BETA IN THE CHINESE MARKETS: WANTED DEAD OR ALIVE

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Abstract

The capital asset pricing model (CAPM) states that higher beta stocks are priced to deliver higher returns. Even when this is not the case, however, goods and services that are inherently more (less) sensitive to the economy are expected to display stable higher (lower) betas. By this we mean, that when the economy rises, the underlying stocks of those firms that benefit the most are those that we expect to rise the most, and thereby have higher betas. And, in reverse, for economic downturns. In the present paper, we apply both considerations (higher beta stocks have higher average performances, and higher beta identifies those firms that respond most sensitively to the economy) to the Chinese markets. Our essential finding is that the level of stability of beta found in U.S. markets is not replicated in Chinese markets. Over the period of 1997-2006, the betas of Chinese stocks tend to revert to the mean (beta = 1). Not surprisingly, Chinese betas provide only weak value as indicators of portfolio exposure to subsequent market movements.

Keywords: Emerging Markets, Beta, Rational Markets, Market Efficiency

JEL Classification: C51, G14

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1. INTRODUCTION

Eugene Fama's quote that "beta as the sole variable explaining returns on stocks is dead" (New York Times, February 18, 1992) has become widely circulated as "beta is dead." The Fama statement derives from the observation that the *average* cross-sections of portfolio returns do not relate to the portfolio betas as the capital asset pricing model (CAPM) predicts (Fama and French, 1992, 1993, 1996, and elsewhere). However, if beta is stationary, by definition, beta remains as a realistic indicator of a portfolio's sensitivity to market movements. Black (1993), building on the study of Black, Jensen and Scholes (1972), documents strong beta stationarity over the period of 1931-1991, leading to the observation that beta is "more useful if the line (of returns against beta) is flat than if it is as steep as the CAPM predicts" (p, 17). The stability of beta for U.S. stocks is also highlighted in the study by Grundy and Malkiel (1996), who observe that portfolios of U.S. stocks comprised of high betas over the period of 1968-1992 consistently fell *more* in market declines than portfolios of stocks of low betas. As the authors point out, their results, ultimately, are a test of the stability of their beta portfolios.

In Chinese markets, Eun and Huang (2002) report that stock returns are related to total risk (consistent with the undiversified positions of China's largely retail investors) as well as showing sensitivity to the "small firm size" and "book-to-market value" variables identified in the Fama and French three-factor model. They consider that "overall, stocks are priced rather *rationally* (their italics) in China, given market imperfections" (p. 6). We might therefore expect that the beta of a portfolio in Chinese markets remains a meaningful indicator of that portfolio's exposure to those markets.

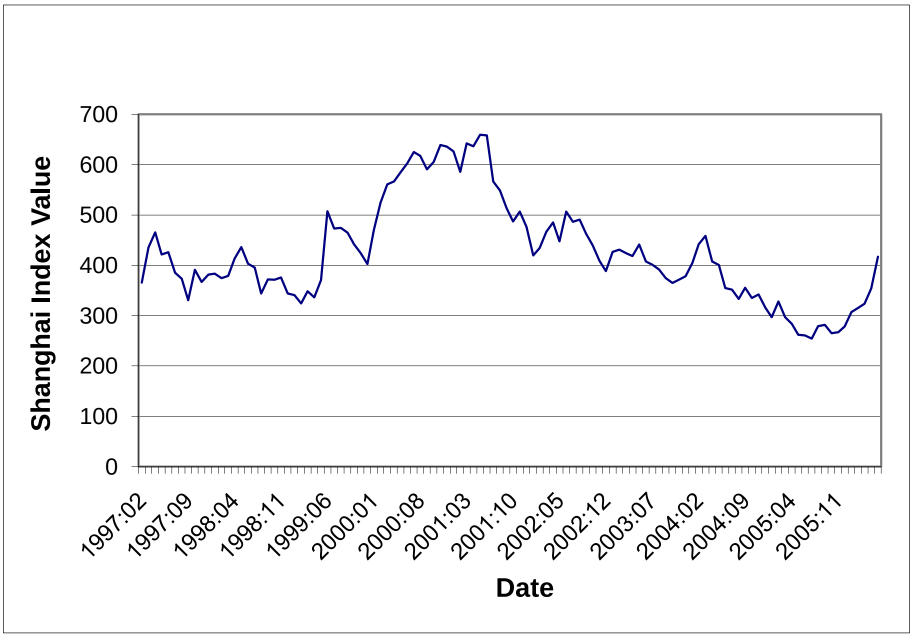
The objective of the present paper is to test both versions of the beta hypothesis: (i) that stocks with higher betas are more highly rewarded as captured by the CAPM, and (ii) that a stock's beta is sufficiently stable as to be indicative of the stock's performance relative to subsequent market movements. Our essential findings are as follows. Over the period of the study, 1997-2006, we find that higher beta assets do not provide significantly higher return performance outcomes. Furthermore, the level of stability of beta found in U.S. markets is not replicated in Chinese markets. Thus, over the period of 1997-2006, we observe that betas of Chinese stocks tend to revert to the mean (beta = 1) to the extent that the post-formation betas of our portfolios are restricted within the narrow range of 0.85–1.05. For this reason, pre-formation betas provide only weak indicators of portfolio exposure to subsequent market movements.

The remainder of the paper is presented as follows. In Section 2, we present a brief background of the data. In Sections 3 and 4, we apply the analyses of Black, Jensen and Scholes (1972) / Black (1993) and of Malkiel and Grundy (1996), respectively, in the context of Chinese markets. The last section summarizes the paper's findings.

2. BACKGROUND

Over the period of 1997-2006, the Shanghai exchange offers a particular opportunity to consider the performances of Chinese stocks in that, over this period, the Shanghai composite market capitalization index ended roughly were it had begun (Figure 1). The index rose dramatically from about 400 in early 1997 to the 650 mark in the early 2000s, sustained severe falls to below 300 by 2005, which were followed by gains to roughly the index starting point of 400 in early 2006. From an investor perspective, the market produced an overall zero return over the period.

Figure 1. Shanghai Market Index (1997:02 to 2006:05)



The number of firms trading on the Shanghai exchange has increased considerably since 1993. In February 1993, 36 firms traded on the Shanghai exchange. By May 2006, 780 firms were trading on the Shanghai exchange, with a maximum of 819 trading in April 2005. For the present study, monthly price data for 820 firms trading on the Shanghai exchange was obtained from the Taiwan Economic Journal's (TEJ) China database, covering the period February 1997 to May 2006. The database provides a one year fixed interest rate which we use to proxy the risk-free rate. Figure 2 shows the number of firms trading each month in the sample period on the Shanghai exchange. The minimum number of months that any firm traded was 13 months and the maximum was 160 months. On average, firms traded for 89.50 months. In total, the dataset contained close to 74,000 observations. The distribution of the number of months that each firm traded over this period is displayed in Figure 3.

Figure 2. Number of Firms Trading Per Month on the Shanghai Exchange (1993:02 to 2006:05)

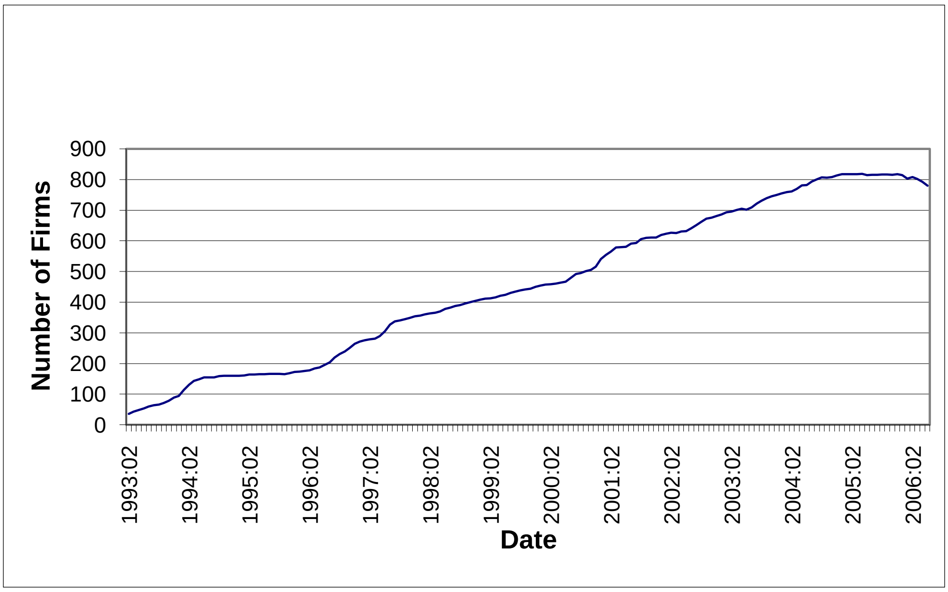
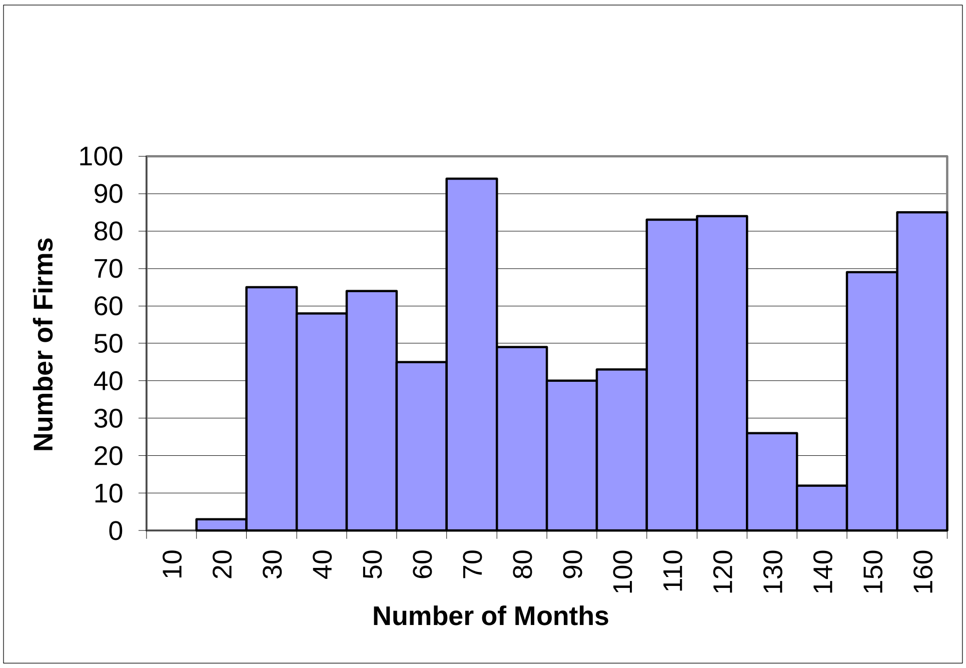


Figure 3. Frequency of Monthly Trading for Firms Trading on the Shanghai Exchange (1993:02 to 2006:05)



3. THE BLACK, JENSEN AND SCHOLES (1972) / BLACK (1993) ANALYSIS REPLICATED FOR CHINESE STOCKS

For each firm in the dataset, beta was calculated at the start of each year by regressing the stock excess return (its return over and above the risk-free rate) against the equally-weighted excess return of the entire sample over the previous 60 months. If the preceding 60 months did not have at least 35 valid firm return observations, the firm was deleted from the dataset for that month. After calculating the pre-formation betas, 39,905 observations remain in the dataset, representing 690 firms spanning the period February 1997 to May 2006 (113 months). Each firm in each month is thereby assigned to one of ten portfolios, high beta to low beta, based upon its beta ranking at the beginning of the year. The whole procedure is then repeated for the following year, and so on over the period from February 1997 to May 2006. The monthly excess returns for the beta-ranked portfolios are then regressed against the market's monthly excess return as:

$$r_{pt} - r_f = \alpha_p + \beta_p (r_{Mt} - r_f) + \varepsilon_{pt} \quad (1)$$

where r_{pt} is the return on the p^{th} portfolio in month t, r_f is the risk-free rate, r_{Mt} is the return on the market in month t, and ε_{pt} denotes the error terms.

In this way, we calculate the betas (β_p) and zero market return intercepts (α_p) for each of the ten beta-ranked portfolios. The β_p and annualized α_p for each portfolio, as averaged over the total sample period, are presented in rows 1 and 2 of Table 1. If the CAPM holds as:

$$E(r_{pt}) - r_f = \beta_p [E(r_{Mt}) - r_f] \quad (2)$$

for our portfolios p, then the α_p's in regression (1) should not be systematically different from zero.

Allowing Black's zero-beta version of the CAPM as:

$$E(r_{pt}) - r_z = \beta_p [E(r_{Mt}) - r_z] \quad (3)$$

where r_z is the return on a zero-beta portfolio, we have on rewriting the equation:

$$E(r_{pt}) - r_f = (r_z - r_f)(1 - \beta_p) + \beta_p [E(r_{Mt}) - r_f] \quad (4)$$

Thus (comparing equations 2 and 4) the appropriate (ex post) market model for Black's model is equation 1 with:

$$\alpha_p = (r_z - r_f)(1 - \beta_p) \quad (5)$$

Black assumes that $r_z > r_f$ and consequently Black's zero-beta version of the CAPM implies:

(a) $\alpha_i > 0$ if $\beta_P < 1$, and

(b) $\alpha_i < 0$ if $\beta_P > 1$ (6)

When we regress the excess portfolio returns on the equal-weighting of all returns (as the "market" return, r_{Mt}), the outcome α_p's as in row 2 of Table 1 show no clear pattern. When we regress on the Shanghai index as the market return, the outcome α_p's are close to 6% (row 3), implying that the market index very much underperforms against an equally-weighed portfolio. The implication here is that the stocks of small firm size in each portfolio are contributing an annualized return close to 6%. Recalling that the alpha parameter should be either 0 (if the CAPM specifies the data) or > 0 (< 0) for beta < 1(> 1) (if the Black version of the CAMP specifies the data), we conclude that we have support for neither the conventional nor Black's version of the CAPM (notwithstanding that the *t*-statistics are generally low; row 4 of Table 1).

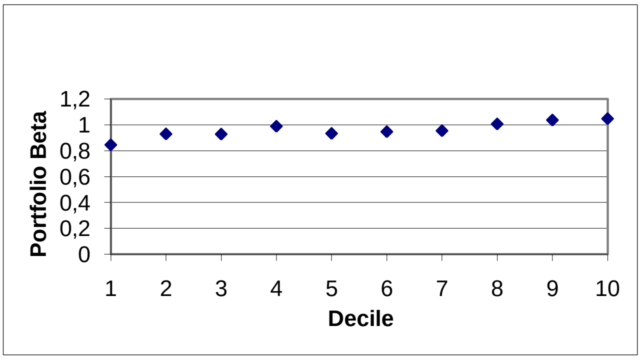
Table 1. Monthly Regressions for Portfolios of Chinese Stocks (Annualized), 1993-2006

The intercept α_P's and gradient β_P' s that are the outcome of the regression of the portfolio excess returns on the market excess returns $r_{pt} - r_f = \alpha_p + \beta_p (r_{mt} - r_f) + \varepsilon_{pt}$ are presented in rows 1 and 2, respectively; with *t* statistics for differences of the intercept α_P from zero (row 4). The average portfolio annualized returns and their standard deviations are depicted in rows 5 and 6, respectively.

Row	Portfolio										
	1	2	3	4	5	6	7	8	9	10	Market
1. β_p	0.85	0.93	0.93	0.94	0.94	0.95	0.95	1.01	1.04	1.05	1.0
2. α_p	0.0	-0.01	-0.02	0.02	-0.01	0.0	0.02	0.0	-0.02	0.01	
3. α_p (Shanghai)	6.0	4.8	3.6	8.4	4.8	6.0	8.4	6.0	3.6	7.2	
4. $t(\alpha)$	1.62	1.15	0.89	2.02	1.24	1.27	2.02	1.40	0.93	1.56	
5. r_p(%)	9.6	8.4	7.2	12.0	7.2	9.6	12.0	10.8	7.2	12.0	9.2
6. σ_p(%)	26	28	28	29	27	29	29	30	30	31	27
7. ½ σ_p^2(%)	3.3	3.9	3.8	4.3	3.7	4.1	4.1	4.6	4.4	5.0	
8. rows 5 - 7	6.3	4.5	3.4	7.7	3.5	5.5	7.9	6.2	2.8	7.0	

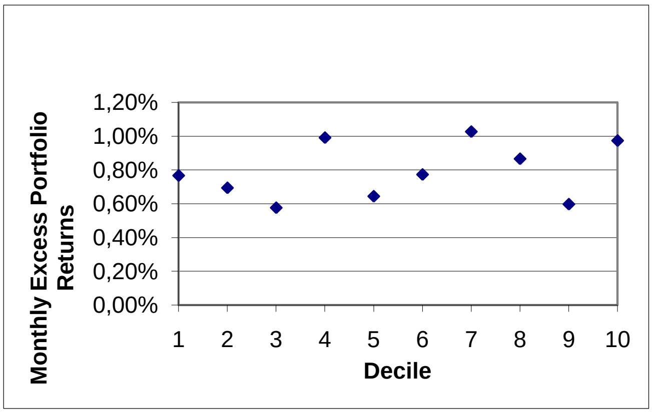
The variation in pre-formation betas of the portfolios is roughly in the range 0.5 (for decile 1) to 1.4 (for decile 10). However, the outcome average post-formation betas of the portfolios are restricted to the narrow range of 0.85-1.05 (Figure 4 and row 1 of Table 1). Thus, there appears to be only a weak relationship between pre-formation betas and the final portfolio beta. We interpret this as the outcome of weak stationarity in betas going forward, leading to a reversal of beta to the mean (beta =1).

Figure 4. Regression Betas



Within the range of portfolio betas, we observe only a very weak relation between average portfolio returns and their beta (Figure 5 and row 5 of Table 1). Even this weak relation is likely to be the outcome of the phenomenon of arithmetic averaging in the determination of the returns. This is because when portfolio returns are approximately log-normally distributed (implying a positive skewness of arithmetic returns) the volatility (σ_P) of such returns contributes to the arithmetic average return as approximately $½\sigma_P^2$ (see, for example, Jacquier, Kane and Marcus (2003) or De La Grandville (1998)). The portfolio volatilities in row 6 of Table 1 range from 26% to 31%, with increasing beta, implying $½\sigma_P^2$ values ranging from approximately 3.3 % (½ 0.26^2) to approximately 5.0 % (½ 0.31^2) (row 7). The increase of (5.0-3.3)% = 1.7% across the beta-portfolios effectively accounts for the increase in portfolio returns as a function of their beta (see row 8).

Figure 5. Monthly Excess Portfolio Returns



4. THE GRUNDY AND MALKIEL (1996) ANALYSIS REPLICATED FOR CHINESE STOCKS

Grundy and Malkiel (1996) highlight the stability of beta for U.S. stocks. The study observes the persistence of beta for U.S. stocks with reference to market declines. The period of study (1968-1992) is close to the period for which Fama and French (1992) find no overall relationship between average portfolio stock returns and beta. A declining market is defined as one in which both the S&P 500 and a value-weighted index falls at least 10% from peak to trough. This definition provides thirteen periods between 1968 and 1992 that qualify as declining or bear markets. The results of Grundy and Malkiel using betas calculated from the 60 months preceding a declining equally-weighted market are reproduced in Table 2. The table shows that high beta portfolios consistently perform most poorly during periods when the S&P 500 and value-weighted indexes drop at least 10%. The usefulness of beta as a measure of downside risk appears compelling.

Table 2. Summary of Aggregate Results for Thirteen Declining Periods of U.S. Markets, 1968-1992 (following Grundy and Malkiel, 1996)

Beta Rank	1	2	3	4	5	6	7	8	9	10
Average Pre-formation Beta	0.33	0.53	0.67	0.79	0.89	0.99	1.09	1.22	1.40	1.79
Average annualized Firm Return	-9%	-14%	-16%	-18%	-20%	-21%	-23%	-23%	-26%	-30%

A similar analysis was conducted for Chinese stocks over periods of decline for the Shanghai market (Figure 1). As in the Grundy and Malkiel study, we look at periods when the Shanghai market drops by 10% or more from peak to trough. Using this criterion, five bear markets were identified over the period of the above study (1997-2006) as in Table 3. This gave us 17,425 observations. Portfolios are formed on betas calculated over the 60-month period prior to a period of market decline. The averaged pre-ranking beta for the stocks of the lowest-beta portfolio and the highest beta portfolio are approximately 0.5 and 1.4, respectively. The portfolio returns are calculated as the average monthly decline of stocks within the portfolio. The results are as in Figure 6 and Table 4 (annualized).

Figure 6. Mean Decile Returns During Bear Markets

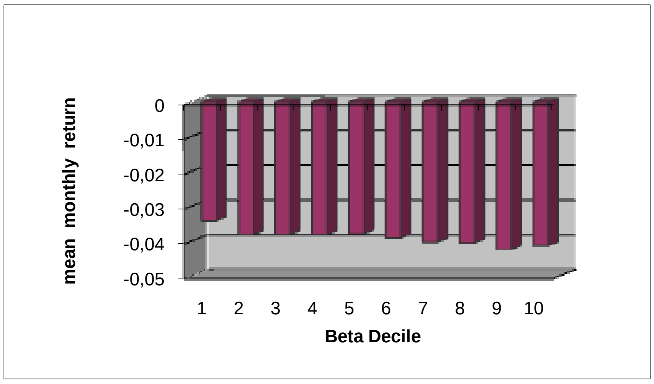


Table 3. Periods of Market Decline Greater than 10 % for the Shanghai Index, 1993-2006

	Start	Finish	Period (Months)
1	1997:05	1997:09	5
2	1998:06	1999:02	9
3	1999:07	1999:12	6
4	2001:07	2002:02	8
5	2002:07	2002:12	6
6	2004:04	2005:07	16
		Total	50

Table 4. Aggregate Results for Six Declining Periods of Chinese Market, 1993-2006

Beta rank	1	2	3	4	5	6	7	8	9	10
Average pre-formation beta	0.529	0.692	0.770	0.829	0.881	0.935	0.993	1.064	1.153	1.414
Average annualized return	-40.9%	-45.6%	-45.6%	-45.6%	-45.4%	-46.7%	-48.2%	-48.6%	-50.8%	-49.5%

We detect a weak portfolio decline in relation to beta. However, the comparison with the results of Grundy and Malkiel is revealing. Whereas the U.S. study indicates differences by a factor of 3 across the negative returns of the beta-portfolios during market declines, the negative returns for the Chinese portfolios as a function of beta are within a 20% separation. Consistent with our observation of reversal to the mean for Chinese betas, the implications of Chinese betas for asset price formation are quite weak.

5. CONCLUSION

The remarkable growth of the Chinese stock markets has attracted many researchers' attention. However, comparatively few studies have been conducted to examine asset pricing mechanisms in China. Our chosen approach has been to apply the "beta test" of whether Chinese stock prices show a consistent relationship with the pricing of the Chinese economy. We conclude that the betas of Chinese stocks are unstable, and tend to return to the mean. The implication is that beta does not function as a useful measure of a portfolio's sensitivity to subsequent market conditions, and, consequently, that the CAPM in either its conventional or Black's form fails to be descriptive of the formation of Chinese stock prices.

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