Beta Is Alive, Well and Healthy

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Abstract

In this study I suggest some evidence that the popular cross-sectional asset pricing test proposed by Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973) drives the conclusion that betas do not explain the cross-sectional asset returns as in Fama and French (1992). In the conventional test, the cross-sectional aggregation of post-formation portfolios is not equivalent to the market portfolio. Moreover a majority of stocks in a pre-formation portfolio migrate into other (post-formation) portfolios over 12 months. After correcting for these problems, I show that the intercept is not different from zero while the slope is significant and close to the average excess market return for the sample period from 1926 to 2005 and various other sub-sample periods. The results hold in two dimensional portfolios – 100 size and beta sorted portfolios; beta is priced while size is not.

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According to the CAPM of Sharpe (1964), Lintner (1965), and Black (1972), an asset's risk is summarised by its beta, and no other characteristics of the asset should influence its return. Early empirical results by Black, Jensen, and Scholes (1972), Blume and Friend (1973), and Fama and MacBeth (1973), which have been confirmed by many subsequent studies, are 1) there is no strong evidence of a relation between mean returns and betas, and 2) the intercept is significant and positive. Not surprisingly, during the last few decades many different approaches have been adopted to explain this 'anomaly'. Some introduce additional factors; in particular, those based on firm characteristics such as size, book-to-market, and momentum (Banz, 1981; Basu, 1983; Fama and French, 1992, 1993, 1996; Jegadeesh and Titman, 1993; and Lakonishok, Shleifer and Vishny, 1994). Others try to explain asset returns within the CAPM framework. For example, Jagannathan and Wang (1996) propose a conditional CAPM model, while Campbell and Vuolteenaho (2004) decompose the beta of a stock into the 'good' beta that comes from news about the discount rate and the 'bad' beta from news about the future cash flows. However, as in Chan and Lakonishok (1993) and Daniel and Titman (2006), the tests associated with these models lack power and do not provide a complete answer to why beta does not work.

To the proponents of the conventional CAPM, these results are a major setback, since high beta stocks are not empirically compensated by higher returns. It is because of such strong empirical evidence that Fama and French (page 449, 1992) conclude that "We emphasize, however, that different approaches to the tests are not likely to revive the Sharpe-Lintner-Black model." In another study Fama and French (1996) argue that the market factor does not explain cross-sectional average returns but is needed to explain positive equity premium.

The purpose of this study is to scrutinise the popular two-step cross-sectional regression proposed by Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973). In particular, I focus on the problems that are associated with the 'procedure', and it is not my intension to develop statistics.[1] I also do not try to test the CAPM in equilibrium to revive it. As pointed out by Roll (1977) and Roll and Ross (1994), when

[1] Many important tests were developed in the 1970s and 80s; See, for example, Blume and Friend (1973), Fama and MacBeth (1973), Black, Jensen and Scholes (1972), Stambaugh (1982), Gibbons (1982), and Gibbons, Ross, and Shanken (1989). For recent developments in testing the CAPM, see Kim (1995), Velu and Zhou (1999), and Hwang and Satchell (2007).

the market portfolio is not available, testing the CAPM is not possible. Instead I narrow down my study by focusing on whether betas are priced.

For this purpose I examine several assumptions implicit in the testing procedure of Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973) (henceforth the Fama-MacBeth procedure). These are the inconsistency between post-formation portfolios and the market portfolio, changes in the beta ranks of individual stocks between pre- and post-formation portfolios, and the so-called regression phenomenon. The regression phenomenon refers to the bias in portfolio betas when estimated betas are used. That is, forming portfolios based on the estimated betas leads to the unfavourable result that pre-formation high (low) beta portfolios have betas higher (lower) than the true betas. The regression phenomenon creates downward bias in the risk premium and upward bias in the intercept in the Fama-MacBeth cross-sectional regression. However, for the various sample periods in this study, the effects are not large enough to purge the cross-sectional relationship between beta and returns; the estimated risk premium is downward biased up to 30% (or 1-2% in annual terms) but still significant.

More serious problems arise from the inconsistency between post-formation portfolios and the market portfolio. Beta ranked portfolios should be created such that the cross-sectional expected return on these portfolios should be equivalent to the market portfolio's expected return. By creating beta ranked portfolios with equal weights (e.g., Black, Jensen, and Scholes, 1972; Fama and MacBeth, 1973; Fama and French, 1992, 1993; Kothari, Shanken, and Sloan, 1995), the performance of these portfolios are significantly affected by small stocks. A direct consequence of using equal weights is that the post-formation portfolios have higher returns than the Centre for Research in Security Prices (CRSP) value weighted market returns. The inconsistency partly explains the significant positive intercept in the Fama-MacBeth regression, and why the performance of the post-formation portfolios is highly related to size.

Another problem is the transition in individual stocks' beta ranks between pre- and post-formation periods. When 20 portfolios are formed on betas, the probability that a stock that belongs to a given beta ranked portfolio remains in the same rank a year later is as low as 17%. Up to 83% of stocks move to the other ranks over 12 months

(71% over 6 months), and moreover the transition is asymmetric. The transition transforms returns and betas in different ways so that post-formation returns have relatively smaller cross-sectional difference than post-formation betas. Therefore a test that relies on post-formation portfolios is less likely to reveal the true relationship between betas and returns.

In order to correct these problems, I use pre-formation portfolios with the market portfolio created with these pre-formation portfolios. I show that there is a strong cross-sectional relationship between betas and returns despite the regression phenomenon. The risk premium estimated from the cross-sectional regression is significant for various sample periods and is not different from the average excess market returns. The estimated intercept is also not significantly different from zero. Despite this favourable result for the CAPM, I find that there is a nonlinear relationship between betas and returns. Moreover with the proxy market portfolio, I do not claim that the strong cross-sectional relation between betas and returns supports the CAPM.

Two important issues from the results are the nonlinearity and poor out-of-sample forecasting. First, firm characteristics based factors such as Fama-French's SML, HML or momentum do not appear to explain the nonlinearity between betas and returns. Other risk based factors such as upside/downside betas improve the CAPM but at the price of a positive intercept. Second, betas cannot be used for out-of-sample forecasting although they work quite well in the contemporaneous cross-sectional asset pricing. The strong cross-sectional relationship between pre-formation betas and returns does not hold port-formation since individual stocks' betas change dramatically over short time periods despite stable portfolio betas.

The results in this study indicate that factors that have been found to explain the intercept need to be re-examined. These factors may be necessary to explain the inconsistency between the market portfolio and the post-formation portfolios as well as the transition in beta ranks. Using post-formation portfolios in the test means that betas cannot explain cross-sectional returns, but requires other firm characteristics to explain the cross-sectional asset returns.

This paper is organized as follows. In the next section I first follow the popular testing procedure to show that betas cannot explain returns in the cross-section. Section 2 discusses several problems in the test procedure, and a new test method is proposed in

Section 3 with the evidence that betas are priced in cross-section. Discussions and conclusions are in Section 4.

1. The Fama-MacBeth Procedure for Testing the CAPM

The CAPM has been subjected to extensive empirical testing since the 1970s. A popular method for testing the CAPM (or more generally to investigate whether or not any factor is priced) is to form post-formation portfolios using the estimated betas of individual stocks and then to employ the following methodology; first estimate betas for these portfolios using time series regression and then run cross-sectional regressions using the estimated betas as explanatory variables to test the hypothesis implied by the CAPM. In this section I follow the literature to show that betas appear to lack power in the cross-section.

In order to replicate the empirical results of previous studies, I follow the method used by Fama and MacBeth (1973) and Fama and French (1992). I form 20 portfolios in June of year *t* using betas estimated with 24 to 60 past monthly returns (as available). As in Fama and French (1992), I use all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files from the CRSP. NYSE stocks are used for the beta breakpoints such that these beta breakpoints are not dominated by a large number of small stocks in NASDAQ. For the market returns I use the CRSP value weighted portfolio returns. In order to minimise the effects of nonsynchronous trading on the estimate of beta (Scholes and Williams, 1977; Dimson, 1979), betas are estimated as the sum of the slopes in the regression of excess returns on the current and prior months' excess market returns. For each of these portfolios equally weighted returns are calculated from July of year *t* to June of year *t*+1 (henceforth 'post-formation' returns). The process is repeated from June 1928 to June 2004 and 924 post-formation monthly returns from July 1928 to June 2005 are obtained for each portfolio. Alphas and betas are re-estimated by regressing the post-formation returns on CRSP value weighted portfolio returns.

Table 1 confirms the results in the previous literature. As in Fama and French (1992, 1993, 1996) the relationship between portfolio returns and betas does not support the CAPM. The best linear relationship appears to hold for Fama and MacBeth's (1973) sample period (January 1935 – December 1968) and for before 1963 when the return difference between the highest and lowest beta portfolios is around 0.5 percent a month. For the other periods, beta does not seem to be priced, and alphas are positive and strongly negatively correlated with betas. The negative relationship is interpreted by Black, Jensen, and Scholes (1972) as the empirical support of the zero beta portfolio. Formal tests on the linear relationship are carried out using the Fama-MacBeth cross-sectional regression. In general, the results in Table 2 support Fama and French's argument that the CAPM actually did not hold even before 1963: although betas seem to have a stronger relationship with portfolio returns before 1963, alphas are positive and betas are not fully priced.

Other combinations of portfolio formation methods (10 portfolios instead of 20 portfolios) are tried along with various sample periods (Chan, Lakonishok, 1993; Shanken, and Sloan, 1995; Fama and French, 1996), CRSP equally weighted market portfolio returns, and all firms including financials, but the results are not different from those in tables 1 and 2. In order to investigate the effects of the time-variation in beta, I also estimate betas of the post-formation portfolios using rolling windows of 60 months and then use them in the cross-sectional regression, but the results change little.

2. Problems with the Cross-sectional Tests

In this section I discuss several problems with the cross-sectional test procedure that could affect the results, and propose some answers to why betas appear not to work in cross-section. I suggest that it is not any single problem in the Fama-MacBeth procedure that causes betas to appear not to work, but several problems in combination that create the misleading result.

2.1 Inconsistency between Beta Ranked Portfolios and Market Portfolio

One reason why we reject the CAPM could be the mismatch between the *equally weighted post-formation portfolios* and the *value weighted market portfolio*. Table 2 reports the results using equally weighted CRSP market returns to estimate the betas of the individual stocks and the post-formation portfolios. There is a small but important difference in the Fama-MacBeth regression results between the equally and value weighted market portfolios. Using the equally weighted CRSP market portfolio tends to provide more favourable results for the CAPM; the slopes (risk premia) are larger than those obtained with the value weighted CRSP market portfolio, and in some cases (before 1963, and for the entire sample period) they are significant. However, the slopes are still lower than the average excess market portfolio returns, and Fama and French (1992) dismiss the difference claiming that using equally weighted market portfolio does not change their conclusions.

To see how the mismatch could lead to biased results in the cross-section, suppose that there are *N* stocks in the market and the market portfolio is constructed by cross-sectionally aggregating these *N* stocks; i.e., $E_c(r_{it}) = r_{mt}$, where r_{it} and r_{mt} are excess returns of stock *i* and the market portfolio at time *t*, respectively. This is not a restriction, but simply reflects the way we calculate the market portfolio. The cross-sectional aggregation requires weights; value and equal weights are common. Consider the following market model;

$$r_{it} = \alpha_i + \beta_i r_{mt} + \varepsilon_{it}, \qquad (1)$$

where α_i may include other factors apart from the market returns and ε_{it} is an idiosyncratic error. By taking cross-sectional expectations of the market model, we obtain $E_c(\alpha_i) = 0$, since $E_c(\varepsilon_{it}) = 0$, $E_c(r_{it}) = r_{mt}$ and $E_c(\beta_i) = 1$, where $E_c(.)$ represents cross-sectional expectation. When $E_c(r_{it}) \neq r_{mt}$, we could face $E_c(\beta_i) \neq 1$ and thus $E_c(\alpha_i) \neq 0$. This simple relation shows that $E_c(\alpha_i) = 0$ should hold regardless of the argument for or against equilibrium since the market portfolio is constructed by cross-sectionally aggregating individual stocks. The same argument holds for portfolios if $E_c(r_{pt}) = r_{mt}$ is satisfied.

2.1.1 Value Weights vs Equal Weights

Tables 1 and 2 show, on average, $E_c(r_{pt}) > r_{mt}$, $E_c(\alpha_i) > 0$, and $E_c(\beta_i) > 1$, when the value weighted CRSP market portfolio is used. For instance, for the entire sample period, the average excess return of the 20 post-formation portfolios is 1.08% per month while the average excess CRSP value weighted market return is only 0.62% per month. Even if betas are fully priced so that the risk premium (the Fama-MacBeth regression slope) is equivalent to the average excess market return (0.62%), we still need the Fama-MacBeth regression intercept to be as large as 0.46% if $E_c(\beta_i) = 1$. The average value of the post-formation betas is 1.25, but the upward biased betas do not explain the large portfolio returns. If we want betas to fully explain the portfolio returns so that $E_c(\alpha_i) = 0$, the average value of betas should be as large as 1.75.

Why is the average post-formation return much larger than the average CRSP market return? Since the post-formation returns of small firms tend to be higher than those of large firms, the post-formation returns obtained by equally weighting individual stock returns are affected more by these small stocks and have higher returns than the value weighted CRSP market returns.[2] Unless the post-formation portfolios and the market portfolios are constructed consistently, i.e., $E_c(r_{pt}) = r_{mt}$, the Fama-MacBeth regression would reject the CAPM.

The results suggest that we could improve the test using an equally weighted market portfolio, which can be seen in Table 2. For the entire sample period, the average excess return of the equally weighted CRSP market portfolio is 0.99% per month, while the average excess return of the 20 equally weighted post-formation portfolios formed with the equally weighted CRSP market portfolio is 1.09% (details not reported). Table 2 shows that by reducing the gap between the post-formation portfolio returns and the market returns, the Fama-MacBeth results are relatively more in favour of the CAPM.

The explanation, however, does not suggest which one, either equal weights or value weights, is to be preferred. Kothari, Shanken, and Sloan (1995) suggest that the choice of the market portfolio, i.e., value weighted vs equally weighted, is largely an empirical question, although the value weighted portfolio of all assets is implied by the CAPM. Our results add one more element; the consistency between the post-formation portfolios and the market portfolio. When the equally weighted market portfolio is used for the estimation of the individual stocks' betas, equal weighting should be used to

[2] At June of every year five portfolios are formed with the market value (ME) of each stock. For each portfolio next 12 months returns are calculated by equally weighting individual stock returns. The small firms (smallest quintile portfolio) outperform the largest firms (largest quintile portfolio) by 1.1% per month for the period from 1931 to 2005, 1.3% before 1963, and 0.9% after 1963.

calculate post-formation portfolios and the equally weighted market portfolio should be used for the calculation of port-formation betas.

Moreover, even if the equally weighted market portfolio is used, using NYSE breakpoints creates different numbers of stocks in each post-formation portfolio and thus portfolios are not equally additive; we could still face $E_c(r_{pt}) \neq r_{mt}$ and $E_c(\alpha_p) \neq 0$. This could partly explain why betas appear not to work after 1963. A large number of small stocks are included in the post-formation portfolios when the AMEX and NASDAQ stocks are included in the CRSP data file in 1962 and 1973 respectively. Since NYSE beta breakpoints are used, some post-formation portfolios (i.e., high beta portfolios) have more small stocks than the others, and thus are seriously affected by these stocks. The idea of using NYSE breakpoints is to minimise the effects of the large number of small stocks, in particular, NASDAQ stocks, on testing the CAPM (Fama and French, 1992). However, post-formation portfolios are created with equal weights, and the impact of the small stocks does not disappear in the equally weighted post-formation portfolios. Thus it is not surprising to see why betas appear not to work in cross-section in the presence of size. A significant $E_c(\alpha_p)$, an unwanted product of $E_c(r_{pt}) \neq r_{mt}$, may also require factors such as size to fill the gap between the market portfolio and the post-formation portfolios.

2.1.2 Stocks Not Included in the Tests

Another problem that creates the inconsistency is the exclusion of stocks whose history is short. Excluding the stocks that have shorter than the minimum 24 monthly observations during the past 60 months may be responsible for the poor relationship between betas and returns. These are young, small stocks whose betas are expected to be higher on average. Although they may be less important in terms of size, testing the CAPM uses equally weighted post-formation portfolios, and thus the exclusion of these stocks may have a significant impact on the test results.

In order to investigate the effects of these stocks on the cross-sectional relationship between betas and returns, I form a portfolio (from now on labelled the ‘excluded portfolio’) in June of each year using the stocks whose available monthly returns are less than 24 during the past 60 months, and calculate its returns from July to

June of following year using individual stocks available each month. The statistics reported in the last column of Table 1 show that the size of these firms is indeed small, but in terms of numbers, they are around one fifth of the stocks that are used to test the CAPM.

Interestingly the excluded stocks show lower returns than are suggested by their betas. In particular, note the period after 1963 when the excluded portfolio shows a smaller average return compared with its beta; i.e., 0.58% per month with a beta of 1.31. Further investigation suggests that the low return of the excluded portfolio is attributable to poor performance during the bear market after 2000. A huge number of small stocks that were listed in the NASDAQ in the late 1990s react sensitively to the market movements (with high betas), but the sensitivity is not priced (low returns).

However, the excluded stocks do not affect the cross-sectional relation between betas and excess returns. The last column of Table 2 shows that the cross-sectional regression with the excluded portfolio together with the 20 post-formation portfolios shows little difference from those calculated without the excluded portfolio. Therefore including these stocks is not likely to reverse the conclusions of Fama and French (1992, 1993, 1996) since they play somewhat limited role.[3]

2.2 Changes in Beta Ranks and the Regression Phenomenon

The Fama-French regression uses post-formation portfolios because a problem known as the ‘regression phenomenon’ could arise when we use pre-formation portfolios. Black, Jensen, and Scholes (1972) argue that “those securities entering the first or high-beta portfolio would tend to have positive measurement errors in their $\hat{\beta}_j$, and this would introduce positive bias in $\hat{\beta}_K$, the estimated portfolio risk coefficient” (pp.84-85), where $\hat{\beta}_j$ and $\hat{\beta}_K$ represent estimated betas for individual stocks and for pre-formation portfolios. Fama and MacBeth (1973) explain that the consequence of forming portfolios on the basis of $\hat{\beta}_j$ is that the pre-formation high (low) beta portfolios have betas higher (lower) than the true betas. Because of this problem, Black, Jensen, and

[3] This conclusion depends on the portfolio formation method. If the betas of these excluded stocks were estimated, we could form two or more portfolios from the excluded stocks and the Fama-MacBeth regression results might be different.

Scholes (1972) and Fama and MacBeth (1973) propose using post-formation portfolios rather than pre-formation portfolios.

Using post-formation portfolios is based on the following implicit assumptions. First, ranks obtained from using the estimated betas are not different from those calculated with the true betas. Second, stocks that belong to a pre-formation portfolio would belong to the post-formation portfolio that is the counterpart of the pre-formation portfolio, or at least the majority of stocks do not change their ranks between pre- and post-formation portfolios.

In this section I first show that these assumptions do not hold in practice. The impact of these assumptions on the Fama-MacBeth regression results is then evaluated by regressing post-formation returns and betas on pre-formation returns and betas respectively. The results suggest that using post-formation returns and betas is likely to lead to a downward bias in the risk premium and upward bias in the intercept in the Fama-MacBeth regression. Finally the effects of the regression phenomenon on the Fama-MacBeth regression are examined to evaluate how serious the regression phenomenon becomes when pre-formation returns and betas are used.

2.2.1 Difference in Ranks between Estimated Betas And True Betas

I use bootstrapping to address the difference in ranks calculated with estimated betas and true betas as follows. First, I estimate both betas and their standard errors for all nonfinancial stocks in the NYSE, AMEX, and NASDAQ files using at least 24 to 60 months of past returns (as available). In order to avoid any adverse effects from using overlapping time series, betas and their standard errors are calculated every 5 years from June 1931 to June 2001. The total number of estimates (or stocks) is 44,598 (5,989 pre- and 38,609 post-1963 estimates). The number of stocks for the Fama-French period (July 1963 – December 1990) is 19,491. The estimated betas are unbiased and thus treated as the 'true betas'. Then I randomly select 2000 stocks, for each of which the true beta is added to a random number that is generated from the normal distribution with the standard deviation equivalent to that beta's standard error.[4] These generated 2000 betas are treated as 'estimated betas'. The estimated betas are ranked to form 20 beta portfolios, each of which has 100 stocks. Likewise the true betas are also ranked to

[4] I also used a t-distribution with 6 degrees of freedom to simulate the fat-tails in the estimates, but the results are not significantly different from those in Panel A of Table 3.

form 20 portfolios. Then a transition matrix is calculated to show the proportions of stocks whose true beta ranks are predicted by their estimated beta ranks. If the estimation errors are zero, we expect the diagonal elements of the transition matrix to be one and the off-diagonal elements to be zero. The process is repeated 1000 times.

The transition matrix in panel A of Table 3 shows that the estimation errors work differently for the high and low beta portfolios and the middle portfolios. The estimation errors have little impact on the difference in ranks for the extreme portfolios while the middle beta portfolios show up to 24% difference simply because of the estimation errors. Despite their larger standard errors, stocks with large (small) estimated betas show quite accurate information for the ranks of the true betas; the stocks that are assigned to the highest ranked portfolio with their sample betas truly belong to the rank in 98% of cases. This is because the estimates of betas in the extreme portfolios are far higher (lower) than their estimation errors.

The results suggest that even if there is no change in the true beta ranks between pre- and post-formation portfolios, using estimated betas could affect the cross-sectional relationship between betas and returns because the effects of the estimation errors in betas work differently for the high (and low) and the middle portfolios.

2.2.2 Persistence in the Beta Ranks

In the Fama-MacBeth procedure, individual stocks' beta ranks are assumed not to change significantly over the subsequent 12 months. It is supported by high persistence in betas in many studies such as Gomes, Kogan and Zhang (2003) and Ang and Chen (2005). However, most of these results are for portfolios, and the impact of changing betas on the beta ranking of individual stocks is not yet known.[5]

In order to investigate how many stocks in a beta-ranked portfolio remain in the same portfolio a year later, I use the following two-step procedure: first, estimate the transition in beta ranks using estimated betas, and then remove the effects of estimation errors. Under the assumption that estimation errors are not related to the transition in true beta ranks, the following relationship holds;

[5] There are several studies on the effects of grouping stocks on testing asset pricing models. As explained by Lo and Mackinlay (1990) and Berk (2000), we could face data snooping biases in testing asset pricing models if the grouping is based on characteristics identified within the sample. See Grauer and Janmaat (2004) for various unintended consequences of grouping.

$$\mathrm{P}_{E\times E} = \mathrm{P}_{E\times T}\mathrm{P}_{T\times T}\mathrm{P}_{T\times E}, \tag{2}$$

where $\mathrm{P}_{E\times E}$ is the transition matrix of beta ranks calculated with estimated betas, $\mathrm{P}_{E\times T} = \mathrm{P}_{T\times E}'$ is the transition matrix of beta ranks that reflects the estimation errors, and $\mathrm{P}_{T\times T}$ is the transition matrix of the true beta ranks. For given $\mathrm{P}_{E\times E}$ and $\mathrm{P}_{E\times T}$, we can calculate the transition matrix of the true beta ranks as follows;

$$\mathrm{P}_{T\times T} = \mathrm{P}_{E\times T}^{-1}\mathrm{P}_{E\times E}\mathrm{P}_{T\times E}^{-1}, \tag{3}$$

where $\mathrm{P}_{E\times T}$ is calculated in panel A of Table 3 and $\mathrm{P}_{E\times E}$ is calculated as follows. In June of each year I assign ranks (from 1 to 20) to individual stocks based on their estimated betas. As in the previous section, betas are estimated for all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files, using at least 24 of 60 past monthly returns. The CRSP value and equally weighted market portfolios are used as the market portfolio, and the NYSE stocks are used for beta breakpoints. The procedure is repeated every year from June 1928 to June 2005. Then the transition matrix of beta ranks calculated with estimated betas ($\mathrm{P}_{E\times E}$) is calculated from the proportion of stocks that move from one rank to another over 12 months.[6]

Somewhat unexpectedly, the matrix $\mathrm{P}_{T\times T}$ in Panel B of Table 3 shows that the proportion of stocks that remain in the same rank is as low as 17%. The vast majority of stocks move to neighbouring ranks. Of course, stocks tend to remain in the same ranks over shorter horizons. The transition matrix over 6 months ($\mathrm{P}_{T\times T}^{S}$) can be estimated from the annual transition matrix as follows;

$$\mathrm{P}_{T\times T}^{S} = (\mathrm{P}_{T\times T})^{1/2},$$

which is reported in Panel C of Table 3.[7] But still up to 70% of stocks move to the other ranks over six months. When Fama and MacBeth (1973) use estimated betas to form beta-ranked portfolios and then use post-formation betas and returns in their analysis, the transition matrix can be calculated as follows;

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[6] I calculate the transition probability matrices using betas calculated with the CRSP value and equal weighted market portfolios for the various sample periods in Table 1. The results are similar and thus I report the transition matrix with the CRSP value weighted market portfolio for the entire sample period.

[7] I calculate the semi-annual transition matrix by decomposing the annual transition matrix into eigenvalues and eigenvectors under the assumption that the annual transition matrix is positive definite. However, the transition matrix is not positive definite. The non-positive eigenvalues and their eigenvectors are not used for the calculation of the semi-annual transition matrix. The number of the non-positive eigenvalues is up to 1 out of 20. The semi-annual transition matrix calculated from the annual transition matrix is symmetric, and some off-diagonal elements are negative though they are very small.

$$\mathrm{P}_{Fama-MacBeth} = \mathrm{P}_{E\times T}\mathrm{P}_{T\times T}. \qquad (4)$$

The result of the Fama-MacBeth transition matrix is reported in panel D of Table 3. As expected, the diagonal elements are lower than those in panel B, but the difference is not large.

There is some evidence of asymmetry in the transition probability matrix. Stocks that belong to the lowest and highest ranks tend to stay in the same rank even more than we expect even if we consider that they can move in one direction. Another interesting result in panels B and D is that large beta stocks tend to migrate into smaller beta ranked portfolios while small beta stocks tend to migrate into larger beta ranked portfolios. For instance, stocks that belong to the first three and last three pre-formation portfolios are more likely to move to the middle post-formation portfolios. The 'mean reversion' (betas tend to revert towards 1, the market beta) could be explained by the regression phenomenon. However, the transition matrix in panel B with true betas suggest that most of the mean reversion is attributable to changes in true betas rather than estimation errors.

In order to investigate how changes in ranks vary over time, I calculate mean absolute change in ranks (MACR) for each portfolio from $\mathrm{P}_{E\times E}$. Figure 1 shows that MACRs change dramatically over time, in particular during market crises, e.g., the late 1920s and early 1930s, the 1974 and 1979 Oil shocks, the 1987 crash, and the 1998 Russian Crisis. The cross-sectional relationship between betas and returns may not work well during the crises because of large difference between pre- and post- beta ranks.

Despite the small standard errors of the post-formation portfolio betas in Table 1, the betas and their ranks of individual stocks are noisy and change significantly over time. The assumption that stocks that belong to a beta rank would remain in the same rank a year later does not seem to hold. The results support the argument of Kothari, Shanken, and Sloan (1995) that forming beta ranked portfolios using historical betas could lead to a failure to capture the difference in cross-sectional asset returns. Moreover the transition is not symmetrical and the level of transition changes over time. Clearly there is a nonlinear transition from pre-ranks and post-ranks, which could make testing the CAPM using post-formation portfolios appear not to work.

2.2.4 The Effects of Transition in Ranks on Betas and Returns

The large migration in ranks, however, may not affect testing the CAPM as long as the *relationship* between betas and returns is not distorted by the transition. If the transition affects betas and returns differently for the pre- and post-formation portfolios, using the post-formation portfolios may fail to provide evidence of the CAPM even if the CAPM works. Although I analyse the linear relationship over 12 months, reflecting the formation of betas in each year, a similar transformation in the linear relationship between betas and returns is expected over shorter horizons.

As in section 2.2.1, betas and returns (average returns from July t-1 to June t) of all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files are calculated in June every five years from 1931 to 2001. Betas are estimated using at least 24 of 60 past monthly returns. I first form 20 equally weighted pre-formation portfolios using the randomly selected 2000 stocks, and then form 20 equally weighted post-formation portfolios using the rank transition matrix in panel D of Table 3. The post-formation portfolio betas and returns are then regressed on the pre-formation portfolio betas and returns, respectively. The generating and estimating procedure is repeated 10,000 times.

Table 4 clearly shows that in all cases reported the intercept is positive and the slope is less than one. The result that the slope of betas is less than 1 can be interpreted that the regression phenomenon disappears in the port-formation portfolios, as explained by Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973), or as the mean reversion explained in the previous section (Table 3).

More importantly, the transition works differently for betas and returns; the slope from the regression of the post-formation returns on the pre-formation returns is significantly lower than the slope from the regression of the post-formation betas on the pre-formation betas. The results indicate that post-formation portfolios are likely to show a weak (or insignificant) relationship between betas and returns, since the cross-sectional return difference becomes much smaller than the cross-sectional beta difference in the post-formation portfolios. This could partly explain why the spread in returns between high and low post-formation portfolios in Davis, Fama and French (2000) is so 'tiny'. The results hold regardless of the use of value or equal market portfolio returns and for different time periods. They can also explain why the CAPM does not seem to work after 1963 when the slope between the pre- and post-formation returns is far less than that between the pre- and post-formation betas.

2.2.5 Regression Phenomenon

The nonlinear transition in ranks could be avoided by using pre-formation portfolios. However, as pointed out by Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973), forming portfolios on the basis of estimated betas leads to the regression phenomenon. The question I investigate in this section is how much the Fama-MacBeth regression is affected by using pre-formation betas and returns.

Both betas and the standard deviations of regression errors of individual stocks are estimated as explained in Section 2.2.1. Then monthly returns of individual stocks are generated using the betas and the standard deviations of regression errors from the randomly selected 2000 cases. I use one month Treasury Bill and the CRSP value or equally weighted returns to calculate excess market returns. Idiosyncratic errors are generated from the normal distribution with the standard deviation of regression errors.[8] For the generated individual stock returns, I follow the procedure of the Fama-MacBeth regression to test the CAPM: construct 20 equally weighted portfolios using estimated betas of individual stocks (using 60 monthly returns), calculate the true betas of the portfolios, pre- and post-formation returns and their betas, and perform the cross-sectional regression. By making alphas zero and not allowing any other factors except for the market portfolio, we can concentrate on the effects of the regression phenomenon on the Fama-MacBeth regression. The generating and estimating procedure is repeated 10,000 times.

Table 5 reports that when true betas are used, the Fama-MacBeth regression coefficients are not significantly different from what we expect; i.e., zero for the intercept and the average excess market return for the slope.[9] As claimed by Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973), using pre-formation portfolios results in bias in the Fama-MacBeth regression; the intercept is positively biased while the estimated risk premium is negatively biased. We do not have such a bias with post-formation portfolios.

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[8] Idiosyncratic errors are also generated using the *t*-distribution with 6 degrees of freedom (equivalent to excess kurtosis of 3) to reflect the non-normality of individual stock returns, but the results with the *t*-distribution are not different from those with the normal distribution. The effects of non-normality on the portfolio returns become trivial because of the central limit theorem.

[9] The results from the Fama-MacBeth regression with the true betas for the post-formation portfolios are not different from those for the pre-formation portfolios.

Our interest in this exercise is twofold; the magnitude of bias and whether or not the coefficient on betas becomes insignificant because of the bias. The bias of the estimated risk premium ranges from 0.08% per month (Fama-French period) to 0.16% (before 1963) for the value weighted market portfolio while it ranges from 0.1% (Fama-French period) to 0.18% (before 1963) for the equally weighted market portfolio. However, these are equivalent to 1-2% in annual terms, which is not large enough to dismiss the role of betas in the cross-sectional asset pricing even if we use pre-formation portfolios. The coefficients on betas are always positive and significant regardless of the sample periods. Therefore, as pointed out by Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973), the coefficient on betas indeed decreases when pre-formation portfolios are used, but the effects are not strong enough to make the positive cross-sectional relationship between betas and returns insignificant.

3 A New Test for the Cross-sectional Relationship between Betas and Asset Returns

The problems discussed in the previous section indicate that the cross-sectional relationship between betas and returns may be stronger than is suggested in previous studies. In this section I first introduce the new test procedure for the cross-sectional relationship between betas and asset returns. Tests of the robustness of the results follow.

3.1 A New Test Procedure

I propose testing the cross-sectional relationship between betas and returns as follows. First, 20 equally weighted portfolios are formed in June of year *t* using stocks with 24 past monthly returns for all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files. As in the previous section betas are estimated as the sum of the slopes in the regression of excess returns on the current and prior month's excess market returns. For the consistency of these portfolios and the market portfolios, the 20 portfolios are formed with an equal number of individual stocks, and the market portfolio (r_{mt}^{24E}) is formed by equally weighting these 20 portfolios. Pre-formation returns are obtained for the period from July of year t-1 to June of year t. Alphas and betas are re-estimated by regressing the pre-formation returns on the market portfolio returns (r_{mt}^{24E}).

I propose using the pre-formation portfolios despite the regression phenomenon. The regression phenomenon creates upward bias in the intercept and downward bias in the slope in the cross-sectional regression, but is not significant enough to purge the relationship between betas and returns. Moreover using pre-formation portfolios avoids the asymmetric transition in betas and returns from the pre-formation portfolios to the post-formation portfolios. By fixing the number of past returns (24 months), we can construct 20 pre-formation portfolios and the market portfolio in a consistent way without a significant reduction in the number of stocks; on average the number of stocks in the new procedure is 2,162.

One may be interested in how different the market portfolio (r_{mt}^{24E}) constructed from the 20 equally weighted portfolios is from the conventional (CRSP) market portfolio. Roll and Ross (1994) and Kandel and Stambaugh (1995) show that the choice of the market portfolio is critical in testing the CAPM. However neither r_{mt}^{24E} nor the CRSP market portfolio represents the market portfolio in the CAPM, and thus testing the CAPM is not possible. (see also Grauer and Janmaat, 2004). Instead I focus on the relationship between betas and returns, which should be investigated free from the various problems pointed out in the previous section. It is important, however, to examine how close the calculated market portfolio in this study is to the CRSP equally weighted market portfolio returns (r_{mt}^{CSRPEW}) and value weighted market portfolio returns (r_{mt}^{CSRPVW}). As expected r_{mt}^{24E} is close to r_{mt}^{CRSPEW} rather than r_{mt}^{CRSPVW} ; for the entire sample period (924 monthly returns from July 1928 to June 2005) the correlation between r_{mt}^{CSRPEW} and r_{mt}^{24E} is 0.998 while that between r_{mt}^{CSRPVW} and r_{mt}^{24E} is 0.908. The regression results of r_{mt}^{24E} on the CRSP market returns are

$$r_{mt}^{24E} = \underset{(0.0002)}{0.0006} + \underset{(0.0041)}{1.0175}\, r_{mt}^{CRSPEW} + e_{mt}^{EW}, \text{ and}$$

$$r_{mt}^{24E} = \underset{(0.0011)}{0.0029} + \underset{(0.0441)}{1.268}\, r_{mt}^{CRSPVW} + e_{mt}^{VW},$$

where the numbers in brackets are Newey-West heteroskedasticity consistent standard errors. These results suggest that r_{mt}^{24E} is larger and more volatile than the CRSP market portfolio returns, in particular, r_{mt}^{CSRPVW}.[10]

Table 6 reports summary statistics for the 20 equally weighted pre-formation portfolios calculated with an equal number of stocks in each portfolio. In all cases the consistency between the pre-formation portfolios and the market portfolio is satisfied; $E_c(\alpha_p)=0$ and $E_c(\beta_p)=1$ since $E_c(r_{pt})=r_{mt}^{24E}$. The cross-sectional differences in returns or betas between the 20 pre-formation portfolios are far larger than those between the 20 post-formation portfolios in Table 1.

The cross-sectional regression results are reported in Table 7. Contrary to Fama and French (1992, 1993, 1996), the relationship between the pre-formation returns and betas is strong and beta is priced. The risk premia appear to be slightly smaller than the average excess market returns, but considering the bias created by the regression phenomenon (see Table 5), the estimated risk premium is very close to the average excess market return. Moreover, the intercept is not significant in all cases. The second column reports the results that obtained with estimated betas calculated with just the past 12 month returns. By using shorter past historical returns, the average number of stocks increases to 2,395. The results are not changed; the intercepts are all not different from zero and the slopes are close to the average excess market returns. The results with 10 pre-formation portfolios in the third column confirm those in the first two columns.

The last three columns of Table 7 show that it is the combination of inconsistency between the market portfolio and beta-ranked portfolios, and transition in beta ranks that leads to the rejection of any relationship between betas and returns. When the pre-formation portfolios are used with the CRSP equally weighted excess market returns (the fourth column), the estimated risk premia are smaller than those with r_{mt}^{24E}, and the adjusted R-bar square values are less than those with r_{mt}^{24E}. The two periods affected significantly by using r_{mt}^{CSRPEW} are the post-1963 and the Fama-French periods, confirming the argument in section 2.1 that the inconsistency between the beta-ranked portfolios and the market portfolio can explain the failure of the cross-sectional

[10] Note that r_{mt}^{24E} is statistically different from r_{mt}^{CSRPEW} and r_{mt}^{CSRPVW} since the Wald test suggests that the intercept and the coefficient are significantly different from 0 and 1, respectively.

relationship between betas and returns during these periods. The results in the two right-hand-side columns in Table 6 are obtained with r_{mt}^{CSRPEW} and r_{mt}^{24E} for the post-formation portfolios rather than the pre-formation portfolios. The results are not different from those in Table 2. However, some improvement comes from using r_{mt}^{24E}. For instance, the risk premium for the Fama-MacBeth period increases and the intercept becomes insignificant for the Fama-French sample period.

3.2 Robustness of the Results

In this section the cross-sectional relationship between betas and returns is investigated in several different ways. First, I investigate whether the relationship between betas and returns holds for value weighted portfolios. I follow a similar procedure to the previous section. I form 20 value weighted portfolios in June of year *t* using stocks with 24 past monthly returns for all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files. NYSE stocks are used for the beta breakpoints. For the consistency of these portfolios and the market portfolios, the market portfolio (r_{mt}^{24V}) is formed by value weighting these 20 portfolios. Pre-formation betas are estimated by regressing the pre-formation returns on the market portfolio returns (r_{mt}^{24V}). Table 8 shows statistics of the 20 portfolios, which are similar to those in panel A of Table 6; portfolio returns increase with their betas. Since there is little difference in the portfolio sizes, I treat the portfolios equally and regress portfolio returns on betas as in the conventional Fama-MacBeth procedure. Panel B of Table 8 shows results very similar to those obtained with equally weighted portfolios. The slopes are significant and close to the average excess market returns, and the intercepts are not different from zero.

Second, I use non-penny stocks in order to avoid the extreme returns associated with microstructure biases and thin trading of penny stocks. At June every year, stocks whose share prices are less than or equal to \$5 are omitted. Other procedures are the same as those in the first column in Table 7. The average number of stocks decreases from 2,162 to 1,527 from the entire sample period. The results in Table 9 are not different from those in the first column of Table 7; the estimated intercepts are not different from zero while the estimated risk premia are significant and close to the average market returns. The results with the non-penny stocks are stronger than those in Table 7 since we have a significant market premium for the Fama-French sample period.

Third, Fama and French (1992) show that betas lose power in the presence of size. I test if the argument they suggest using post-formation holds in the new test. I form 20 size-ranked portfolios and 100 size-beta ranked portfolios in June of year *t*, and then calculate equally weighted pre-formation returns from July of year *t*-1 to June of year *t* for the two portfolios. Pre-formation betas and the market portfolio are calculated in the same way as in the previous section. Then each month, I estimate the following cross-sectional regression of portfolio returns on beta, size or beta and size;

$$r_{pt_m} = \gamma_{0t_m} + \gamma_{1t_m}\beta_p + \gamma_{2t_m} Size_{pt-1} + \xi_{pt_m}, \quad (5)$$

where r_{pt_m} is pre-formation portfolio returns for month t_m, β_p is the full-period pre-formation beta of portfolio *p*, and $Size_{pt-1}$ is the average value of the natural logs of the individual stock capitalisations at the end of June of year *t*-1.

The cross-sectional regression results in Table 10 confirm the relationship between betas and returns. Size has a negative relationship to the 20 pre-formation portfolio returns formed on betas, but the relationship becomes insignificant in the presence of betas. The R-bar square values suggest that it is betas that matter not size. From the results with the 20 pre-formation portfolios formed on size, I find a significant positive relationship between sizes and returns,[11] but a significant negative relationship between betas and returns. When both size and beta are used as independent variables, the regression results do not show the same relationship, indicating that a serious problem can arise in the regression from the high correlation between betas and sizes. The R-bar square values indicate that for the size-ranked portfolios, size is the explanatory variable that should be used. Finally, the regression results with the 100 size- and beta-ranked portfolios support the strong relationship between betas and returns. Size explains the portfolio returns, but in the presence of beta, size becomes insignificant, and all intercepts are also not different from zero.

The cross-sectional difference in returns between the lowest and highest beta portfolios in Table 6 is 2.5% per month for the entire sample period and over 1.5% even

[11] I find that size-ranked pre-formation returns are positively related with sizes while size-ranked post-formation returns are negatively related with sizes. The results suggest a cross-sectional mean reversion in size; large firms which did well in the past slow down in the future while small firms that did not perform well in the past do well in the future.

for the Fama-French period. The cross-sectional difference in returns between the lowest four and highest four beta portfolios is 1.1% per month for the entire sample period and over 0.7% for the Fama-French period. I examine other sample; January 1932 - December 1991 (Chan and Lakonishok, 1993), January 1941 - December 1990 (Kothari, Shanken, and Sloan, 1995), and July 1928 - December 1993 (Fama and French, 1996). The results do not change. In fact there is no sample period that beta fails to explain returns in cross-section. So, I conclude that beta is alive, well and healthy.

5. Discussion and Conclusions

Is the CAPM Alive? The empirical results in the previous section support the strong relationship between betas and returns in cross-section, even in the presence of size. However, the evidence is not enough to firmly support the CAPM. First, there is no assurance that either the market portfolio in this study or other proxy market portfolios used in many empirical studies are consistent with the market portfolio in the CAPM. Second, a close look at the portfolio returns and betas of the 20 pre-formation portfolios in Table 6 (and also panel A of Table 8) reveals a nonlinear relationship between them. To see the relationship, I plot betas and returns of the portfolios in Figure 2. The four pictures in the first row show the relationship between betas and returns in the 20 post-formation portfolios in the conventional way as in Table 1. As explained, alphas are positive and there is little relationship between betas and returns, especially after 1963 and during the Fama-French period. The second row shows the same relationship using the pre-formation portfolios with r_{mt}^{24E} as in Table 6. Although the Fama-MacBeth regression shows that pre-formation returns increase with their betas, the relationship does not appear to be linear and alphas tend to decrease for large beta portfolios. The nonlinearity suggests that beta alone may not be enough to explain the cross-sectional asset returns. Thus I agree with the conclusion Fama and French (1992, 1993) that the CAPM does not hold.

The nonlinearity between betas and returns is not explained by other firm characteristics based factors. I find that the pre-formation betas estimated in the presence of Fama-French's SMB, HML, and momentum (from Kenneth French's data library) do not explain the nonlinearity. The higher moments (co-skewness and co-kurtosis) of Kraus and Litzenberger (1976) and Harvey and Siddique (2000) do improve the CAPM in terms of R-Bar square values, but the nonlinearity does not disappear and the intercept becomes significant. Finally, I allow different betas conditional on market movements; the lower partial moment CAPM developed by Bawa and Lindenberg (1977) and Harlow and Rao (1989). The last row of Figure 2 shows that the relationship between the downside and upside betas and their returns is linear, and the slope for the downside betas are steeper than that for the upside betas. However, the intercept is always positive and significant. [12] The lower partial moment CAPM explains the nonlinearity in the CAPM but at the price of a positive intercept.

There are many other issues in empirical tests of the CAPM, but my approach in this study focuses on the way the market portfolio is constructed without mentioning efficiency of the market portfolio. I show that if the market model in (1) or other models such as the Fama-French three factor model holds and the beta of one portfolio is larger than that of another, there should be a return difference between the two portfolios due to the beta difference. Of course when this argument is extended to the entire asset classes, the simple approach is not different from the theoretical approach.

An important implication of the results relates to whether or not we can use beta to forecast asset returns. The conventional cross-sectional asset pricing tests proposed by Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973) do in fact make use of the CAPM for out-of-sample forecasting. The results in this study show that although the relationship between betas and returns hold firmly during the pre-formation period, the relationship can not be used to create a successful hedge portfolio such as the momentum strategy because the relationship changes over a short time period. To be a successful hedge fund we require a characteristic that shows cross-sectional distinction in returns and does not easily change over time. Betas lack the second component.

[12] However, this result does not suggest that the lower partial moment CAPM does not work, since our 20 portfolios are beta-ranked, not downside or upside beta ranked.

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Table 1 Properties of Portfolios Formed on Pre-Ranking Beta

The portfolios are formed in June of year t using betas estimated with at least 24 to 60 past monthly returns. As in Fama and French (1992), all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files from the Centre for Research in Security Prices (CRSP) are used, and NYSE stocks are used for the beta breakpoints. For the market returns the CRSP value weighted portfolio returns are used. Betas are estimated as the sum of the slopes in the regression on the current and prior month's excess market returns. For each of these portfolios equally weighted returns are calculated to get post-formation returns from July of year t to June of year t+1. Alphas and betas are estimated using the post-formation returns on CRSP value weighted portfolio returns.

	Low	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	High	Excluded Stocks
A. Entire Sample Period: July 1928 - June 2005, 924 Monthly Observations																					
Excess Returns	0.916	0.809	0.967	0.982	0.973	1.026	1.066	1.131	1.153	1.137	1.123	1.102	1.077	1.158	1.216	1.159	1.178	1.149	1.182	1.165	0.765
STEs	0.186	0.164	0.181	0.186	0.192	0.203	0.215	0.233	0.241	0.252	0.253	0.268	0.270	0.276	0.312	0.312	0.323	0.343	0.367	0.418	0.266
Alphas	0.475	0.328	0.419	0.423	0.381	0.410	0.414	0.418	0.419	0.370	0.342	0.285	0.257	0.333	0.282	0.223	0.218	0.140	0.130	0.017	-0.005
	(0.134)	(0.084)	(0.083)	(0.089)	(0.082)	(0.092)	(0.099)	(0.102)	(0.108)	(0.112)	(0.107)	(0.119)	(0.122)	(0.132)	(0.151)	(0.148)	(0.159)	(0.174)	(0.198)	(0.248)	(0.141)
Betas	0.714	0.779	0.887	0.905	0.958	0.998	1.057	1.155	1.188	1.242	1.265	1.323	1.328	1.335	1.511	1.515	1.553	1.633	1.704	1.859	1.247
	(0.024)	(0.015)	(0.015)	(0.016)	(0.015)	(0.017)	(0.018)	(0.018)	(0.019)	(0.020)	(0.019)	(0.021)	(0.022)	(0.024)	(0.027)	(0.027)	(0.029)	(0.031)	(0.036)	(0.045)	(0.025)
Regression Error	4.057	2.546	2.504	2.677	2.483	2.776	2.977	3.070	3.250	3.386	3.229	3.588	3.693	3.980	4.547	4.460	4.803	5.256	5.988	7.480	4.264
R-Bar Square	0.485	0.741	0.793	0.777	0.819	0.798	0.793	0.812	0.803	0.804	0.824	0.806	0.798	0.774	0.771	0.779	0.761	0.746	0.712	0.653	0.723
Ln(Firm Size)	11.17	11.62	11.44	11.44	11.31	11.19	11.11	11.06	10.93	10.83	10.74	10.65	10.51	10.37	10.25	10.09	9.92	9.79	9.62	9.25	10.10
Number of Stocks	85	100	107	112	112	113	114	116	114	113	116	117	121	124	125	128	135	141	151	135	483
B. Before 1963: July 1928 - June 1963, 420 Monthly Observations																					
Excess Returns	0.924	0.799	1.100	1.090	1.081	1.131	1.296	1.291	1.375	1.391	1.277	1.312	1.302	1.354	1.583	1.356	1.392	1.468	1.379	1.439	0.985
STDs	0.272	0.293	0.339	0.346	0.355	0.376	0.398	0.437	0.452	0.475	0.471	0.500	0.496	0.499	0.590	0.568	0.582	0.614	0.642	0.722	0.432
Alphas	0.377	0.131	0.315	0.301	0.244	0.266	0.382	0.274	0.334	0.294	0.175	0.153	0.156	0.217	0.248	0.054	0.061	0.076	-0.052	-0.133	0.008
	(0.164)	(0.121)	(0.129)	(0.145)	(0.120)	(0.149)	(0.159)	(0.161)	(0.178)	(0.185)	(0.169)	(0.190)	(0.191)	(0.208)	(0.254)	(0.229)	(0.239)	(0.264)	(0.295)	(0.358)	(0.188)
Betas	0.679	0.831	0.975	0.981	1.040	1.075	1.136	1.264	1.294	1.363	1.370	1.441	1.424	1.413	1.660	1.618	1.655	1.729	1.779	1.955	1.214
	(0.025)	(0.018)	(0.019)	(0.022)	(0.018)	(0.023)	(0.024)	(0.024)	(0.027)	(0.028)	(0.026)	(0.029)	(0.029)	(0.031)	(0.038)	(0.035)	(0.036)	(0.040)	(0.044)	(0.054)	(0.028)
Regression Error	3.340	2.469	2.627	2.944	2.437	3.040	3.234	3.274	3.611	3.769	3.439	3.871	3.890	4.228	5.171	4.666	4.856	5.361	5.996	7.292	3.815
R-Bar Square	0.642	0.831	0.857	0.828	0.888	0.844	0.843	0.866	0.848	0.850	0.873	0.857	0.853	0.829	0.817	0.839	0.834	0.819	0.793	0.757	0.815

C. After 1963: July 1963 - June 2005, 504 Monthly Observations

Excess Returns	0.910	0.818	0.856	0.893	0.883	0.939	0.875	0.999	0.968	0.926	0.995	0.927	0.890	0.994	0.909	0.994	0.999	0.883	1.018	0.937	0.582
STDs	0.255	0.177	0.174	0.183	0.192	0.201	0.215	0.224	0.231	0.236	0.248	0.259	0.274	0.287	0.294	0.321	0.340	0.366	0.408	0.474	0.330
Alphas	0.550	0.500	0.521	0.539	0.509	0.543	0.454	0.557	0.508	0.455	0.498	0.415	0.357	0.443	0.338	0.381	0.367	0.211	0.294	0.158	-0.022
	(0.204)	(0.114)	(0.100)	(0.104)	(0.107)	(0.108)	(0.118)	(0.120)	(0.122)	(0.124)	(0.128)	(0.140)	(0.152)	(0.165)	(0.164)	(0.186)	(0.208)	(0.228)	(0.266)	(0.340)	(0.206)
Betas	0.779	0.687	0.725	0.767	0.808	0.857	0.910	0.956	0.994	1.019	1.074	1.108	1.153	1.194	1.236	1.326	1.367	1.456	1.568	1.685	1.308
	(0.046)	(0.026)	(0.022)	(0.023)	(0.024)	(0.024)	(0.026)	(0.027)	(0.027)	(0.028)	(0.029)	(0.031)	(0.034)	(0.037)	(0.037)	(0.042)	(0.047)	(0.051)	(0.060)	(0.076)	(0.046)
Regression Error	4.559	2.556	2.229	2.315	2.385	2.416	2.630	2.678	2.719	2.778	2.859	3.122	3.392	3.687	3.660	4.160	4.654	5.085	5.943	7.587	4.600
R-Bar Square	0.365	0.587	0.676	0.684	0.694	0.713	0.702	0.715	0.725	0.726	0.736	0.713	0.695	0.674	0.692	0.667	0.629	0.618	0.578	0.493	0.614

D. Fama and MacBeth (1973): January 1935 - December 1968, 408 Monthly Observations

Excess Returns	1.151	0.954	1.214	1.195	1.202	1.187	1.376	1.391	1.477	1.439	1.351	1.428	1.384	1.596	1.522	1.591	1.542	1.614	1.613	1.636	1.261
STDs	0.184	0.187	0.200	0.220	0.231	0.251	0.275	0.290	0.300	0.306	0.312	0.346	0.337	0.368	0.399	0.402	0.407	0.425	0.456	0.499	0.303
Alphas	0.530	0.239	0.434	0.338	0.273	0.194	0.292	0.249	0.287	0.250	0.120	0.106	0.074	0.204	0.020	0.069	-0.005	0.030	-0.018	-0.141	0.083
	(0.115)	(0.084)	(0.083)	(0.093)	(0.080)	(0.097)	(0.109)	(0.114)	(0.113)	(0.129)	(0.122)	(0.159)	(0.143)	(0.176)	(0.194)	(0.190)	(0.190)	(0.212)	(0.255)	(0.283)	(0.127)
Betas	0.654	0.753	0.821	0.901	0.976	1.044	1.141	1.201	1.252	1.251	1.295	1.390	1.378	1.464	1.580	1.601	1.627	1.666	1.716	1.869	1.240
	(0.025)	(0.018)	(0.018)	(0.020)	(0.017)	(0.021)	(0.024)	(0.025)	(0.025)	(0.028)	(0.027)	(0.035)	(0.031)	(0.038)	(0.042)	(0.041)	(0.041)	(0.046)	(0.056)	(0.062)	(0.028)
Regression Error	2.270	1.669	1.649	1.847	1.580	1.921	2.161	2.256	2.234	2.554	2.406	3.137	2.817	3.470	3.832	3.752	3.756	4.192	5.046	5.598	2.518
R-Bar Square	0.626	0.804	0.833	0.828	0.885	0.856	0.849	0.851	0.864	0.829	0.854	0.799	0.829	0.782	0.774	0.786	0.791	0.761	0.700	0.692	0.830

E. Fama and French (1992): July 1963 - December 1990, 330 Monthly Observations

Excess Returns	0.517	0.528	0.642	0.680	0.675	0.701	0.630	0.766	0.770	0.676	0.701	0.634	0.598	0.691	0.643	0.693	0.660	0.621	0.635	0.483	0.546
STDs	0.245	0.210	0.222	0.237	0.249	0.264	0.278	0.288	0.303	0.309	0.322	0.328	0.344	0.366	0.366	0.393	0.405	0.433	0.452	0.492	0.373
Alphas	0.281	0.295	0.381	0.396	0.379	0.385	0.299	0.420	0.410	0.309	0.317	0.250	0.197	0.274	0.219	0.243	0.206	0.140	0.135	-0.032	0.138
	(0.172)	(0.118)	(0.107)	(0.107)	(0.117)	(0.119)	(0.129)	(0.130)	(0.141)	(0.144)	(0.147)	(0.160)	(0.171)	(0.194)	(0.185)	(0.206)	(0.224)	(0.244)	(0.257)	(0.308)	(0.216)
Betas	0.700	0.692	0.774	0.845	0.877	0.939	0.980	1.025	1.066	1.089	1.142	1.141	1.190	1.239	1.258	1.335	1.346	1.428	1.483	1.529	1.212
	(0.038)	(0.026)	(0.024)	(0.023)	(0.026)	(0.026)	(0.028)	(0.029)	(0.031)	(0.031)	(0.032)	(0.035)	(0.037)	(0.042)	(0.041)	(0.045)	(0.049)	(0.053)	(0.056)	(0.067)	(0.047)
Regression Error	3.109	2.147	1.946	1.930	2.124	2.157	2.344	2.361	2.559	2.607	2.667	2.897	3.103	3.513	3.359	3.740	4.055	4.420	4.650	5.582	3.913
R-Bar Square	0.513	0.684	0.767	0.800	0.780	0.798	0.785	0.797	0.783	0.784	0.792	0.764	0.754	0.721	0.745	0.726	0.696	0.685	0.679	0.609	0.666

Table 2 Fama-MacBeth Regression Results for the Portfolios Formed on Betas

The post-formation portfolios are formed in the same way as in Table 1 using all firms in the CRSP data file and nonfinancial firms. For each case, CRSP value weighted and equally weighted market returns are used. The post-formation returns are then cross-sectionally regressed on betas each month, and the average estimates of the corss-sectional regression coefficients and their standard errors are calculated. The results in the last column are obtained with 21 post-formation portfolios, 20 of which are the same as those in the 'Value Weighted CRSP, Nonfinancials' and one of which is calculated with returns of excluded stocks. The portfolio of the excluded stocks is formed at June of each year using the stocks whose avilable monthly returns are less than 24 for the past 60 months, and its post-formation returns are calculate from July to June next year using individual stocks available each month. The numbers in bold fonts represent significance at the 5% level.

	20 Post-Ranking Portfolios								20 Post-Ranking Portfolios and 1 Portfolio Formed with Excluded Stocks	
	Value Weighted CRSP, All Firms		Value Weighted CRSP, Nonfinancials		Equally Weighted CRSP, All Firms		Equally Weighted CRSP, Nonfinancials		Value Weighted CRSP, Nonfinancials	
	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics
A. Entire Sample Period: July 1928 - June 2005										
Excess Market Return	0.618		0.618		0.992		0.992		0.618	
γ_0	**0.709**	4.606	**0.731**	4.694	**0.524**	3.540	**0.578**	3.903	**0.716**	4.601
γ_1	0.312	1.264	0.283	1.130	**0.572**	1.989	0.505	1.748	0.283	1.129
B. Before 1963: July 1928 - June 1963										
Excess Market Return	0.805		0.805		1.220		1.220		0.805	
γ_0	**0.609**	2.467	**0.607**	2.448	**0.503**	2.174	**0.503**	2.164	**0.581**	2.310
γ_1	0.497	1.224	0.495	1.208	0.763	1.499	0.757	1.482	0.506	1.234
C. After 1963: July 1963 - June 2005										
Excess Market Return	0.462		0.462		0.799		0.799		0.462	
γ_0	**0.745**	3.859	**0.819**	4.105	**0.558**	3.159	**0.656**	3.680	**0.855**	4.261
γ_1	0.191	0.609	0.103	0.317	0.403	1.304	0.280	0.895	0.054	0.166
D. Fama and MacBeth (1973): January 1935 - December 1968										
Excess Market Return	0.951		0.951		1.376		1.376		0.951	
γ_0	**0.722**	3.723	**0.733**	3.672	**0.633**	3.543	**0.632**	3.460	**0.726**	3.603
γ_1	0.513	1.663	0.516	1.651	**0.729**	2.063	**0.747**	2.097	0.518	1.655
E. Fama and French (1992): July 1963 - December 1990										
Excess Market Return	0.337		0.337		0.580		0.580		0.337	
γ_0	**0.628**	2.899	**0.646**	2.905	**0.423**	2.123	**0.473**	2.358	**0.651**	2.916
γ_1	0.009	0.023	0.001	0.003	0.216	0.573	0.177	0.467	-0.008	-0.020

Table 3 Transition Matrix in Ranks between Pre- and Post-Ranked Portfolios

A. The Effects of Estimation Errors in Beta Ranks

Both betas and their standard errors of all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files from the CRSP are estimated with at least 24 to 60 past monthly returns every 5 years from June 1931 to June 2001. A total number of 44598 stocks are used. In the simulation, these estimated betas are treated as the true betas, and the sample betas are generated using the standard errors of the estimated betas as follows. I first randomly select 2000 stocks, and then 2000 random numbers are generated from the mean zero normal distribution whose standard deviation is set equal to the standard errors of the estimated betas of the selected stocks. The generated randomly numbers are added to the 2000 estimated betas to create sample betas. Then I calculate the proportions of stocks that the sample betas predicte the true ranks of the stocks. The process is repeated 1000 times.

		True Beta Ranks																			
		Low	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	High
Sample (Estimated) Beta Ranks	Low	**0.97**	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.03	**0.93**	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3	0.00	0.05	**0.89**	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.06	**0.86**	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5	0.00	0.00	0.00	0.08	**0.83**	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6	0.00	0.00	0.00	0.00	0.09	**0.81**	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7	0.00	0.00	0.00	0.00	0.00	0.10	**0.79**	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8	0.00	0.00	0.00	0.00	0.00	0.00	0.10	**0.78**	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	**0.77**	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	**0.76**	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	**0.76**	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	**0.77**	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	**0.78**	0.10	0.00	0.00	0.00	0.00	0.00	0.00
	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	**0.79**	0.10	0.00	0.00	0.00	0.00	0.00
	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	**0.81**	0.09	0.00	0.00	0.00	0.00
	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	**0.82**	0.08	0.00	0.00	0.00
	17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	**0.85**	0.07	0.00	0.00
	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	**0.88**	0.05	0.00
	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	**0.93**	0.02
	High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	**0.98**

B. Transition Matrix in Beta Ranks over 12 Months

In June of each year (from June 1928 to June 2005) I assign ranks (from 1 to 20) to all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files based on their estimated betas which are estimated using at least 24 to 60 past monthly returns on the CRSP value weighted market portfolios. The NYSE stocks are used for beta breakpoints. Then the transition matrix based on the estimated betas is calculated to show the proportion of stocks that move from one rank to another over 12 months. Then I use the following equation to obtain the transition matrix in beta ranks.

$$P_{T\times T} = P^{-1}_{E\times T} P_{E\times E} P^{-1}_{T\times E},$$

where $P_{E\times T} = P_{T\times E}'$ is in panel A of Table 1 and $P_{E\times E}$ is the transition matrix based on the estimated betas.

		Post-Ranks of True Betas																			
		Low	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	High
Pre-Ranks of True Betas	Low	**0.56**	0.21	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.11	**0.40**	0.24	0.09	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3	0.04	0.15	**0.33**	0.21	0.09	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	4	0.02	0.06	0.14	**0.29**	0.19	0.10	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5	0.01	0.04	0.06	0.15	**0.25**	0.17	0.10	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00
	6	0.01	0.02	0.05	0.08	0.15	**0.22**	0.18	0.09	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00
	7	0.01	0.01	0.03	0.05	0.09	0.15	**0.20**	0.16	0.10	0.06	0.04	0.03	0.03	0.01	0.02	0.01	0.01	0.00	0.00	0.00
	8	0.01	0.01	0.02	0.03	0.06	0.08	0.14	**0.19**	0.15	0.10	0.06	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00
	9	0.00	0.01	0.01	0.02	0.04	0.06	0.08	0.15	**0.19**	0.14	0.10	0.06	0.05	0.03	0.02	0.02	0.01	0.01	0.00	0.00
	10	0.01	0.01	0.01	0.01	0.02	0.05	0.05	0.09	0.13	**0.18**	0.14	0.10	0.06	0.05	0.03	0.02	0.01	0.01	0.01	0.00
	11	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.15	**0.17**	0.14	0.11	0.07	0.05	0.02	0.02	0.01	0.00	0.00
	12	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.07	0.08	0.15	**0.17**	0.15	0.09	0.06	0.04	0.03	0.02	0.01	0.00
	13	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.16	**0.17**	0.15	0.10	0.06	0.04	0.02	0.01	0.00
	14	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.16	**0.19**	0.15	0.09	0.06	0.03	0.02	0.00
	15	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.10	0.15	**0.21**	0.16	0.10	0.05	0.03	0.01
	16	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.05	0.06	0.09	0.16	**0.23**	0.17	0.09	0.05	0.01
	17	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.04	0.06	0.10	0.17	**0.26**	0.17	0.08	0.02
	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.11	0.20	**0.31**	0.18	0.04
	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.02	0.02	0.04	0.08	0.22	**0.42**	0.15
	High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.03	0.06	0.23	**0.64**

C. Transition Matrix in Beta Ranks over 6 Months

The transition matrix in beta ranks in panel B of Table 3 is used to calculate the transition matrix in beta ranks over 6 months as follows.

$$\mathrm{P}^{S}_{T\times T} = (\mathrm{P}_{T\times T})^{1/2}$$

Pre-Ranks of True Betas	Post-Ranks of True Betas																			
	Low	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	High
Low	**0.74**	0.08	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.08	**0.62**	0.12	0.04	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.02	0.12	**0.54**	0.12	0.04	0.03	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.01	0.04	0.12	**0.50**	0.14	0.05	0.03	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.01	0.02	0.04	0.14	**0.45**	0.16	0.06	0.04	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.01	0.01	0.03	0.05	0.16	**0.40**	0.16	0.05	0.04	0.03	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.01	0.01	0.03	0.06	0.16	**0.38**	0.16	0.05	0.03	0.03	0.02	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00
8	0.00	0.00	0.01	0.02	0.04	0.05	0.16	**0.34**	0.18	0.08	0.03	0.01	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00
9	0.00	0.01	0.00	0.01	0.02	0.04	0.05	0.18	**0.34**	0.15	0.07	0.05	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.01	0.00	0.01	0.03	0.03	0.08	0.15	**0.33**	0.18	0.05	0.03	0.04	0.01	0.02	0.01	0.00	0.00	0.00
11	0.00	0.00	0.00	0.01	0.00	0.01	0.03	0.03	0.07	0.18	**0.31**	0.20	0.06	0.03	0.03	-0.01	0.02	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.01	0.05	0.05	0.20	**0.29**	0.21	0.06	0.03	0.05	0.00	0.01	0.01	0.00
13	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.03	0.03	0.06	0.21	**0.28**	0.21	0.07	0.03	0.02	0.01	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.04	0.03	0.06	0.21	**0.34**	0.17	0.05	0.05	0.01	0.01	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.01	0.03	0.03	0.07	0.17	**0.38**	0.18	0.07	0.03	0.01	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	-0.01	0.05	0.03	0.05	0.18	**0.41**	0.16	0.07	0.02	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.02	0.00	0.02	0.05	0.07	0.16	**0.44**	0.19	0.04	0.01
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.03	0.07	0.19	**0.48**	0.20	0.02
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.02	0.04	0.20	**0.59**	0.16
High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.16	**0.79**

D. Transition Matrix in Beta Ranks from Estimated Betas to the True Betas over 12 Months

In order to investigate changes in beta ranks from pre-formation (estimated) betas to postformation betas, I use the following equation.

$$P_{Fama-MacBeth} = P_{E\times T} P_{T\times T} .$$

where $P_{E\times T}$ and $P_{T\times T}$ are in panels A and B of Table 3 respectively.

	Post-Ranks of the True Betas																			
Pre-Ranks Calculated with Estimated Betas	Low	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	High
Low	**0.54**	0.22	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.12	**0.39**	0.24	0.09	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.04	0.15	**0.31**	0.21	0.10	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
4	0.02	0.06	0.14	**0.28**	0.19	0.10	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.01	0.04	0.07	0.16	**0.24**	0.17	0.10	0.07	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00
6	0.01	0.02	0.05	0.08	0.16	**0.21**	0.17	0.10	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
7	0.01	0.01	0.03	0.05	0.09	0.15	**0.19**	0.16	0.10	0.06	0.04	0.03	0.02	0.01	0.02	0.01	0.01	0.00	0.00	0.00
8	0.01	0.01	0.02	0.03	0.06	0.09	0.14	**0.18**	0.15	0.10	0.07	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00
9	0.00	0.01	0.01	0.02	0.04	0.06	0.08	0.15	**0.18**	0.14	0.10	0.07	0.05	0.03	0.02	0.02	0.01	0.01	0.00	0.00
10	0.00	0.01	0.01	0.01	0.02	0.05	0.06	0.10	0.14	**0.17**	0.14	0.10	0.07	0.05	0.03	0.02	0.01	0.01	0.00	0.00
11	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.14	**0.17**	0.14	0.11	0.07	0.05	0.02	0.02	0.01	0.00	0.00
12	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.07	0.09	0.15	**0.16**	0.15	0.10	0.06	0.04	0.03	0.02	0.01	0.00
13	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.15	**0.17**	0.15	0.10	0.06	0.04	0.02	0.01	0.00
14	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.05	0.06	0.10	0.16	**0.18**	0.15	0.10	0.06	0.03	0.02	0.00
15	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.10	0.15	**0.20**	0.16	0.10	0.05	0.03	0.01
16	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.05	0.06	0.09	0.16	**0.22**	0.17	0.09	0.05	0.01
17	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.04	0.06	0.10	0.17	**0.25**	0.17	0.09	0.02
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.11	0.20	**0.30**	0.19	0.05
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.02	0.03	0.04	0.09	0.22	**0.40**	0.15
High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.03	0.06	0.23	**0.63**

Table 4 Changes in Returns and Betas from Pre- and Post- Ranking Beta Portfolios

In June of every year betas and returns (average returns from July *t* -1 to June *t*) of all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files are calculated every five years from 1931 to 2001. Betas are estimated using at least 24 to 60 past monthly returns. I first form 20 equally weighted pre-formation portfolios using the randomly selected 2000 stocks, each of which has 100 stocks. The equally weighted 20 post-formation portfolios are formed using the rank transition matrix in panel D of Table 3. Then the post-formation portfolio betas and returns are regressed on the pre-formation portfolio betas and returns respectively. The generating and estimating procedure is repeated 10,000 times. The numbers in bold fonts represent significance at the 5% level.

	Value Weighted CRSP				Equally Weighted CRSP			
	Post-Ranking Returns are Regressed on Pre-Ranking Returns		Post-Ranking Betas are Regressed on Pre-Ranking Betas		Post-Ranking Returns are Regressed on Pre-Ranking Returns		Post-Ranking Betas are Regressed on Pre-Ranking Betas	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
A. Entire Sample Period: July 1931 - July 2001								
Average Estimates	**0.006**	**0.558**	**0.119**	**0.905**	**0.007**	**0.503**	**0.070**	**0.917**
Standard Error	0.000	0.002	0.000	0.000	0.000	0.002	0.000	0.000
B. Before 1963: July 1931 - June 1961								
Average Estimates	**0.003**	**0.835**	**0.104**	**0.917**	**0.005**	**0.726**	**0.064**	**0.939**
Standard Error	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000
C. After 1963: July 1966 - June 2001								
Average Estimates	**0.007**	**0.500**	**0.161**	**0.875**	**0.007**	**0.470**	**0.105**	**0.891**
Standard Error	0.000	0.002	0.000	0.000	0.000	0.002	0.000	0.000
D. Fama and French (1992): July 1966 - December 1986								
Average Estimates	**0.004**	**0.787**	**0.124**	**0.911**	**0.004**	**0.798**	**0.082**	**0.924**
Standard Error	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000

Table 5 Bias in Fama-MacBeth Regression from Using Betas of Pre- and Post- Ranked Portfolios

Both betas and the standard deviations of regression errors of individual stocks are estimated in June of every 5 years from June 1931 to June 2001 using at least 24 to 60 past monthly returns. I use all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files from the CRSP. I have a total number of 44,598 estimates of betas and the standard deviations of regression errors of which 5,989 estimates come from before 1963 and 38,609 come from after 1963. For the Fama-French period, I have 19,491 estimates. Then monthly returns of 2,000 individual stocks are generated using the randomly selected betas and the standard deviations of regression errors. One month Treasury Bill and the CRSP value or equally weighted returns are used to calculate excess market returns. Idiosyncratic errors are generated using the normal distribution. I construct 20 portfolios using the estimated betas of the generated stocks (60 monthly returns), calculate pre-and post-formation portfolio returns and their betas, and perform the Fama-Macbeth regression. The generating and estimating procedure is repeated 10,000 times. The numbers in bold fonts represent significance at the 5% level.

	Value Weighted CRSP, All Firms						Equally Weighted CRSP, All Firms					
	True Betas on Pre-Formation Portfolios		Estimated Betas on Pre-Formation Portfolios		Estimated Betas on Post-Formation Portfolios		True Betas on Pre-Formation Portfolios		Estimated Betas on Pre-Formation Portfolios		Estimated Betas on Post-Formation Portfolios	
	γ_0	γ_1	γ_0	γ_1	γ_0	γ_1	γ_0	γ_1	γ_0	γ_1	γ_0	γ_1
A. Entire Sample Period: July 1931 - July 2001, Excess Market Return: 0.71							Excess Market Return: 1.09					
Average Estimates	0.000	**0.704**	**0.161**	**0.586**	0.017	**0.685**	0.000	**1.083**	**0.165**	**0.927**	0.017	**1.107**
Standard Error	0.025	0.020	0.026	0.020	0.028	0.023	0.024	0.026	0.025	0.025	0.027	0.030
B. Before 1963: July 1931 - June 1961, Excess Market Return: 1.01							Excess Market Return: 1.47					
Average Estimates	0.001	**1.042**	**0.239**	**0.850**	0.041	**0.962**	0.000	**1.502**	**0.212**	**1.289**	0.043	**1.528**
Standard Error	0.038	0.035	0.037	0.033	0.041	0.039	0.033	0.038	0.034	0.038	0.037	0.049
C. After 1963: July 1966 - June 2001, Excess Market Return: 0.43							Excess Market Return: 0.66					
Average Estimates	0.001	**0.427**	**0.103**	**0.352**	0.008	**0.420**	0.000	**0.663**	**0.130**	**0.541**	-0.007	**0.667**
Standard Error	0.036	0.028	0.034	0.026	0.040	0.031	0.034	0.036	0.032	0.033	0.038	0.039
D. Fama and French (1992): July 1966 - December 1986, , Excess Market Return: 0.32							Excess Market Return: 0.45					
Average Estimates	0.000	**0.297**	**0.083**	**0.236**	-0.021	**0.332**	0.000	**0.474**	**0.129**	**0.348**	-0.017	**0.463**
Standard Error	0.042	0.034	0.039	0.030	0.048	0.037	0.039	0.042	0.037	0.039	0.044	0.046

Table 6 Properties of Pre-Ranking Portfolios

The 20 portfolios are formed in June of year t using betas estimated with 24 past monthly returns for all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files. These 20 beta ranked portfolios are formed with an equal number of individual stocks in each portfolio, and the market portfolio is formed by equally weighting these 20 beta portfolios. As in Table 1 betas are estimated as the sum of the slopes in the regression of excess returns on the current and prior month's excess market returns. Equally weighted pre-formation portfolio returns are calculated from July of year t-1 to June of year t. Alphas and betas are re-estimated by regressing the pre-formation returns on the constructed market portfolio returns.

	Low	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	High
A. Entire Sample Period: July 1928 - June 2005, 924 Monthly Observations, 2163 stocks																				
Returns	1.084	0.724	0.719	0.801	0.761	0.768	0.811	0.794	0.847	0.832	0.902	0.896	0.944	0.963	1.053	1.107	1.254	1.521	1.789	3.518
STDs	0.132	0.126	0.137	0.151	0.168	0.183	0.196	0.211	0.223	0.235	0.251	0.266	0.285	0.305	0.322	0.346	0.372	0.407	0.469	0.646
Alphas	0.845	0.307	0.207	0.217	0.092	0.022	0.006	- 0.083	- 0.091	- 0.162	- 0.170	- 0.244	- 0.278	- 0.345	- 0.328	- 0.375	- 0.328	- 0.197	- 0.141	1.046
	(0.121)	(0.083)	(0.072)	(0.071)	(0.070)	(0.066)	(0.067)	(0.063)	(0.058)	(0.057)	(0.054)	(0.051)	(0.052)	(0.055)	(0.059)	(0.067)	(0.083)	(0.102)	(0.156)	(0.312)
Betas	0.216	0.378	0.464	0.529	0.606	0.676	0.729	0.794	0.850	0.899	0.971	1.032	1.107	1.184	1.250	1.342	1.433	1.556	1.748	2.238
	(0.016)	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.011)	(0.013)	(0.020)	(0.040)
Regression Error	3.652	2.505	2.166	2.127	2.092	2.000	2.004	1.902	1.740	1.718	1.617	1.522	1.571	1.655	1.767	2.011	2.503	3.060	4.679	9.403
R-Bar Square	0.171	0.574	0.731	0.785	0.832	0.871	0.887	0.912	0.934	0.942	0.955	0.965	0.967	0.968	0.967	0.963	0.951	0.939	0.892	0.770
Ln(size)	10.94	11.36	11.40	11.37	11.24	11.20	11.11	10.98	10.94	10.88	10.80	10.69	10.58	10.47	10.34	10.23	10.08	9.89	9.73	9.41
B. Before 1963: July 1928 - June 1963, 420 Monthly Observations																				
Returns	1.112	0.848	0.837	0.927	0.929	0.994	1.027	0.928	1.034	1.068	1.096	1.100	1.181	1.210	1.348	1.302	1.415	1.767	1.838	3.301
STDs	0.193	0.228	0.253	0.280	0.310	0.342	0.365	0.391	0.411	0.432	0.462	0.486	0.520	0.551	0.579	0.614	0.648	0.704	0.794	1.046
Alphas	0.764	0.307	0.197	0.212	0.129	0.099	0.067	- 0.114	- 0.070	- 0.095	- 0.155	- 0.222	- 0.231	- 0.287	- 0.224	- 0.364	- 0.336	- 0.129	- 0.252	0.704
	(0.148)	(0.117)	(0.103)	(0.109)	(0.109)	(0.109)	(0.111)	(0.105)	(0.097)	(0.099)	(0.094)	(0.086)	(0.095)	(0.100)	(0.106)	(0.115)	(0.134)	(0.158)	(0.242)	(0.463)
Betas	0.275	0.428	0.507	0.565	0.634	0.709	0.760	0.825	0.874	0.921	0.990	1.047	1.118	1.185	1.244	1.319	1.386	1.501	1.655	2.056
	(0.016)	(0.012)	(0.011)	(0.012)	(0.012)	(0.011)	(0.012)	(0.011)	(0.010)	(0.011)	(0.010)	(0.009)	(0.010)	(0.011)	(0.011)	(0.012)	(0.014)	(0.017)	(0.026)	(0.049)
Regression Error	3.000	2.385	2.095	2.214	2.222	2.204	2.257	2.127	1.962	2.018	1.909	1.740	1.931	2.030	2.143	2.329	2.724	3.213	4.906	9.408
R-Bar Square	0.424	0.739	0.837	0.851	0.877	0.901	0.909	0.930	0.946	0.948	0.959	0.970	0.967	0.968	0.967	0.966	0.958	0.950	0.909	0.807

C. After 1963: July 1963 - June 2005, 504 Monthly Observations

Returns	1.061	0.621	0.621	0.696	0.620	0.580	0.631	0.683	0.692	0.635	0.741	0.725	0.746	0.756	0.806	0.944	1.120	1.316	1.748	3.699
STDs	0.181	0.133	0.137	0.149	0.169	0.179	0.192	0.207	0.222	0.235	0.253	0.272	0.292	0.319	0.340	0.376	0.417	0.460	0.549	0.801
Alphas	0.969	0.355	0.258	0.256	0.088	- 0.010	- 0.015	- 0.027	- 0.085	- 0.196	- 0.163	- 0.248	- 0.307	- 0.393	- 0.419	- 0.406	- 0.366	- 0.306	- 0.139	1.154
	(0.182)	(0.113)	(0.096)	(0.089)	(0.087)	(0.079)	(0.077)	(0.074)	(0.067)	(0.062)	(0.058)	(0.058)	(0.053)	(0.057)	(0.062)	(0.075)	(0.099)	(0.127)	(0.192)	(0.405)
Betas	0.094	0.274	0.374	0.453	0.547	0.607	0.665	0.731	0.799	0.855	0.930	1.000	1.083	1.182	1.260	1.389	1.529	1.669	1.941	2.617
	(0.030)	(0.019)	(0.016)	(0.015)	(0.014)	(0.013)	(0.013)	(0.012)	(0.011)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.013)	(0.016)	(0.021)	(0.032)	(0.067)
Regression Error	4.028	2.493	2.131	1.982	1.933	1.742	1.704	1.634	1.489	1.382	1.295	1.294	1.180	1.263	1.375	1.670	2.199	2.817	4.258	8.979
R-Bar Square	0.017	0.299	0.522	0.650	0.740	0.812	0.844	0.877	0.911	0.931	0.948	0.955	0.968	0.969	0.968	0.961	0.945	0.926	0.881	0.751

D. Fama and MacBeth (1973): January 1935 - December 1968, 408 Monthly Observations

Returns	1.063	0.857	0.916	1.008	1.065	1.005	1.167	1.073	1.202	1.262	1.167	1.242	1.379	1.327	1.453	1.567	1.628	1.868	2.152	3.409
STDs	0.166	0.163	0.175	0.200	0.208	0.227	0.247	0.253	0.273	0.279	0.303	0.318	0.333	0.357	0.385	0.413	0.431	0.477	0.553	0.787
Alphas	0.623	0.271	0.224	0.189	0.200	0.045	0.105	- 0.025	0.002	0.032	- 0.172	- 0.176	- 0.098	- 0.263	- 0.257	- 0.273	- 0.285	- 0.222	- 0.225	0.305
	(0.138)	(0.102)	(0.090)	(0.090)	(0.087)	(0.085)	(0.084)	(0.078)	(0.072)	(0.070)	(0.074)	(0.064)	(0.075)	(0.073)	(0.086)	(0.085)	(0.095)	(0.129)	(0.184)	(0.402)
Betas	0.317	0.421	0.497	0.589	0.622	0.690	0.764	0.789	0.863	0.885	0.963	1.020	1.062	1.143	1.229	1.323	1.376	1.503	1.710	2.232
	(0.022)	(0.016)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)	(0.012)	(0.011)	(0.011)	(0.012)	(0.010)	(0.012)	(0.012)	(0.014)	(0.013)	(0.015)	(0.020)	(0.029)	(0.064)
Regression Error	2.719	2.014	1.764	1.770	1.705	1.684	1.654	1.528	1.416	1.384	1.454	1.265	1.474	1.440	1.687	1.681	1.868	2.537	3.633	7.921
R-Bar Square	0.340	0.625	0.752	0.809	0.836	0.865	0.891	0.911	0.934	0.940	0.944	0.961	0.952	0.960	0.953	0.959	0.954	0.931	0.894	0.752

E. Fama and French (1992): July 1963 - December 1990, 330 Monthly Observations

Returns	0.651	0.428	0.432	0.505	0.457	0.346	0.457	0.524	0.466	0.470	0.484	0.542	0.540	0.447	0.507	0.666	0.656	0.796	1.101	2.346
STDs	0.196	0.166	0.180	0.198	0.223	0.242	0.259	0.275	0.292	0.310	0.330	0.349	0.369	0.395	0.414	0.451	0.488	0.532	0.599	0.783
Alphas	0.538	0.201	0.138	0.161	0.053	- 0.101	- 0.025	0.007	- 0.086	- 0.122	- 0.148	- 0.126	- 0.169	- 0.310	- 0.287	- 0.196	- 0.272	- 0.207	- 0.012	0.962
	(0.188)	(0.118)	(0.098)	(0.089)	(0.082)	(0.077)	(0.075)	(0.067)	(0.064)	(0.053)	(0.053)	(0.059)	(0.055)	(0.064)	(0.065)	(0.077)	(0.097)	(0.125)	(0.171)	(0.326)
Betas	0.176	0.355	0.460	0.536	0.630	0.696	0.752	0.806	0.861	0.923	0.987	1.041	1.105	1.180	1.238	1.345	1.448	1.565	1.737	2.159
	(0.031)	(0.020)	(0.016)	(0.015)	(0.014)	(0.013)	(0.012)	(0.011)	(0.011)	(0.009)	(0.009)	(0.010)	(0.009)	(0.011)	(0.011)	(0.013)	(0.016)	(0.021)	(0.028)	(0.054)
Regression Error	3.399	2.137	1.765	1.606	1.478	1.389	1.355	1.213	1.154	0.964	0.966	1.063	1.002	1.161	1.179	1.390	1.755	2.262	3.089	5.884
R-Bar Square	0.086	0.498	0.709	0.800	0.867	0.901	0.917	0.941	0.953	0.971	0.974	0.972	0.978	0.974	0.975	0.971	0.961	0.945	0.919	0.829

Table 7 Fama-MacBeth Regression Results for the Equally Weighted Portfolios Formed on Beta

For the proposed test method, the market portfolio is constructed by equally weighting the 20 pre-formation portfolios in Table 6, and then the pre-formation betas of these portfolios are estimated with the constructed market portfolio. The pre-formation returns are cross-sectionally regressed on the betas each month, and the average estimates of the cross-sectional regression coefficients and their standard errors are calculated. The numbers in bold fonts represent significance at the 5% level.

Beta-ranked Portfolios	Pre-Formation		Pre-Formation		Pre-Formation		Pre-Formation		Post-Formation		Post-Formation	
Market Portfolio	Equally Weighted Market Portfolio from the 20 Pre-Formaion Portfolios		Equally Weighted Market Portfolio from the 20 Pre-Formation Portfolios: Betas Estimated with 12 Monthly Returns		Equally Weighted Market Portfolio from the 10 Pre-Formaion Portfolios		CRSP Equally Weighted Market Portfolio		Equally Weighted Market Portfolio from the 20 Pre-Formation Portfolios		CRSP Equally Weighted Market Portfolio	
	Average Estimates	t-statiati	Average Estimates	t-statiatics	Average Estimates	t-statiatic	Average Estimates	t-statiatics	Average Estimates	t-statiatic	Average Estimates	t-statiati
A. Entire Sample Period: July 1928 - June 2005												
Excess Market Return	1.104		1.089		1.104		0.992		1.080		0.992	
γ_0	0.092	0.546	-0.104	-0.511	0.150	0.912	0.283	1.866	**0.520**	3.259	**0.578**	3.903
γ_1	**1.013**	3.335	**1.192**	3.666	**0.953**	3.158	**0.758**	2.655	0.560	1.871	0.505	1.748
R-Bar Square	0.597		0.642				0.578		0.384		0.414	
B. Before 1963: July 1928 - June 1963												
Excess Market Return	1.263		1.262		1.263		1.224		1.259		1.224	
γ_0	0.226	0.874	0.104	0.340	0.275	1.081	0.257	0.997	**0.497**	1.987	**0.503**	2.164
γ_1	**1.037**	1.975	**1.158**	2.104	0.988	1.889	1.005	1.942	0.761	1.456	0.757	1.482
R-Bar Square	0.521		0.578		0.609		0.521		0.335		0.382	
C. After 1963: July 1963 - June 2005												
Excess Market Return	0.972		0.944		0.972		0.799		0.932		0.799	
γ_0	0.060	0.322	-0.149	-0.659	0.121	0.659	0.318	1.922	**0.540**	2.883	**0.656**	3.680
γ_1	**0.912**	2.810	**1.094**	3.110	**0.850**	2.636	0.559	1.895	0.392	1.211	0.279	0.895
R-Bar Square	0.661		0.694		0.725		0.626		0.427		0.445	
D. Fama and MacBeth (1973): January 1935 - December 1968												
Excess Market Return	1.390		1.382		1.390		1.376		1.388		1.376	
γ_0	0.257	1.185	0.236	0.917	0.294	1.389	0.345	1.615	**0.498**	2.560	**0.632**	3.460
γ_1	**1.134**	3.025	**1.146**	2.866	**1.097**	2.950	**0.997**	2.692	**0.890**	2.445	**0.747**	2.097
R-Bar Square	0.545		0.588		0.630		0.541		0.353		0.398	
E. Fama and French (1992): July 1963 - December 1990												
Excess Market Return	0.641		0.632		0.641		0.580		0.619		0.580	
γ_0	0.007	0.032	-0.335	-1.174	0.046	0.229	0.208	1.110	0.344	1.593	**0.473**	2.358
γ_1	0.635	1.634	**0.967**	2.208	0.595	1.540	0.361	0.976	0.275	0.699	0.177	0.467
R-Bar Square	0.647		0.686		0.712		0.621		0.424		0.446	

Table 8 The Robustness Tests Using Value Weights

The value 20 portfolios are formed in June of year *t* using betas estimated with 24 past monthly returns for all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files. NYSE stocks are used for the beta breakpoints. The market portfolio is formed by value weighting these 20 value weighted beta portfolios. As in Table 1 betas are estimated as the sum of the slopes in the regression of excess returns on the current and prior month's excess market returns. Value weighted pre-formation portfolio returns are calculated from July of year *t* -1 to June of year *t* . Pre-fromation betas are re-estimated by regressing the preformation returns on the constructed market portfolio returns. The results in panel B are obtained by cross-sectionally regressing preformation returns on betas each month. The numbers in bold fonts represent significance at the 5% level.

A. Entire Sample Period: July 1928 - June 2005, 924 Monthly Observations, 2161 stocks

	Low	2	3	5	6	7	9	10	11	13	14	15	17	18	19	High
Returns	1.102	0.905	0.821	0.983	1.059	1.090	1.185	1.049	1.137	1.386	1.370	1.419	1.597	1.728	2.147	3.138
STEs	0.124	0.124	0.137	0.169	0.180	0.194	0.215	0.231	0.240	0.277	0.286	0.302	0.346	0.373	0.419	0.532
Alphas	0.694	0.364	0.168	0.115	0.109	0.055	0.022	-0.192	-0.164	-0.102	-0.177	-0.228	-0.264	-0.243	-0.048	0.512
	(0.104)	(0.083)	(0.077)	(0.077)	(0.072)	(0.074)	(0.074)	(0.083)	(0.079)	(0.098)	(0.096)	(0.096)	(0.123)	(0.147)	(0.174)	(0.275)
Betas	0.357	0.475	0.573	0.762	0.834	0.908	1.020	1.089	1.142	1.306	1.357	1.446	1.632	1.730	1.926	2.304
	(0.017)	(0.013)	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.016)	(0.016)	(0.016)	(0.020)	(0.024)	(0.028)	(0.045)
Regression Error	3.102	2.470	2.311	2.288	2.146	2.199	2.210	2.473	2.363	2.917	2.872	2.879	3.679	4.403	5.187	8.214
R-Bar Square	0.326	0.574	0.691	0.802	0.846	0.862	0.886	0.876	0.895	0.880	0.891	0.902	0.878	0.849	0.834	0.742
Ln(Firm Size)	10.50	11.06	11.11	11.05	11.02	11.01	10.89	10.83	10.80	10.65	10.53	10.40	10.17	10.02	9.87	9.55
Ln(Portfolio Size)	18.12	18.27	18.46	18.50	18.49	18.42	18.35	18.32	18.23	18.32	18.11	18.05	18.14	18.02	18.01	17.93

B. Cross-sectional Regression Results

	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics
	Entire Sample Period		Before 1963		After 1963		Fama and MacBeth (1973		Fama and French (1992)	
Excess Market Return	1.140		1.261		1.038		1.231		0.775	
γ_0	0.256	1.756	0.202	0.926	0.319	1.753	0.130	0.647	0.284	1.353
γ_1	**0.934**	3.798	**1.141**	2.652	**0.760**	2.818	**1.118**	3.669	0.510	1.533
R-Bar Square	0.445		0.415		0.473		0.417		0.487	

Table 9 The Robustness Tests Using Non-penny Stocks

The 20 portfolios are formed in June of year t using stocks whose share prices are larger than or equal to $5. Betas estimated with 24 past monthly returns for all nonfinancial firms in the NYSE, AMEX, and NASDAQ return files. These 20 beta ranked portfolios are formed with an equal number of individual stocks in each portfolio, and the market portfolio is formed by equally weighting these 20 beta portfolios. As in Table 1 betas are estimated as the sum of the slopes in the regression of excess returns on the current and prior month's excess market returns. Equally weighted pre-formation portfolio returns are calculated from July of year t-1 to June of year t. Alphas and betas are re-estimated by regressing the pre-formation returns on the constructed market portfolio returns. The results in panel B are obtained by cross-sectionally regressing pre-formation returns on betas each month. The numbers in bold fonts represent significance at the 5% level.

A. Non-penny Stocks for the Entire Sample Period: July 1928 - June 2005, 924 Monthly Observations, 1527 stocks

	Low	2	3	5	6	7	9	10	11	13	14	15	17	18	19	High
Returns	1.210	0.951	0.951	0.931	0.847	1.019	1.088	1.065	1.055	1.237	1.234	1.310	1.562	1.828	2.173	3.707
STEs	0.127	0.130	0.139	0.165	0.179	0.190	0.216	0.231	0.236	0.269	0.283	0.301	0.344	0.376	0.424	0.554
Alphas	0.847	0.385	0.281	0.080	-0.091	0.013	-0.078	-0.185	-0.235	-0.232	-0.317	-0.343	-0.319	-0.196	-0.083	0.954
	(0.111)	(0.082)	(0.071)	(0.066)	(0.064)	(0.062)	(0.057)	(0.056)	(0.051)	(0.057)	(0.058)	(0.058)	(0.072)	(0.102)	(0.132)	(0.258)
Betas	0.272	0.424	0.502	0.637	0.702	0.753	0.873	0.937	0.966	1.101	1.162	1.238	1.409	1.516	1.690	2.062
	(0.015)	(0.011)	(0.010)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.010)	(0.014)	(0.018)	(0.035)
Regression Error	3.316	2.460	2.122	1.964	1.921	1.849	1.691	1.665	1.510	1.714	1.743	1.728	2.139	3.059	3.951	7.710
R-Bar Square	0.261	0.610	0.747	0.847	0.876	0.898	0.934	0.944	0.956	0.956	0.959	0.964	0.958	0.928	0.906	0.791
Ln(Firm Size)	11.72	11.95	11.95	11.84	11.70	11.62	11.44	11.48	11.29	11.26	11.14	11.03	10.81	10.70	10.55	10.32

B. Cross-sectional Regression Results

	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics
	Entire Sample Period		Before 1963		After 1963		Fama and MacBeth (1973		Fama and French (1992)	
Excess Market Return	1.335		1.371		1.305		1.470		0.924	
γ_0	0.131	0.846	0.189	0.869	0.169	0.896	0.224	1.167	0.081	0.408
γ_1	**1.204**	4.231	**1.182**	2.454	**1.136**	3.596	**1.246**	3.558	**0.843**	2.210
R-Bar Square	0.584		0.510		0.645		0.542		0.627	

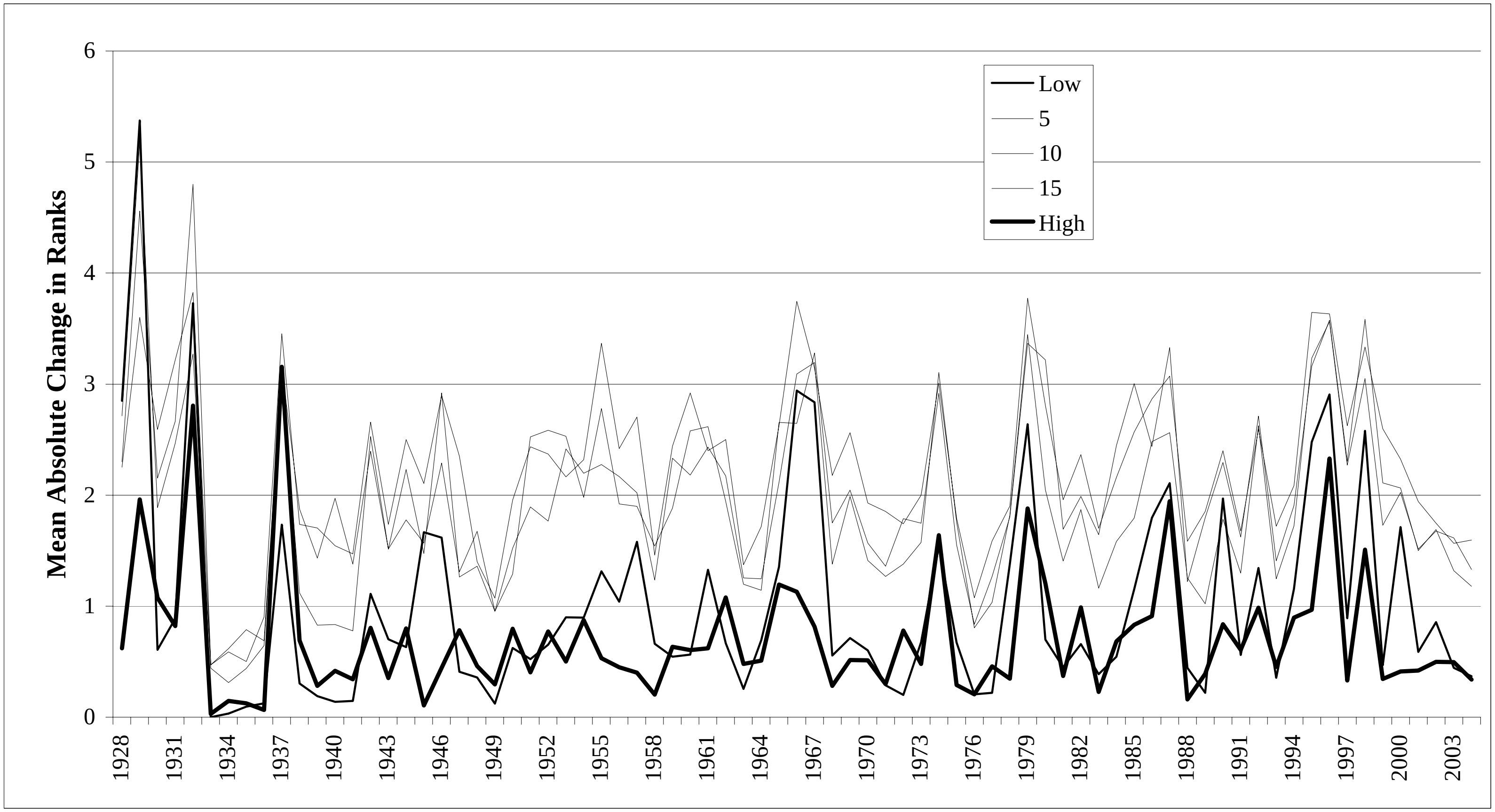
Table 10 Cross-sectional Regression Results for the Equally Weighted Portfolios Formed on Size and Beta

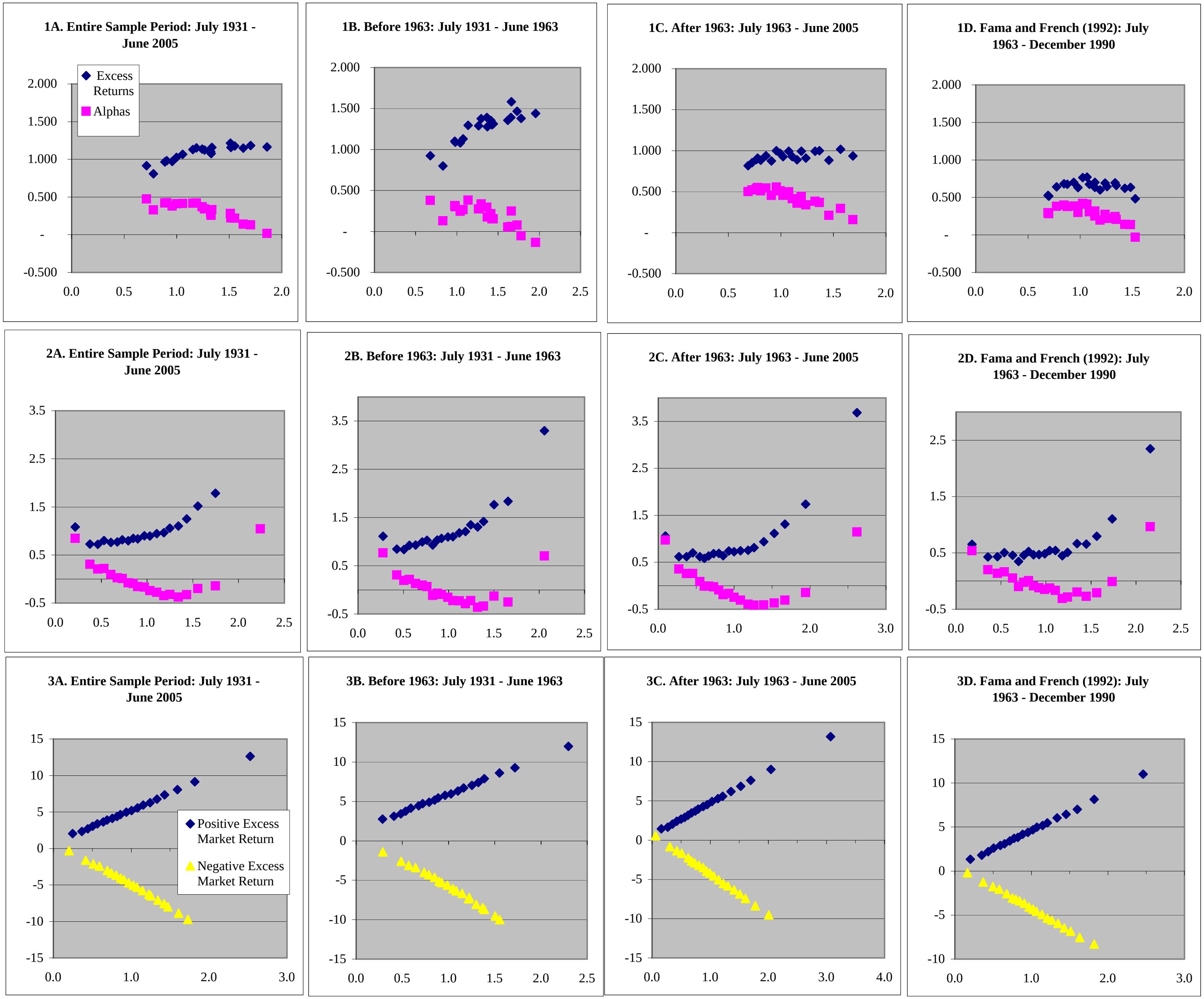
The 20 pre-formation portfolios formed on beta are constructed as in Table 6. The 20 size ranked portfolios and 100 size-beta ranked portfolios are formed in June of year *t*, and then equally weighted pre-formation returns are calculated from July of year *t*-1 to June of year *t*. For each of the three cases the market portfolios are calculated separately by equally weighting pre-formation portfolios. The numbers in bold fonts represent significance at the 5% level.

Market Portfolio	Equally Weighted Market Portfolio from the 20 Pre-Formation Portfolios Formed on Beta		Equally Weighted Market Portfolio from the 20 Pre-Formation Portfolios Formed on Size		Equally Weighted Market Portfolio from the 100 Pre-Formation Portfolios Formed on Size and Beta	
	Average Estimates	t-statiatics	Average Estimates	t-statiatics	Average Estimates	t-statiatics
A. Entire Sample Period: July 1928 - June 2005						
Excess Market Return	1.104		1.044		1.083	
γ_0	0.092	0.546	**2.742**	8.159	0.292	1.781
γ_1	**1.013**	3.335	**-1.699**	-4.029	**0.791**	2.641
R Bar Square	0.597		0.368		0.331	
γ_0	**7.866**	3.445	-1.093	-1.820	-0.576	-0.966
γ_2	**-0.653**	-3.413	**0.185**	4.321	**0.139**	3.323
R Bar Square	0.404		0.380		0.120	
γ_0	0.502	0.732	-0.877	-0.926	-0.560	-1.921
γ_1	**0.799**	3.125	0.822	1.702	**0.757**	3.371
γ_2	-0.050	-0.934	0.058	1.053	0.041	1.663
R Bar Square	0.313		0.203		0.214	
B. Fama and French (1992): July 1963 - December 1990						
Excess Market Return	0.641		0.585		0.631	
γ_0	0.007	0.032	**1.973**	3.797	0.062	0.309
γ_1	0.635	1.634	**-1.387**	-2.249	0.569	1.476
R Bar Square	0.647		0.292		0.373	
γ_0	**6.747**	2.367	**-2.176**	-2.768	-1.549	-1.914
γ_2	**-0.581**	-2.421	**0.253**	4.621	**0.196**	3.515
R Bar Square	0.434		0.428		0.151	
γ_0	1.047	1.180	**-5.284**	-4.976	-0.649	-1.567
γ_1	**0.657**	2.030	**3.232**	6.228	**0.658**	2.270
γ_2	-0.106	-1.491	**0.245**	4.087	0.051	1.429
R Bar Square	0.334		0.304		0.245	

Figure 1 Changes in the Ranks over Time

In June of each year I assign ranks (from 1 to 20) to individual stocks based on their estimated betas. The betas are estimated using at least 24 to 60 past monthly returns on the CRSP value and equally weighted market portfolios. Then mean absolute change in ranks (MACR) is calculated for each portfolio in order to investigate how the changes in ranks vary over time.




1A. Entire Sample Period: July 1931 - June 2005
Excess Returns
Alphas
2.000
1.500
1.000
0.500
-
-0.500
0.0
0.5
1.0
1.5
2.0
1B. Before 1963: July 1931 - June 1963
2.000
1.500
1.000
0.500
-
-0.500
0.0
0.5
1.0
1.5
2.0
2.5
1C. After 1963: July 1963 - June 2005
2.000
1.500
1.000
0.500
-
-0.500
0.0
0.5
1.0
1.5
2.0
1D. Fama and French (1992): July 1963 - December 1990
2.000
1.500
1.000
0.500
-
-0.500
0.0
0.5
1.0
1.5
2.0
2A. Entire Sample Period: July 1931 - June 2005
3.5
2.5
1.5
0.5
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
2B. Before 1963: July 1931 - June 1963
3.5
2.5
1.5
0.5
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
2C. After 1963: July 1963 - June 2005
3.5
2.5
1.5
0.5
-0.5
0.0
1.0
2.0
3.0
2D. Fama and French (1992): July 1963 - December 1990
2.5
1.5
0.5
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
3A. Entire Sample Period: July 1931 - June 2005
Positive Excess Market Return
Negative Excess Market Return
15
10
5
0
-5
-10
-15
0.0
1.0
2.0
3.0
3B. Before 1963: July 1931 - June 1963
15
10
5
0
-5
-10
-15
0.0
0.5
1.0
1.5
2.0
2.5
3C. After 1963: July 1963 - June 2005
15
10
5
0
-5
-10
-15
0.0
1.0
2.0
3.0
4.0
3D. Fama and French (1992): July 1963 - December 1990
15
10
5
0
-5
-10
0.0
1.0
2.0
3.0