A monotonic relationship between average returns and average beta values can be identified. This indicates that beta has explanatory value for company returns in these markets. Average daily return in the highest beta portfolio is 0.093%, whereas shares in the lowest beta portfolio only offer 0.034%. Both values are return per day. This is consistent with studies on the major developed markets; however it is not necessarily an indication that no other measure will also offer an explanation of company returns.

Average negative beta values and average positive beta values also decline, indicating relatively close relationships between the various beta measures. This is expected, considering how these measures are constructed. The range in average values of both negative beta and positive beta also is similar to the range in values of average beta, across the various portfolios. Average measures of idiosyncratic risk also are strongly related. Negative co-skewness is unattractive to investors, and is rewarded with a greater level of company returns. A monotonic relationship again exists. Similarly, shares in portfolio 1 offer higher returns, and average returns in the other portfolios decline as expected. Only portfolio 5 provides an exception, as it offers unexpectedly high average returns.

- Table 3 approximately here-

In Panels B and C, the quintile portfolios are constructed using ranked values of negative beta and of positive beta. Negative beta also offers a good explanation of company returns, as average portfolio returns decline in portfolios exhibiting lower exposure to negative beta. Average values of beta and positive beta again are strongly related, as is the level of negative co-skewness. Variance however is less strongly related, as portfolio 3 exhibits the lowest average value of this measure. A reasonable conclusion from this observation is that variance and negative beta appear to capture different aspects of risk. An examination of quintile portfolios in Panel C indicates that positive beta is less successful in explaining company returns. Average returns for the top three portfolios are relatively similar, suggesting relatively little reward for an excessive exposure to this measure. As expected, the return distribution on the upside is less valued than that on the downside, even in developing markets. Average values of beta and negative beta also do decline, if lower ranked portfolios are considered, however the spread in values is considerably lower. This also indicates that beta and negative beta may capture different aspects of the return distribution. A similarity between beta and negative beta may be due to exposures associated with downside returns. Of the two measures of idiosyncratic risk, co-skewness continues to be the best discriminator.

Panels D and E provide ranked portfolios of shares, with rankings dependent on relative negative beta and relative positive beta values respectively. Relative negative beta provides in indication of the incremental impact of negative beta, over and above that offered by beta. As expected, average beta values are similar in all portfolios, so that only the incremental impact of negative beta continues to differentiate. Only average negative beta values and relative negative beta values decline. Relative negative beta provides only a moderately good explanatory measure for returns in these markets, as the spread between the lowest and highest ranked portfolio is smaller. An implication is that whereas negative beta offers extra discriminatory power, this extra contribution is reasonably low. Average values of co-skewness are similar across all portfolios. Surprisingly, the portfolio with lowest levels of relative negative beta has unusually high average levels of variance, compared to all other portfolios. Panel E presents average statistics for all portfolios ranked by relative positive beta. Results indicate that it offers a relatively poor explanatory measure of portfolio average returns. This measure is related to positive betas, as average values of this measure do drop as lower ranked portfolios are considered. There also is a reasonable spread between average positive betas for the highest and lowest ranked portfolios. However, all other risk measures are relatively similar across all portfolios, suggesting little relationship between them and relative positive beta.

A similar set of ranked portfolios are constructed for 04/05, and for 05/06. Methods of construction are similar to those employed for 03/04. Relevant results for these years are presented in Tables 4 and 5. Results for these years are of interest, as the simple regression tests identify less strongly significant relationships between exposure to beta, and company returns. Exposure patterns for all beta related measures of risk were similar. Because of the methodology employed, test results reported in these tables are less likely to be subject to estimation error. Table 4 reports results for 04/05. An examination of Panel A indicates that the spread between high beta and low beta portfolios is considerably smaller. Also, a number of the mid ranked portfolios offer a superior return to the highest beta portfolio. A sorting based on negative beta is more successful (note Panel B), as the spread is considerably greater. However, realized return for portfolio 2 is surprisingly low, so that even a ranking based on negative beta is not fully successful. It should again however be noted that this period is characterized by a relatively high incidence of negative returns recorded by individual companies. It is of interest to note that an exposure to positive beta or to relative positive beta is a good indicator of portfolio returns in this year.

- Tables 4 and 5 approximately here-

Results for 05/06 also are not as strong as 03/04, however they are somewhat stronger than 04/05. The pattern therefore is similar to that demonstrated by the previous simple regression tests. The spread of returns between portfolios ranked by beta again is small, because the highest ranked portfolio offers a relatively low return. In Panel B, the ranking by negative beta is more successful, as a monotonic relationship between portfolio returns and ranking can be identified. An examination of Panels C, D, and E again demonstrates that positive beta, relative positive beta, and relative negative beta measures tend not to be strong predictors of portfolio returns.

As a further control, we also construct portfolios of shares using data over the full three year study period. Results are presented in Table 6. In this case all annual measures of return and of risk exposures are combined, so that there are 1500 available observations. This analysis is of interest, as it spans a time period that includes periods of both consistent positive performance, and of consistent underperformance. The latter includes negative annual returns by sizable numbers of companies. As such, this longer period is more representative of the range of long-run patterns in the equity markets. An initial examination of Panel A demonstrates that exposure to beta is a reasonably good explanatory measure of portfolio returns. Low exposure portfolios generate considerably lower returns. However, if the higher ranked portfolios are considered, the reward for accepting greater exposure to beta is limited, as average returns for the top three ranking portfolios are very similar. In comparison, a ranking by negative beta is more successful. An examination of Panel B indicates a larger spread between the portfolio of shares with lowest negative beta, and the portfolio with highest values. Also, a monotonic relationship remains across all five rankings. Results over the full study period indicate that negative beta is a stronger indicator of returns than overall beta. This confirms the proposal of a skewed pattern of company returns, and a greater reward for exposure to down-side risk.

It is also of interest to note that the spread in average values of negative beta is greater than that for conventional beta. This pattern is replicated in each individual study year, as well as over the full study period. This indicates that, by concentrating on periods of relative market downturn, there is a greater differentiation across the quintile portfolios. An implication is that, in these markets, negative beta offers explanatory power over and above that already provided by traditional beta. Relative negative beta focuses on this incremental impact of negative beta, over conventional beta. In Panel D, the spread in average quintile portfolio returns confirms the presence of this incremental effect. However, it is lower than might be expected. This is largely due to unexpectedly low average returns experienced by the highest ranked portfolio. This suggests that, whereas negative beta does have incremental explanatory power in the developing markets, it may be of less importance than in the larger developed markets. This finding is in conformity with Pedersen and Hwang (2007). In a study on U.K. listed shares, they find that negative beta is more strongly related to a cross-section of returns of mid sized companies, rather than smaller companies. Although this study is limited to the largest 100 firms in each market, this group continues to include very large numbers of small firms, so that they may typically be described as a population of small firms. Also, as discussed earlier, the features of developing markets are such that whereas beta and its related measures do have explanatory power for company returns, idiosyncratic measures of risk may continue to be unusually important. The findings in relation to negative beta would appear to confirm this, as although it does contribute to an explanation for company returns, this contribution is limited.

- Table 6 approximately here-

An examination of Panel B in Tables 3, 4, 5, and 6 indicates a surprisingly strong relationship between average values of negative beta, and of negative co-skewness, in the ranked portfolios. In all cases, a monotonic relationship between average values of both risk measures is maintained across all portfolios. This strong relationship probably is because both measures capture similar effects in company return distributions. They are very similar in the sense that they both offer a measure of exposure to downside risk.

**6. Negative Co-skewness and Negative Beta, Control Tests.**

We note the close nature of these measures, and the strong relationships between average measures of the exposure to each in the ranked portfolios. Control tests therefore investigate whether negative beta may merely capture the explanatory power of co-skewness, and vice versa. When conducting these tests, we use data from the full study period, to ensure a reasonably sizable population of observations.

Initially, the magnitude of the reward for exposure to negative beta is evaluated, after explicitly controlling for the effect of co-skewness. Using the full dataset of 1500 observations, we initially form quintile portfolios sorted on co-skewness. Within each co-skewness quintile, shares are then sorted into five equally weighted portfolios, based on levels of negative beta. As previously, all values of co-skewness and negative beta are computed over the same period. Average returns are reported for every negative beta quintile, within each co-skewness portfolio. After controlling for differences in co-skewness, any differences in portfolio return within an individual quintile should be due to differences in exposure to negative beta. Average returns for all 5X5 groupings of portfolios are presented in Table 7, Section A.

- Table 7 approximately here-

Portfolios in the first co-skewness quintile experience the highest levels of co-skewness, whereas the lowest levels are experienced by shares allocated to portfolios in the fifth quintile. Within each quintile, shares in portfolio 1 record the greatest levels of negative beta, whereas those allocated to portfolio 5 have minimum exposure. In the highest co-skewness group, there is very little differentiation between portfolios with significant exposures to negative beta, and those without. This pattern is expected. As suggested by Ang, Chen, and Xing (2006), shares with negative co-skewness tend to have low returns when market volatility is high. High volatility will normally be associated with periods of low market returns, and shares with large negative co-skewness tend to decrease with market falls, but they may also decrease with market rises. In contrast, negative beta specifically only concentrates on market falls. When co-skewness is very high, there is little spread in negative beta, as most volatility already is already represented by it. These shares exhibit little asymmetry, so there is little change in behaviour of returns during market down-turns. With the exception of this highest co-skewness group, negative beta remains an important explanatory variable for company returns. The difference in average returns between shares with a high exposure to negative beta and shares with a low exposure is considerable, although it does decline if one considers those quintiles with lower levels of co-skewness. Nevertheless, results in this section do demonstrate that with the exception of those firms allocated to the quintile with very high levels of co-skewness, negative beta continues to have relatively strong explanatory relationships with company returns.

In Panel B this exercise is repeated, however the initial control is now for negative beta. It therefore offers an examination of the premium for taking on co-skewness, after controlling for negative beta. Shares are initially allocated to each quintile. Within each quintile, levels of negative beta are reasonably similar. In this case, the spread of returns between portfolios with high and low levels of co-skewness remains relatively stable, regardless of levels of negative beta. The highest negative beta quintile provides an exception to this observation; however this is because of the relatively low performance of the highest co-skewness portfolio in this group. An explanation for the unusual behavior of shares with very high levels of co-skewness has been discussed in the previous paragraph. In summary, control tests confirm differences in the behavior of negative beta and of co-skewness in emerging markets. The extent of differences is not as great as that associated with developed markets, and this is largely because of unusual behavior at extreme levels of risk. The power of downside beta to capture returns in declining markets can be observed, however at extreme levels this relationship is less obvious. Inefficiencies in these markets may impact on the expected returns response when extreme levels of volatility are experienced.

## 7. Fama-MacBeth Regressions

In a final series of tests, we examine the continued importance of downside betas, when in combination with other idiosyncratic risk measures. It is possible that idiosyncratic risk will have greater importance in emerging markets, due to the presence of inefficiencies that may even impact on the largest 100 firms in each market. Regression tests are run on negative beta and relative negative beta, when in combination with variance, skewness, and co-skewness of returns. As in previous tests, all risk measures are estimated over the same period, and are regressed on company returns over this twelve month period. Separate regression tests are run for 03/04, 04/05, and 05/06. Results are presented in Table 8.

- Table 8 approximately here-

Regression coefficients for negative beta and relative negative beta remain similar to those in Table 2. There is no indication that they cease to be important explanatory factors, when in combination with measures of idiosyncratic risk. Significant relationships are clear in 03/04, and to a lesser extent in 05/06. In 04/05, this test does not identify a significant relationship between negative beta and 04/05 company returns, however as previously noted, a very sizable proportion of companies in the study population experience negative returns during this period.

The obvious importance of all measures of idiosyncratic risk, even when in combination with negative beta, is of considerable interest. In all years, skewness and co-skewness remain significantly related to company returns. Negative coefficients for co-skewness are expected, as downside exposure will be unattractive to investors, and will be compensated by higher levels of return. Variance also is a significant explanatory factor for company returns in two of the three study periods. Control tests in the previous section confirm that, although they have similar attributes, negative beta does not capture the same aspects of risk exposure as co-skewness. Both risk measures are priced in these developing markets. Significant levels of skewness are not surprising. As previously noted, Bekaert, Erb, Harvey, and Viscanta (1998) report evidence that emerging market equity index returns are highly non-normal. They report significant skewness in returns, and they observe the persistence of skewness over time. Tests reported here confirm the continued significance of negative beta, when in combination with skewness. Negative beta captures aspects of the return distribution in emerging markets, that are not related this measure of idiosyncratic risk. Significant coefficients for variance, in the majority of periods under investigation, probably are due to a shortage of diversification opportunities in emerging markets. Investors in these markets therefore continue to receive a premium for exposure to variance in their investments. Regression tests however confirm that, after allowing for variance, negative beta again remains a relatively important explanatory factor for company returns in these markets.

## 8 Summary and Conclusions

We present the results of a series of examinations on the explanatory power of downside beta, in developing markets. Annual returns of individual companies quoted in five Asian emerging markets form the basis of this investigation. Beta, downside beta, and all related risk measures are estimated over the same period. An investigation at individual company level is appropriate, as it will provide evidence on which elements of risk have been priced, and therefore have impacted on cost of capital at company level. Earlier research offers evidence on the potential value of downside beta in developing markets, at an aggregate level. An empirical examination on the cross-sectional relationship with individual company returns therefore offers an extension to this.

Initial simple tests confirm significant relationships between negative beta and individual company returns, in most study years. This result is similar to that previously reported for U.S. companies (Ang, Chen and Xing, 2006), and for U.K. companies (Pedersen and Hwang, 2007). Beta also offers similar levels of explanatory power. As expected, positive or upside beta is less important, and it is significantly related to company returns in only one study year. This is unsurprising as positive beta captures a response to upside company returns, and it is unlikely that investors will require unsymmetrical extra compensation for this.

Portfolios based on ranked values of beta or negative beta provide a detailed analysis on the pricing of downside beta. Results confirm that, in all individual years and over the full study period, downside risk is rewarded in the cross-section of individual company returns. These observed excess returns are only partially driven by conventional beta, as is indicated by the results for relative negative beta. The extra contribution offered by negative beta is however less than might be expected. This may be partially because emerging markets are dominated by small firms. It also is likely that inefficiencies in developing markets limit the ability of both beta and negative beta to offer a full explanation of company returns. An implication is that there are aspects of idiosyncratic risk that are priced in these markets, and that are not captured by negative beta.

Considering the similarities between negative beta and co-skewness, separate tests provide an investigation of whether they may capture the same pricing effects in these markets. This is necessary as both measures specifically attempt to concentrate on periods when the return distribution is relatively negative, and to identify an extra market return that compensates for this. After allowing for the impact of co-skewness, negative beta retains some explanatory power in developing markets. However, the importance of negative beta in these markets appears to be lower than that associated with larger markets. Also, although these measures are similar, when compared with co-skewness, negative beta continues to capture different aspects of risk.

In a final series of tests, the continued significance of beta and of negative beta is examined, when in combination with a series of measures of idiosyncratic risk. Results indicate that, when in combination with beta and with negative beta, measures of idiosyncratic risk continue to be significantly related to company returns. Negative beta also remains relatively important, when in combination with beta, variance, skewness, and co-skewness of returns. It therefore retains some importance in explaining the distribution of returns in these markets.

Table 1 Outline Details, Developing Stock Markets.

| | Sri Lanka | Malaysia | India | Thailand | Korea |
|---|---|---|---|---|---|
| No. of Companies | 240 | 824 | 1019 | 641 | 1669 |
| Total Market Value: | | | | | |
| Local Currency, Millions | 202,947 | 512,776 | 9,796,768 | 6,138,107 | 297,501,296 |
| US $, Millions | 2,087 | 134,941 | 207,383 | 147,055 | 246,684 |
| Average Co. Mkt. Value: | | | | | |
| Local Currency, Millions | 845 | 622 | 9614 | 9575 | 178,251 |
| US $, Millions | 8.69 | 163 | 203 | 229 | 148 |
| Median Co. Mkt. Value: | | | | | |
| Local Currency, Millions | 238 | 101 | 735 | 1495 | 19,115 |
| US $, Millions | 2.45 | 26.5 | 15.5 | 35.8 | 15.8 |
| Top 100, % of Tot. Mkt. Value | 91.7 | 79.2 | 81.6 | 83.6 | 80.9 |

*Notes*: All amounts and values are as on June 1st. 2003. Sri Lanka values are expressed in Sri Lankan Rupees, Malaysian values are expressed in Malaysian Ringgit, Indian Values are expressed in Indian Rupee, Thailand Values are expressed in Thai Baht, and Korean values are expressed in South Korean Won. US $ values are estimated, using the appropriate exchange rate on June 1st 2003.

Table 2 Single Factor Regression Coefficients.

| Periods | 03/04 | 04/05 | 05/06 |
|---|---|---|---|
| Panel A: No Thin Trading Adjustment | | | |
| Beta | 0.579** | 0.035 | 0.312** |
| Positive Beta | 0.638** | 0.066 | 0.130 |
| Negative Beta | 0.471** | 0.128 | 0.282** |
| Relative Positive Beta | 1.180** | 0.106 | -0.328* |
| Relative Negative Beta | -0.231 | 0.305* | -0.029 |
| Panel B: Dimson Adjustment For Thin Trading | | | |
| Beta | 0.482** | -0.073 | 0.245** |
| Positive Beta | 0.381** | -0.038 | -0.009 |
| Negative Beta | 0.378** | -0.059 | 0.142* |
| Relative Positive Beta | 0.397** | -0.033 | -0.054 |
| Relative Negative Beta | 0.349** | -0.054 | 0.058 |

*Notes*: Risk measures are the independent variables, and average daily return is the dependent variable. All coefficients are estimated from single factor regression models.

[a] Beta coefficients are ($x10^3$)

[b] Skewness Coefficients are ($x10^3$)

* and ** indicate statistically significant coefficients, at the 5% and 1% levels, respectively.

Table 3 Stock Portfolios, Sorted by Risk Factors, 2003-2004.

Panel A: Sorted by Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000936 | 1.43 | 1.49 | 1.48 | 0.00145 | -0.00362 |
| 2 | 0.000832 | 1.07 | 1.11 | 1.11 | 0.00092 | -0.00189 |
| 3 | 0.000756 | 0.82 | 0.85 | 0.85 | 0.00078 | -0.00166 |
| 4 | 0.000225 | 0.57 | 0.56 | 0.56 | 0.00079 | -0.00129 |
| 5 | 0.000342 | 0.21 | 0.17 | 0.17 | 0.00150 | -0.00049 |

Panel B: Sorted by Negative Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000931 | 1.37 | 1.39 | 1.53 | 0.00140 | -0.00307 |
| 2 | 0.000716 | 1.06 | 1.09 | 1.12 | 0.00094 | -0.00226 |
| 3 | 0.000624 | 0.84 | 0.85 | 0.87 | 0.00075 | -0.00177 |
| 4 | 0.000562 | 0.59 | 0.57 | 0.62 | 0.00078 | -0.00150 |
| 5 | 0.000258 | 0.25 | 0.27 | 0.21 | 0.00156 | -0.00035 |

Panel C: Sorted by Positive Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000817 | 1.37 | 1.58 | 1.37 | 0.00136 | -0.00337 |
| 2 | 0.000779 | 1.06 | 1.12 | 1.09 | 0.00094 | -0.00189 |
| 3 | 0.000800 | 0.84 | 0.84 | 0.89 | 0.00074 | -0.00129 |
| 4 | 0.000537 | 0.60 | 0.52 | 0.67 | 0.00084 | -0.00164 |
| 5 | 0.000158 | 0.25 | 0.10 | 0.32 | 0.00155 | -0.00074 |

Panel D: Sorted by Relative Negative Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000590 | 0.83 | 0.74 | 1.12 | 0.00094 | -0.00118 |
| 2 | 0.000749 | 0.83 | 0.83 | 0.95 | 0.00097 | -0.00188 |
| 3 | 0.000621 | 0.81 | 0.81 | 0.85 | 0.00104 | -0.00221 |
| 4 | 0.000473 | 0.75 | 0.79 | 0.72 | 0.00155 | -0.00246 |
| 5 | 0.000659 | 0.91 | 1.01 | 0.72 | 0.00925 | -0.00121 |

Panel E: Sorted by Relative Positive Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000714 | 0.99 | 1.33 | 0.95 | 0.00129 | -0.00225 |
| 2 | 0.000500 | 0.79 | 0.93 | 0.84 | 0.00086 | -0.00132 |
| 3 | 0.000635 | 0.75 | 0.76 | 0.78 | 0.00075 | -0.00124 |
| 4 | 0.000795 | 0.77 | 0.66 | 0.85 | 0.00085 | -0.00190 |
| 5 | 0.000449 | 0.82 | 0.50 | 0.93 | 0.00169 | -0.00223 |

*Notes*: This table lists equally weighted average excess returns and risk characteristics of quintile portfolios formed from shares ranked by beta or a beta related measure, estimated over the same one-year time period.

Table 4 Stock Portfolios, Sorted by Risk Factors, 2004-2005.

Panel A: Sorted by Beta.

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000655 | 1.45 | 1.39 | 1.39 | 0.00098 | -0.000096 |
| 2 | 0.000591 | 1.06 | 1.05 | 1.05 | 0.00046 | -0.000079 |
| 3 | 0.000684 | 0.83 | 0.77 | 0.84 | 0.00048 | -0.000071 |
| 4 | 0.000715 | 0.59 | 0.51 | 0.59 | 0.00047 | -0.000046 |
| 5 | 0.000311 | 0.19 | 0.16 | 0.22 | 0.00043 | -0.000025 |

Panel B: Sorted by Negative Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000768 | 1.36 | 1.21 | 1.52 | 0.00075 | -0.000130 |
| 2 | 0.000473 | 1.03 | 0.97 | 1.09 | 0.00047 | -0.000087 |
| 3 | 0.000674 | 0.82 | 0.75 | 0.82 | 0.00040 | -0.000061 |
| 4 | 0.000684 | 0.63 | 0.62 | 0.56 | 0.00043 | -0.000037 |
| 5 | 0.000357 | 0.29 | 0.34 | 0.11 | 0.00077 | -0.000000 |

Panel C: Sorted by Positive Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000511 | 1.31 | 1.60 | 1.15 | 0.00077 | -0.000039 |
| 2 | 0.000752 | 1.02 | 1.07 | 1.01 | 0.00046 | -0.000078 |
| 3 | 0.000657 | 0.85 | 0.77 | 0.88 | 0.00043 | -0.000070 |
| 4 | 0.000763 | 0.63 | 0.46 | 0.69 | 0.00038 | -0.000082 |
| 5 | 0.000273 | 0.31 | -0.01 | 0.35 | 0.00079 | -0.000049 |

Panel D: Sorted by Relative Negative Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000514 | 0.84 | 0.59 | 1.20 | 0.00055 | -0.000130 |
| 2 | 0.000613 | 0.86 | 0.70 | 0.98 | 0.00047 | -0.000098 |
| 3 | 0.000544 | 0.64 | 0.59 | 0.65 | 0.00036 | -0.000054 |
| 4 | 0.000762 | 0.76 | 0.81 | 0.65 | 0.00048 | -0.000040 |
| 5 | 0.000523 | 1.01 | 1.17 | 0.59 | 0.00097 | -0.000007 |

Panel E: Sorted by Relative Positive Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000547 | 0.92 | 1.38 | 0.70 | 0.00073 | 0.000002 |
| 2 | 0.000602 | 0.85 | 0.94 | 0.84 | 0.00036 | -0.000054 |
| 3 | 0.000697 | 0.66 | 0.61 | 0.69 | 0.00032 | -0.000060 |
| 4 | 0.000338 | 0.79 | 0.59 | 0.88 | 0.00038 | -0.000088 |
| 5 | 0.000772 | 0.90 | 0.35 | 0.98 | 0.00104 | -0.000120 |

*Notes*: This table lists equally weighted average excess returns and risk characteristics of quintile portfolios formed from shares ranked by beta or a beta related measure, estimated over the same one-year time period.

Table 5 Stock Portfolios, Sorted by Risk Factors, 2005-2006.

Panel A: Sorted by Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000635 | 1.63 | 1.61 | 1.59 | 0.00113 | -0.00076 |
| 2 | 0.000820 | 1.12 | 1.14 | 1.12 | 0.00064 | -0.00052 |
| 3 | 0.000702 | 0.89 | 0.91 | 0.92 | 0.00055 | -0.00035 |
| 4 | 0.000473 | 0.64 | 0.57 | 0.69 | 0.00053 | -0.00023 |
| 5 | 0.000307 | 0.19 | 0.14 | 0.25 | 0.00034 | -0.00006 |

Panel B: Sorted by Negative Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000796 | 1.53 | 1.40 | 1.68 | 0.00111 | -0.00083 |
| 2 | 0.000721 | 1.12 | 1.11 | 1.17 | 0.00063 | -0.00047 |
| 3 | 0.000715 | 0.88 | 0.89 | 0.89 | 0.00054 | -0.00037 |
| 4 | 0.000450 | 0.68 | 0.69 | 0.64 | 0.00049 | -0.00024 |
| 5 | 0.000255 | 0.26 | 0.29 | 0.18 | 0.00042 | -0.00002 |

Panel C: Sorted by Positive Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000425 | 1.50 | 1.78 | 1.36 | 0.00102 | -0.00055 |
| 2 | 0.000848 | 1.09 | 1.15 | 1.10 | 0.00066 | -0.00055 |
| 3 | 0.000838 | 0.96 | 0.85 | 0.99 | 0.00063 | -0.00048 |
| 4 | 0.000585 | 0.66 | 0.53 | 0.73 | 0.00055 | -0.00024 |
| 5 | 0.000241 | 0.26 | 0.05 | 0.37 | 0.00034 | -0.00011 |

Panel D: Sorted by Relative Negative Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000518 | 0.88 | 0.63 | 1.24 | 0.00070 | -0.00038 |
| 2 | 0.000699 | 0.90 | 0.84 | 1.00 | 0.00063 | -0.00058 |
| 3 | 0.000520 | 0.68 | 0.68 | 0.70 | 0.00043 | -0.00039 |
| 4 | 0.000721 | 0.92 | 0.95 | 0.85 | 0.00070 | -0.00043 |
| 5 | 0.000478 | 1.08 | 1.27 | 0.77 | 0.00074 | -0.00015 |

Panel E: Sorted by Relative Positive Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000421 | 1.05 | 1.47 | 0.91 | 0.00091 | -0.00031 |
| 2 | 0.000660 | 0.91 | 1.01 | 0.89 | 0.00049 | -0.00038 |
| 3 | 0.000585 | 0.68 | 0.66 | 0.74 | 0.00049 | -0.00034 |
| 4 | 0.000585 | 0.84 | 0.70 | 0.88 | 0.00060 | -0.00039 |
| 5 | 0.000686 | 0.99 | 0.54 | 1.16 | 0.00072 | -0.00051 |

*Notes*: This table lists equally weighted average excess returns and risk characteristics of quintile portfolios formed from shares ranked by beta or a beta related measure, estimated over the same one-year time period.

Table 6 Stock Portfolios, Sorted by Risk Factors, All Years

Panel A: Sorted by Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000714 | 1.51 | 1.50 | 1.49 | 0.00120 | -0.00153 |
| 2 | 0.000801 | 1.08 | 1.10 | 1.08 | 0.00067 | -0.00077 |
| 3 | 0.000714 | 0.85 | 0.84 | 0.88 | 0.00059 | -0.00068 |
| 4 | 0.000454 | 0.60 | 0.55 | 0.64 | 0.00061 | -0.00057 |
| 5 | 0.000312 | 0.19 | 0.16 | 0.24 | 0.00075 | -0.00019 |

Panel B: Sorted by Negative Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000820 | 1.42 | 1.33 | 1.58 | 0.00107 | -0.00131 |
| 2 | 0.000652 | 1.07 | 1.05 | 1.12 | 0.00071 | -0.00098 |
| 3 | 0.000648 | 0.86 | 0.85 | 0.86 | 0.00058 | -0.00077 |
| 4 | 0.000589 | 0.63 | 0.60 | 0.61 | 0.00055 | -0.00055 |
| 5 | 0.000284 | 0.27 | 0.30 | 0.17 | 0.00092 | -0.00012 |

Panel C: Sorted by Positive Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000634 | 1.39 | 1.66 | 1.29 | 0.00105 | -0.00134 |
| 2 | 0.000775 | 1.07 | 1.11 | 1.08 | 0.00071 | -0.00083 |
| 3 | 0.000706 | 0.87 | 0.82 | 0.92 | 0.00059 | -0.00064 |
| 4 | 0.000637 | 0.63 | 0.51 | 0.71 | 0.00062 | -0.00065 |
| 5 | 0.000242 | 0.28 | 0.04 | 0.34 | 0.00086 | -0.00026 |

Panel D: Sorted by Relative Negative Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000493 | 0.86 | 0.66 | 1.19 | 0.00070 | -0.00044 |
| 2 | 0.000708 | 0.85 | 0.79 | 0.97 | 0.00072 | -0.00099 |
| 3 | 0.000508 | 0.71 | 0.68 | 0.73 | 0.00072 | -0.00105 |
| 4 | 0.000715 | 0.83 | 0.87 | 0.76 | 0.00087 | -0.00106 |
| 5 | 0.000571 | 0.99 | 1.15 | 0.68 | 0.00082 | -0.00019 |

Panel E: Sorted by Relative Positive Beta

| Portfolio | Return | Beta | Pos-Beta | Neg-Beta | Variance | Co-skewness |
|---|---|---|---|---|---|---|
| 1 | 0.000568 | 0.98 | 1.39 | 0.85 | 0.00099 | -0.00087 |
| 2 | 0.000582 | 0.86 | 0.97 | 0.86 | 0.00059 | -0.00063 |
| 3 | 0.000651 | 0.69 | 0.67 | 0.73 | 0.00051 | -0.00057 |
| 4 | 0.000585 | 0.81 | 0.67 | 0.87 | 0.00071 | -0.00084 |
| 5 | 0.000609 | 0.89 | 0.44 | 1.01 | 0.00103 | -0.00082 |

*Notes*: This table lists equally weighted average excess returns and risk characteristics of quintile portfolios formed from shares ranked by beta or a beta related measure, estimated over the same one-year time period. Annual values are combined, to increase the number of observations.

Table 7 Negative Beta and Co-skewness Control Tests

Panel A: Negative Beta Sorts, controlling for Coskewness

| | Co-skewness Quintiles | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Portfolio 1 | 0.000701 | 0.001334 | 0.000921 | 0.000518 | 0.000241 |
| Portfolio 2 | 0.000993 | 0.000824 | 0.000606 | 0.000661 | 0.000233 |
| Portfolio 3 | 0.000998 | 0.000965 | 0.000553 | 0.000441 | 0.000202 |
| Portfolio 4 | 0.000926 | 0.000619 | 0.000618 | 0.000469 | 0.000184 |
| Portfolio 5 | 0.000648 | 0.000638 | 0.000303 | 0.000275 | 0.000096 |
| High-Low | 0.000053 | 0.000696 | 0.000618 | 0.000243 | 0.000145 |

Panel B: Co-skewness Sorts, controlling for Negative Beta

| | Negative Beta Quintiles | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Portfolio 1 | 0.000672 | 0.001234 | 0.000946 | 0.000972 | 0.000497 |
| Portfolio 2 | 0.001072 | 0.000746 | 0.000580 | 0.000577 | 0.000421 |
| Portfolio 3 | 0.000906 | 0.000669 | 0.000624 | 0.000556 | 0.000257 |
| Portfolio 4 | 0.000847 | 0.000544 | 0.000499 | 0.000378 | 0.000219 |
| Portfolio 5 | 0.000305 | 0.000467 | 0.000294 | 0.000062 | -0.000170 |
| Low-High | 0.000367 | 0.000767 | 0.000652 | 0.000910 | 0.000667 |

*Notes*: This table offers an examination of the relationship between negative beta and co-skewness. Using the full dataset, annual values of each measure are estimated. In Panel A, shares are firstly ranked into quintiles, based on co-skewness. Within each quintile, shares are ranked by negative beta value for the same period, and are allocated to further quintile portfolios. In Panel B, initial ranking is by negative beta and secondary ranking is by negative beta. Equally weighted average returns are reported. In each Panel, a final row reports the difference in returns between Portfolio 1 and Portfolio 5.

Table 8 Fama-McBeth Regressions.

| Periods | 03/04 | 04/05 | 05/06 |
|---|---|---|---|
| Negative Beta | 0.507** | -0.140 | 0.216* |
| Relative Negative Beta | -0.890* | -0.391 | -0.172 |
| Variance | 0.247** | 0.136** | -0.042 |
| Skewness | 0.345** | 0.175** | 0.124** |
| Coskewness | -0.048* | -4.22** | -0.252* |

*Notes*: Risk measures are the independent variables, and average daily return is the dependent variable. All coefficients are estimated from single factor regression models.

[a] Negative Beta, and Relative Negative Beta coefficients are ($x10^3$)

[b] Skewness Coefficients are ($x10^3$)

* and ** indicate statistically significant coefficients, at the 5% and 1% levels, respectively.

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