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Empirical Equity Duration and Structural Change

Wei-Yu Kuo, Shinn-Juh Lin, and Yu-Ching Li *

Department of International Business, National Chengchi University, Taiwan

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Abstract

This paper studies the empirical equity duration by examining the sensitivity of stock returns to interest rate changes. In the regression framework, we control for three important asset-pricing factors, namely the market excess returns, and Fama and French's (1993) two factors constructed on firm-size and book-to-market ratio. To account for possible biases generated from the collinearity between the market excess return and the interest rate change, this paper extends the work of Cornell (2000) by taking care of the collinearity problem with Fama and French's orthogonalized market factor. This allows us to obtain a more viable estimate of the empirical equity duration. Furthermore, considering the time-varying nature of the empirical equity duration, we also test for the most recent break point of the regression relationship by the reversed ordered Cusum test (Pesaran and Timmermann, 2002), and propose a most up-to-date estimate of empirical equity duration, which is important for investors who view the empirical equity duration as important information in constructing their investment strategies.

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* Wei-Yu Kuo is an associate professor of the Department of International Business, National Chengchi University. Shinn-Juh Lin is an associate professor of the Department of International Business, National Chengchi University. Yu-Ching Li is a PhD candidate of the Department of International Business, National Chengchi University. Kuo acknowledges financial support from the National Science Council of Taiwan (grant number: NSC-98-2410-H-004-060). Corresponding author: Wei-Yu Kuo. Email: wkuo@nccu.edu.tw. Tel: 886-2-29393091 ext. 81244. Fax: 886-2-29387699. Address: Department of International Business, National Chengchi University, 64, Sec. 2, Tz-Nan Road, Taipei 116, Taiwan.

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1. Introduction

Compared to the theoretical equity duration calculated on the basis of the dividend discount model, the empirical equity duration measured by the sensitivity of common stock returns to interest rate changes, is more appropriate and important for fund managers and investors to assess the overall interest rate risk exposure of their portfolios.

In its most primitive form, the empirical equity duration is typically estimated by regressing stock returns on interest rate changes. However, as pointed out by Cornell (2000), a simple univariate regression of stock returns on interest rate changes may produce spurious results when other important explanatory variables are omitted from the regression. To ensure model adequacy, previous studies also include in their regression models other influential asset pricing factors as explanatory variables, such as the market excess returns (Sweeney & Warga, 1986; Hevert, McLaughlin, & Taggart, 1998; Cornell, 2000; and Reilly, Wright, & Johnson, 2007); and Fama-French's (1993) size and book-to-market (B/M) factors (Cornell, 2000). For example, Hevert, McLaughlin, and Taggart (1998, HMT hereafter) find that the estimated duration switches from negative to positive for high growth (low book-to-market) portfolios when the market return is added as an additional explanatory variable. HMT conclude that growth opportunity leads to positive equity duration. To examine more fully the impact of the specification of the regression model on empirical estimates of equity duration, Cornell (2000) extends HMT's work by dividing HMT's sample into 25 size-B/M sorted portfolios, and demonstrating what HMT see as a book-to-market effect is a pure size effect. Cornell deduces that HMT's finding is seen to be an artifact of failing to include Fama and French's (1993) two factors constructed on firm-size (SMB) and book-to-market ratio (HML) in the regression. By employing a full Fama-French three-factor model, Cornell (2000) shows that none of the estimated equity durations is significantly different from 0, and there is no longer any evidence of size, or B/M variation in equity durations. Since the coefficient of the change in the interest rate is highly sensitive to the other explanatory variable included in the regression, Cornell (2000) concludes that the relation between stock returns and changes in interest rates depends critically on the conditioning variables, especially the market factor.

Despite acknowledging the importance of controlling for the impact of the market factor, past studies of empirical equity durations fail to account for the possible collinearirty problem between market excess returns and interest rate changes, which may contribute to biased parameter estimates in the regression framework. Such a problem is not unusual, because existing common factors such as financial distress risk often generate a certain degree of correlation between the stock market and the bond market. For example, Fama and French (1993) find that, when the interest rate factor is added as the fourth explanatory variable in their celebrated three-factor model, the impact of interest rate factor tends to be absorbed by the market factor, and causes insignificant parameter estimate on the interest rate factor. What's more interesting is that Fama and French (1993) also suggest to remedy the problem by replacing the market excess returns with the orthogonalized market factor to eliminate collinearity between the market excess returns and the interest rate changes. Although the collinearity problem was also noted by Cornell (2000), no attempt has been made to remedy the entailed statistical problem. Consequently, the main aim of this paper is to extend the work of Cornell by taking care of the collinearity problem with Fama and French's orthogonalized market factor, which allows us to obtain a more viable estimate of the empirical equity duration.

Empirical studies in the literature also reveal that the estimated equity durations are time-varying. For example, Reilly et al. (2007) apply the rolling windows in their empirical investigation, and find evidence supporting that empirical equity durations vary over time, which implies the relationship between stock-returns and interest rate changes may exhibit structural breaks. From the historical perspective, it may be interesting to detect and to date all of the structural break points. Nevertheless, since most investors probably care more about "the nearest-future relationship between the stock returns and the interest rate changes" than about "how many times this relationship has broken so far", we decide to focus on estimating the most up-to-date empirical equity duration. To facilitate our analysis, we adopt the two-stage reversed ordered Cusum test propsoed by Pesaran and Timmermann (2002), which allows researchers to date the most recent break point.[1] Compared with other popular parameter-instability models, Pesaran and Timmermann find that the reversed ordered Cusum test performs much better in predicting future changes in stock returns than other models. In other words, even in the situation of multiple structural breaks, using all available historical data to simultaneously estimate all the possible break points and time-varying parameters does not help in correctly predicting future relationship between the dependent variable and explanatory variables. Therefore, the second aim of this paper is to propose an up-to-date empirical equity duration based on Pesaran and Timmermann's two-stage reversed ordered Cusum test. This would be very helpful for investors who view the empirical equity duration as important information in constructing their investment strategies.

The rest of the paper is organized as follows. In section 2, we lay out the methodology adopted in this paper. Section 3 presents our empirical results. Section 4 concludes the paper.

[1] What motivates Pesaran and Timmermann's reverse ordered Cusum test is a practical one. That is, when facing with the possibility that model parameters might change over time, model users are often confronted with the problem in deciding how much historical data are adequate in correctly estimating the relationship between the dependent variable and the explanatory variables.

2. Methodology

2.1 Estimating the Empirical Equity Duration

As employed in the literature, there are three main types of regression models as follows.

$$R_{i,t} = \alpha_i + ED_i \, \Delta I_t + \varepsilon_{i,t} \, , \quad (1)$$

$$R_{i,t} = \alpha_i + ED_i \, \Delta I_t + \beta_i \, R_{m,t} + \varepsilon_{i,t} \, . \quad (2)$$

$$R_{i,t} = \alpha_i + ED_i \, \Delta I_t + \beta_i \, R_{m,t} + s_i \, R_{smb,t} + h_i \, R_{hml,t} + \varepsilon_{i,t} \, . \quad (3)$$

where $R_{i,t}$ denotes excess returns on portfolio i; ΔI_t is the interest rate change; ED_i represents empirical equity duration of the portfolio considered; $R_{m,t}$ is the market excess return; $R_{smb,t}$ and $R_{hml,t}$ are returns to the Fama-French mimicking portfolios formed on size and book-to-market ratio, respectively.[2]

All three types of models try control for risk factor(s) to some extent in order to examine the real impact of interest rate changes on stock returns.

2.2 Collinearity Problem

In this paper, we follow the literature in using regression models to estimate the empirical equity duration. In addition to the interest rate changes, our regression

[2] Fama and French construct the factor returns as follows. Each June, NYSE, Amex, and Nasdaq stocks are allocated to two size groups, S and B, depending on whether the market equity is below or above the NYSE median. Stocks are also allocated to three book-to-market groups based on the bottom 30%, middle 40%, and top 30% break points for book-to-market ratio for NYSE stocks. $R_{smb,t}$ is the average monthly return on stocks in the three small-firm portfolios (one for each book-to-market ratio category) minus the average return on the three large-firm portfolios. Similarly, $R_{hml,t}$ is the average monthly return on the two highest book-to-market portfolios (for both size groups) minus the average return on the two lowest book-to-market portfolios. $R_{m,t}$ is the return on the value-weighted average of all stocks that go into construction of the size and book-to-market portfolios, net of the one-month Treasury bill rate.

model also includes three important asset pricing factors, namely: market excess returns, size factor, and book-to-market factor. In doing so, one needs to worry about potential biases on the estimate caused by collinearity existing among interest rate changes and the three asset pricing factors. Fama and French (1993) find statistical significance of bond risk factor in explaining stock returns when the bond risk factor is the sole explanatory variable. However, when other equity risk factors, such as the market excess returns, are also included as explanatory variables, the significance on the bond risk factor disappears. Fama and French (1993) deduce that such results occur because stock markets are not completely isolated from the bond markets. In particular, the two markets are very likely linked through a common risk factor. As a result, when the bond risk factor is collinear with the equity risk factors, the impact of the bond risk factor on stock returns are absorbed by the equity market factors, particularly the market excess returns, which leads to insignificant coefficient estimate on the bond risk factor. Similar problems also occur in Cornell (2000) and Reilly et al.(2007). To resolve such a problem, Fama and French (1993) propose replacing the market excess returns with the orthogonalized market factor to reduce interference on the bond risk factor from the market factor. Specifically, regress the market excess returns on other explanatory variables as follows,

$$R_{m,t} = a_1 \Delta I_t + a_2 R_{smb,t} + a_3 R_{hml,t} + \varepsilon_{m,t} \,. \tag{4}$$

The estimated residuals from the above regression are defined as the orthogonalized market factor (RMO_t , hereafter),

$$RMO_t \equiv \hat{\varepsilon}_{m,t} = R_{m,t} - \hat{a}_1 \Delta I_t - \hat{a}_2 R_{smb,t} - \hat{a}_3 R_{hml,t} \,. \tag{5}$$

Intuitively, RMO_t represents the part of market excess returns which cannot be explained by interest rate changes, the size factor, or the book-to-market factor.

After replacing the market excess returns with the orthogonalized market factor, the regression model is modified as follows,

$$R_{i,t} = \alpha_i + \left(-ED_i\right)\Delta I_t + \beta_i\, RMO_t + s_i\, R_{smb,t} + h_i\, R_{hml,t} + \varepsilon_{i,t}\,. \tag{6}$$

This completes the description of the regression model adopted in this paper.

2.3 The Reversed Ordered Cusum Test

As demonstrated in Reilly et al. (2007), the empirical equity durations are time-varying, which implies the relationship between stock-returns and interest rate changes is not time-invariant, and may exhibit multiple structural break points. In the literature, there exist many econometric models in estimating unstable parameters, such as the recursive least squares model, the rolling least squares model, the time-varying parameters model, and the multiple structural break model of Bai and Perron (1998). Since most investors probably care more about "the nearest-future relationship between the stock returns and the interest rate changes" than about "how many times this relationship has broken in the past", we decide to focus on the most recent structural break point, and estimate the most up-to-date empirical equity duration based only on data after the break date. To facilitate our analysis, we adopt the two-stage reversed ordered Cusum test propsoed by Pesaran and Timmermann (2002).

In the following, we summarize Pesaran and Timmermann's (2002) methodology.[3] To begin with, the reversed ordered Cusum test reverses the order of the historical data, i.e. treat the most recent observation as the first record, and the most distant observation as the last record.

$$\tilde{\mathbf{Y}}_{T,\tau} = \left(y_T, y_{T-1}, \ldots, y_{\tau+1}, y_\tau\right)', \quad \tilde{\mathbf{X}}_{T,\tau} = \left(x_T, x_{T-1}, \ldots, x_{\tau+1}, x_\tau\right)'. \tag{7}$$

Then, the recursive least squares is applied to the order-reversed sample, which yield

[3] See Pesaran and Timmermann (2002) for detail description of the reversed ordered Cusum test。

the following parameter estimate

$$\tilde{\beta}_{\tau} = \left(\tilde{\mathbf{X}}'_{T,\tau}\tilde{\mathbf{X}}_{T,\tau}\right)^{-1}\tilde{\mathbf{X}}'_{T,\tau}\tilde{\mathbf{Y}}_{T,\tau}, \qquad \tau = \tilde{T}, \tilde{T}-1, \ldots, 2, 1. \tag{8}$$

where the shortened estimation period $\left(T - \tilde{T} + 1\right)$ must be greater than the number of explanatory variables *p*, i.e. $\left(T - \tilde{T} + 1\right) > p$, to ensure the functionality of the least squares. The resulting recursive residual at period τ is then defined as

$$\hat{\varepsilon}_{\tau} = y_{\tau} - \tilde{\beta}'_{\tau-1}x_{\tau}, \qquad \tau = \tilde{T}, \tilde{T}-1, \ldots, 2, 1. \tag{9}$$

The corresponding standardized recursive residual at period τ is

$$\hat{v}_{\tau} = \frac{\hat{\varepsilon}_{\tau}}{d_{\tau}}, \qquad \tau = \tilde{T}, \tilde{T}-1, \ldots, 2, 1. \tag{10}$$

where

$$d_{\tau} = \left(1 + x'_{\tau}\left(\tilde{\mathbf{X}}'_{T,\tau-1}\tilde{\mathbf{X}}_{T,\tau-1}\right)^{-1}x_{\tau}\right)^{1/2}, \qquad \tau = \tilde{T}, \tilde{T}-1, \ldots, 2, 1. \tag{11}$$

Based on the standardized recursive residual, the reversed ordered Cusum statistic is defined as follows,

$$WW_{T,\tau} = \sum_{j=\tilde{T}}^{\tau}\hat{v}_j^2 \bigg/ \sum_{j=\tilde{T}}^{1}\hat{v}_j^2, \qquad \tau = \tilde{T}, \tilde{T}-1, \ldots, 2, 1. \tag{12}$$

According to Brown, Durbin, and Evans (1975), under the null of no structural change on the model parameter, the confidence interval of the above reversed ordered Cusum statistic can be specified as

$$WW_{\tau,T} = \frac{\tau - p}{T - p} \pm \left(c^{+}, c^{-}\right) = \left(\frac{\tau - p}{T - p} - c^{-},\ \frac{\tau - p}{T - p} + c^{+}\right). \tag{13}$$

where

$$c^{+} = \max_{i=1,\ldots,T-p-1}\left(WW_{p+i} - \frac{i}{T-p}\right),\ \ c^{-} = \max_{i=1,\ldots,T-p-1}\left(\frac{i}{T-p} - WW_{p+i}\right). \tag{14}$$

Furthermore, to control for the estimated parameter variance, Pesaran and Timmermann (2002) suggest the shortest estimation period $\left(T - \tilde{T} + 1\right)$ to be set to at least two to three times the number of parameters.

3. Empirical Results

3.1 The Interference of the Market Factor

In order to clarify the influence of the market excess return on the interest rate change, we need to see the difference between the results of regressions in which the market factor is added or not. What we are going to do is exactly to compare the results of Equation (1) with the ones of Equation (2) and (3). The sample period is January 1966 through December 1998, the same as Cornell's (2000).

Table 1, corresponding to Equation (1), shows that used alone as the explanatory variable in the regression, the interest rate change does explain stock returns. We find that the 25 stock portfolios formed on size and book-to-market ratio all produce significantly negative equity durations ranging between 3.54 and 5.41. Exhibit 1 displays the estimated equity durations as a bar and the associated t-statistics as a line. The 25 portfolios on the x-axis are arranged first by size and then by book-to-market ratio. The quintile of the smallest firms is on the far left, and that of the largest is on the far right. Within each size quintile, the portfolios run from low book-to-market to high. From Exhibit 1, we recognize that there is a monotonic relationship between equity duration and size or book-to-market ratio. The estimated equity durations decrease when moving from small to large firms, and also when moving from low to high book-to-market portfolios. But, on the other hand, the t-statistics have a different pattern. As firm size or book-to-market ratio increases, the t-statistics rise. However, the interest rate change does not explain much of stock returns. All of the 25 adjusted R^2 value are merely below 0.14. And it means that there is a large part of stock returns not explained by the interest rate change.

【Insert Table 1 and Exhibit 1】

In addition to the single effect of bond risk factor on stock returns, we next regress the 25 portfolios returns on three stock-pricing factors – the market, size, and book-to-market factors to see influences of these factors. Table 2 presents that these three stock risk factors explain much more stock returns than the interest rate change does (see Table 1). All of the 25 adjusted R^2 value are above 0.82 and the coefficients of the three factors are almost reliably different from 0, except the *h*s of two portfolios in the second book-to-market ratio quintile. From the results of Table 1 and 2, we know that the interest rate change and the three stock risk factors all have significant explanatory power on stock returns, but with different degrees.

【Insert Table 2】

Table 3, corresponding to Equation (2), indicate that adding the market factor to the regressions has an interesting effect on the estimated equity durations. In regressions of Table 3, six large-size portfolios in the middle-B/M quintile still have significantly negative estimated equity durations. But the rest 19 portfolios' equity durations alter to be indistinguishable from 0 or significantly positive. From Exhibit 2, we realize that equity durations are much smaller and seem to be periodically insignificantly different from zero. Most important, there is a cross-sectional pattern on size and book-to-market ratio. The estimated equity durations switch from positive to negative when moving from small to large firms if we ignore ones in the lowest book-to-market quintile. Furthermore, there is a decreasing tendency in equity durations when moving from low to high book-to-market portfolios.

【Insert Table 3 and Exhibit 2】

In Table 4, corresponding to Equation (3), when all three stock risk factors are added to the regression, the pattern of results changes once again. All the estimated equity durations for the 25 portfolios are smaller, and most of them are indifferent from 0 or reliably positive. Exhibit 3 reveals that there is a cross-sectional but reverting pattern on size. The estimated equity durations switch from positive to negative when moving from small to medium-size firms, but revert to positive for large firms. Moreover, a decreasing trend also exists when moving from low to high book-to-market portfolios, except in the largest-size quintile with a rise pattern. All of the R's for the regressions are just a little bit higher than ones of the regressions in Table 2 where three stock risk factors are explanatory variables. Therefore, adding the interest rate change into this three-factor model has no impact on model's explanatory power.

【Insert Table 4 and Exhibit 3】

As Cornell reports, there are substantial changes in the estimated equity durations when progressing from a univariate regression to the model adding the market return, and finally to the full three-factor model. He demonstrates that the significant relation between the market factor and changes in interest rates causes these results. The impact of interest rate changes on stock returns is transmitted almost exclusively through the market factor. In our sample, the correlation coefficients between the market excess return and the interest rate change is -0.3 showing that the market factor is highly correlated with the interest rate change. However, the correlation coefficients of -0.02 and -0.04 between the interest rate change and the size factor, the book-to-market factor showing that the interest rate change is not highly related with the size and book-to-market factors. Therefore, we also suggest that the collinearity existing between the interest rate change and the market excess return causes this phenomenon. However, Cornell does not further deal with such problem, but concludes that the relation between stock returns and changes in interest rate depends critically on the conditioning variables, such as the Fama-French's size and book-to-market factors. Here, to accommodate such a problem in estimating the empirical equity durations, we follow Fama and French (1993) by replacing the market excess returns with the orthogonalized market factor.

3.2 The Estimated Equity Durations on the Full Sample

After the orthogonalized market factor is used to replace the market excess return, the results is shown in Table 5. Notice that the market *β*s in Table 4 and Table 5 are almost the same, so are the adjusted R^2 values. Therefore, the explanatory power of this four-factor model is not influenced if we replace the market factor with the orthogonalized one.

Compared to the results of Table 4, Table 5 reveals that changes in interest rate can explain much more stock returns after the orthogonalized market factor is a substitute for the market factor. The 25 stock portfolios all produce significantly negative equity durations ranging from 3.41 to 5.35, like the results of Equation (1) in Table 1. From Exhibit 4, we can see that the cross-sectional pattern on the size and book-to-market ratio still exists. As firm size or book-to-market increases, the estimated equity duration as well as the associated t-statistic decrease.

Exhibit 5 displays the estimated equity duration and the market βs. As we can see that there is a positive relationship between them. In each size quintile, the marketβs as well as the equity durations show a negative relation with the book-to-market ratio. While the book-to-market ratio increases, the market β decreases, so does the equity duration. Therefore, we say that portfolios with low interest rate sensitivity tend to face high market risk.

【Insert Table 5, Exhibit 4 and 5】

3.3 Structural Changes of Equity Duration

Since we have confirmed the validity of model to estimate equity durations of stock returns, we next conduct the reversed ordered Cusum test to examine the most recent structural break point for our model. Before doing that, let’s first look at the estimated 36-month moving average equity durations to realize dynamic patterns of equity durations over time.

Exhibit 6 shows that all 25 portfolios formed on size and book-to-market ratio produce time-varying empirical equity durations, which implies the relationship between stock returns and interest rates is not time-invariant. Most estimated equity durations are negative before around 2002, but positive after 2002. Besides, it seems that there are two structural changes during the period 1966-2008. One is about in 1981 and the other in 2002. Before 1981, equity durations for most portfolios are more volatile but become stable after that. During the latter period of 2002-2008, equity durations have ever risen sharply but finally declined.

【Insert Exhibit 6】

Table 6 presents the results of the reversed ordered Cusum test. Here, the sample period is January 1990 to December 2008 because what we care about is the most "up-to-date" empirical equity duration. From Table 6, we can see that the most recent structural break for most portfolios happened in early 2000s. That is exactly when the Internet bubble burst. In addition, it is worth to note that the detected most recent structural break dates of some portfolios vary with different shortest estimation windows. Pesaran and Timmermann (2002) do not specify rules of setting the shortest estimation window; just roughly suggest to be set to at least two to three times the number of parameters. Thus, we test by starting with the setting as 10, and choose the one with the highest adjusted R^2.

【Insert Table 6】

Table 7 presents the estimated results after the most recent break date. Notice that all the 25 adjusted R^2 values are above 0.86, not lower than the full sample models. So it doesn't affect the adequacy of regression if considering the structural breaks. The relationship between stock returns and changes in interest rate has converted to be positive. There are 21 portfolios producing significantly positive equity durations, and other 4 having insignificant ones. From the panel (a) of Exhibit 7, we know that there is not a cross-sectional pattern on size any more. At a fist glance, small firms seem to have lower equity durations than large firms. However, the smallest growth firms have higher equity durations than most of the large firms. Besides, there is either no cross-sectional pattern on book-to-market ratio from the panel b of Exhibit 7.

【Insert Table 7 and Exhibit 7】

4. Conclusion

This paper studies the empirical equity duration by examining the sensitivity of stock returns to interest rate changes in the regression framework that control for three important asset-pricing factors, namely the market excess returns, and Fama and French's (1993) two factors constructed on firm-size and book-to-market ratio. Compared to the existing literature, the contribution of this paper is twofold. First of all, although the collinearity problem was also noted by Cornell (2000), no attempt has been made to remedy the entailed statistical problem. This paper takes care of the collinearity problem with Fama and French's orthogonalized market factor, which allows us to obtain a more viable estimate of the empirical equity duration. Secondly, considering the time-varying nature of the empirical equity duration, we also test for the most recent break point of the regression relationship by the reversed ordered Cusum test (Pesaran and Timmermann, 2002), and propose a most up-to-date estimate of empirical equity duration, which is important for investors who view the empirical equity duration as important information in constructing their investment strategies.

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Table 1
Regressions on the interest rate changes

$$R_{i,t} = \alpha_i + \left(-ED_i\right) \Delta I_t + \varepsilon_{i,t}$$

Book-to-market ratio quintile	Size quintile				
	Small	2	3	4	Big
			α		
Low	0.125	0.38	0.445	0.476*	0.491**
	(0.326)	(1.046)	(1.34)	(1.651)	(2.058)
2	0.664**	0.624**	0.682**	0.43*	0.533**
	(1.995)	(2.067)	(2.505)	(1.664)	(2.346)
3	0.712**	0.841**	0.68**	0.67**	0.485**
	(2.363)	(3.094)	(2.795)	(2.821)	(2.288)
4	0.935**	0.949**	0.845**	0.745**	0.613**
	(3.298)	(3.752)	(3.693)	(3.421)	(3)
High	1.031**	1**	0.93**	0.858**	0.696**
	(3.438)	(3.557)	(3.527)	(3.332)	(3.057)
			ED		
Low	-3.538**	-4.142**	-4.317**	-4.265**	-3.709**
	(-3.044)	(-3.765)	(-4.296)	(-4.88)	(-5.135)
2	-3.706**	-4.286**	-4.65**	-4.815**	-4.147**
	(-3.679)	(-4.69)	(-5.64)	(-6.149)	(-6.026)
3	-3.893**	-4.512**	-4.922**	-4.944**	-4.132**
	(-4.27)	(-5.482)	(-6.683)	(-6.872)	(-6.442)
4	-3.779**	-4.766**	-4.804**	-5.411**	-4.084**
	(-4.402)	(-6.223)	(-6.934)	(-8.202)	(-6.598)
High	-3.653**	-4.668**	-4.797**	-4.89**	-3.868**
	(-4.023)	(-5.483)	(-6.008)	(-6.275)	(-5.612)
			Adj_R^2		
Low	0.02	0.032	0.042	0.055	0.06
2	0.031	0.05	0.072	0.085	0.082
3	0.042	0.069	0.1	0.105	0.093
4	0.044	0.087	0.106	0.144	0.097
High	0.037	0.069	0.082	0.089	0.072

1. *, ** indicate significant at the 10% and 5% levels, respectively.
2. The t-statistics are in parentheses.

Table 2
Regressions on the market excess return and the mimicking returns for the size and book-to-market factors

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + s_i R_{smb,t} + h_i R_{hml,t} + \varepsilon_{i,t}$$

Book-to-market ratio quintile	Size quintile				
	Small	2	3	4	Big
			α		
Low	-0.495**	-0.116	-0.027	0.089	0.233**
	(-5.008)	(-1.527)	(-0.352)	(1.254)	(3.604)
2	-0.057	-0.033	0.054	-0.176**	0.034
	(-0.786)	(-0.525)	(0.758)	(-2.191)	(0.509)
3	-0.033	0.122**	-0.023	-0.021	-0.061
	(-0.553)	(1.977)	(-0.325)	(-0.275)	(-0.735)
4	0.155**	0.169**	0.096	-0.001	-0.071
	(2.598)	(2.855)	(1.472)	(-0.018)	(-1.023)
High	0.125*	0.071	0.017	-0.037	-0.123
	(1.929)	(1.1)	(0.223)	(-0.392)	(-1.206)
			β		
Low	1.044**	1.093**	1.097**	1.053**	0.951**
	(42.95)	(58.271)	(58.596)	(60.606)	(59.722)
2	0.983**	1.022**	1.024**	1.083**	1.043**
	(55.081)	(65.37)	(58.137)	(54.931)	(63.326)
3	0.947**	0.971**	0.985**	1.058**	0.997**
	(63.688)	(63.8)	(56.611)	(57.338)	(48.482)
4	0.917**	0.976**	0.976**	1.017**	1.007**
	(62.304)	(67.035)	(60.678)	(56.312)	(58.764)
High	0.962**	1.064**	1.07**	1.124**	1.032**
	(60.48)	(67.235)	(55.715)	(47.913)	(41.026)
			s		
Low	1.4**	1.037**	0.735**	0.319**	-0.239**
	(40.193)	(38.558)	(27.379)	(12.819)	(-10.466)
2	1.27**	0.919**	0.624**	0.272**	-0.197**
	(49.646)	(41.005)	(24.702)	(9.621)	(-8.325)
3	1.13**	0.841**	0.532**	0.236**	-0.267**
	(53.028)	(38.531)	(21.303)	(8.917)	(-9.071)
4	1.061**	0.717**	0.444**	0.204**	-0.186**
	(50.254)	(34.332)	(19.255)	(7.862)	(-7.559)
High	1.154**	0.838**	0.613**	0.328**	-0.022
	(50.63)	(36.919)	(22.27)	(9.748)	(-0.604)
			h		
Low	-0.283**	-0.52**	-0.474**	-0.473**	-0.463**
	(-7.125)	(-16.929)	(-15.483)	(-16.645)	(-17.779)
2	0.098**	0.02	0.054*	0.056*	0.014
	(3.343)	(0.786)	(1.869)	(1.749)	(0.534)
3	0.256**	0.268**	0.326**	0.316**	0.217**
	(10.534)	(10.762)	(11.447)	(10.479)	(6.456)
4	0.407**	0.464**	0.487**	0.52**	0.522**
	(16.901)	(19.47)	(18.522)	(17.598)	(18.628)
High	0.635**	0.683**	0.718**	0.713**	0.769**
	(24.419)	(26.359)	(22.837)	(18.569)	(18.688)
			Adj_R^2		
Low	0.939	0.96	0.952	0.946	0.935
2	0.956	0.96	0.939	0.917	0.925
3	0.964	0.954	0.928	0.916	0.867
4	0.96	0.953	0.931	0.908	0.901
High	0.958	0.954	0.924	0.882	0.823

1. *, ** indicate significant at the 10% and 5% levels, respectively.
2. The t-statistics are in parentheses.

Table 3
Regressions on the interest rate changes and the market excess return

$$R_{i,t} = \alpha_i + (-ED_i)\Delta I_t + \beta_i R_{m,t} + \varepsilon_{i,t}$$

Book-to-market ratio quintile	Size quintile				
	Small	2	3	4	Big
			α		
Low	-0.609**	-0.361**	-0.255*	-0.151	-0.02
	(-2.793)	(-2.088)	(-1.846)	(-1.508)	(-0.218)
2	0.03	0.007	0.107	-0.133	0.033
	(0.156)	(0.048)	(0.957)	(-1.527)	(0.47)
3	0.136	0.295**	0.175	0.16*	0.044
	(0.796)	(2.17)	(1.616)	(1.806)	(0.472)
4	0.402**	0.443**	0.375**	0.292**	0.196**
	(2.414)	(3.457)	(3.538)	(3.035)	(2.024)
High	0.49**	0.458**	0.417**	0.349**	0.274**
	(2.59)	(2.925)	(2.899)	(2.587)	(1.996)
			ED		
Low	2.517**	1.973**	1.454**	0.909**	0.506*
	(3.662)	(3.619)	(3.339)	(2.887)	(1.765)
2	1.526**	0.807*	0.094	-0.164	-0.022
	(2.544)	(1.797)	(0.267)	(-0.595)	(-0.099)
3	0.856	-0.009	-0.757**	-0.729**	-0.497*
	(1.587)	(-0.02)	(-2.215)	(-2.613)	(-1.684)
4	0.62	-0.593	-0.925**	-1.673**	-0.638**
	(1.179)	(-1.466)	(-2.765)	(-5.505)	(-2.092)
High	0.812	-0.195	-0.565	-0.695	-0.387
	(1.361)	(-0.394)	(-1.245)	(-1.631)	(-0.894)
			β		
Low	1.463**	1.478**	1.395**	1.25**	1.019**
	(29.102)	(37.049)	(43.778)	(54.259)	(48.559)
2	1.265**	1.231**	1.147**	1.124**	0.997**
	(28.823)	(37.485)	(44.335)	(55.791)	(60.834)
3	1.148**	1.088**	1.007**	1.019**	0.878**
	(29.078)	(34.643)	(40.285)	(49.951)	(40.719)
4	1.063**	1.008**	0.937**	0.903**	0.833**
	(27.657)	(34.062)	(38.319)	(40.62)	(37.326)
High	1.079**	1.081**	1.023**	1.014**	0.841**
	(24.716)	(29.896)	(30.775)	(32.525)	(26.535)
			Adj_R^2		
Low	0.689	0.784	0.837	0.888	0.865
2	0.688	0.792	0.845	0.897	0.912
3	0.695	0.77	0.824	0.878	0.826
4	0.675	0.768	0.811	0.835	0.801
High	0.622	0.715	0.73	0.752	0.667

1. *, ** indicate significant at the 10% and 5% levels, respectively.
2. The t-statistics are in parentheses.

Table 4
Regressions on the interest rate changes, the market excess return and the mimicking returns for the size and book-to-market factors

$$R_{i,t} = \alpha_i + (-ED_i)\Delta I_t + \beta_i R_{m,t} + s_i R_{smb,t} + h_i R_{hml,t} + \varepsilon_{i,t}$$

Book-to-market ratio quintile	**Size quintile**				
	Small	2	3	4	Big
			α		
Low	-0.518**	-0.126*	-0.032	0.089	0.232**
	(-5.298)	(-1.656)	(-0.414)	(1.25)	(3.568)
2	-0.072	-0.035	0.062	-0.168**	0.03
	(-0.997)	(-0.555)	(0.869)	(-2.097)	(0.452)
3	-0.04	0.13**	-0.006	-0.009	-0.062
	(-0.665)	(2.101)	(-0.079)	(-0.122)	(-0.738)
4	0.148**	0.182**	0.111*	0.025	-0.077
	(2.473)	(3.094)	(1.709)	(0.354)	(-1.099)
High	0.107*	0.069	0.019	-0.038	-0.14
	(1.682)	(1.073)	(0.245)	(-0.396)	(-1.369)
			ED		
Low	1.028**	0.43*	0.211	-0.003	0.065
	(3.344)	(1.793)	(0.881)	(-0.012)	(0.319)
2	0.652**	0.089	-0.354	-0.321	0.164
	(2.88)	(0.445)	(-1.571)	(-1.27)	(0.778)
3	0.301	-0.338*	-0.772**	-0.506**	0.021
	(1.581)	(-1.737)	(-3.51)	(-2.148)	(0.08)
4	0.33*	-0.561**	-0.641**	-1.17**	0.243
	(1.753)	(-3.038)	(-3.146)	(-5.224)	(1.105)
High	0.779**	0.066	-0.08	0.02	0.719**
	(3.889)	(0.324)	(-0.323)	(0.067)	(2.242)
			β		
Low	1.074**	1.106**	1.103**	1.053**	0.953**
	(41.842)	(55.241)	(55.051)	(56.554)	(55.855)
2	1.002**	1.024**	1.013**	1.073**	1.048**
	(52.971)	(61.178)	(53.865)	(50.916)	(59.419)
3	0.956**	0.961**	0.962**	1.043**	0.997**
	(60.187)	(59.15)	(52.406)	(53.059)	(45.273)
4	0.927**	0.959**	0.957**	0.982**	1.014**
	(58.995)	(62.209)	(56.217)	(52.493)	(55.318)
High	0.985**	1.066**	1.068**	1.124**	1.053**
	(58.907)	(62.869)	(51.886)	(44.738)	(39.33)
			s		
Low	1.39**	1.033**	0.732**	0.319**	-0.24**
	(40.225)	(38.333)	(27.171)	(12.749)	(-10.439)
2	1.263**	0.918**	0.627**	0.275**	-0.198**
	(49.622)	(40.744)	(24.787)	(9.705)	(-8.357)
3	1.127**	0.844**	0.54**	0.241**	-0.268**
	(52.752)	(38.624)	(21.841)	(9.119)	(-9.028)
4	1.057**	0.722**	0.451**	0.216**	-0.188**
	(50.006)	(34.823)	(19.681)	(8.572)	(-7.631)
High	1.146**	0.837**	0.614**	0.328**	-0.029
	(50.95)	(36.687)	(22.179)	(9.687)	(-0.812)
			h		
Low	-0.259**	-0.51**	-0.469**	-0.473**	-0.462**
	(-6.499)	(-16.38)	(-15.069)	(-16.356)	(-17.412)
2	0.113**	0.022	0.046	0.049	0.018
	(3.836)	(0.852)	(1.56)	(1.494)	(0.665)
3	0.263**	0.26**	0.308**	0.304**	0.218**
	(10.666)	(10.302)	(10.792)	(9.97)	(6.358)
4	0.415**	0.451**	0.472**	0.493**	0.528**

Book-to-market ratio quintile	**Size quintile**				
	Small	2	3	4	Big
	(16.985)	(18.809)	(17.862)	(16.946)	(18.529)
High	0.653**	0.684**	0.716**	0.713**	0.786**
	(25.149)	(25.96)	(22.383)	(18.256)	(18.881)
			Adj_R^2		
Low	0.94	0.96	0.952	0.946	0.934
2	0.957	0.96	0.94	0.917	0.925
3	0.964	0.955	0.93	0.917	0.866
4	0.96	0.954	0.933	0.914	0.901
High	0.959	0.954	0.924	0.882	0.825

1. *, ** indicate significant at the 10% and 5% levels, respectively.
2. The t-statistics are in parentheses.

Table 5
Regressions on the interest rate changes, the orthogonalized market factor and the mimicking returns for the size and the book-to-market factors

$$R_{i,t} = \alpha_i + (-ED_i)\Delta I_t + \beta_i RMO_t + s_i R_{smb,t} + h_i R_{hml,t} + \varepsilon_{i,t}$$

Book-to-market ratio quintile	Size quintile				
	Small	2	3	4	Big
			α		
Low	-0.518**	-0.126*	-0.032	0.089	0.232**
	(-5.298)	(-1.656)	(-0.414)	(1.25)	(3.568)
2	-0.072	-0.035	0.062	-0.168**	0.03
	(-0.997)	(-0.555)	(0.869)	(-2.097)	(0.452)
3	-0.04	0.13**	-0.006	-0.009	-0.062
	(-0.665)	(2.101)	(-0.079)	(-0.122)	(-0.738)
4	0.148**	0.182**	0.111*	0.025	-0.077
	(2.473)	(3.094)	(1.709)	(0.354)	(-1.099)
High	0.107*	0.069	0.019	-0.038	-0.14
	(1.682)	(1.073)	(0.245)	(-0.396)	(-1.369)
			ED		
Low	-3.539**	-4.271**	-4.476**	-4.479**	-3.987**
	(-12.316)	(-19.065)	(-19.969)	(-21.496)	(-20.876)
2	-3.607**	-4.265**	-4.662**	-4.883**	-4.289**
	(-17.039)	(-22.763)	(-22.143)	(-20.701)	(-21.739)
3	-3.762**	-4.424**	-4.863**	-4.937**	-4.218**
	(-21.171)	(-24.328)	(-23.663)	(-22.454)	(-17.112)
4	-3.611**	-4.638**	-4.708**	-5.345**	-4.068**
	(-20.534)	(-26.883)	(-24.721)	(-25.531)	(-19.831)
High	-3.408**	-4.467**	-4.618**	-4.759**	-3.758**
	(-18.215)	(-23.535)	(-20.055)	(-16.922)	(-12.541)
			β		
Low	1.074**	1.106**	1.103**	1.053**	0.953**
	(41.842)	(55.241)	(55.051)	(56.554)	(55.855)
2	1.002**	1.024**	1.013**	1.073**	1.048**
	(52.971)	(61.178)	(53.865)	(50.916)	(59.419)
3	0.956**	0.961**	0.962**	1.043**	0.997**
	(60.187)	(59.15)	(52.406)	(53.059)	(45.273)
4	0.927**	0.959**	0.957**	0.982**	1.014**
	(58.995)	(62.209)	(56.217)	(52.493)	(55.318)
High	0.985**	1.066**	1.068**	1.124**	1.053**
	(58.907)	(62.869)	(51.886)	(44.738)	(39.33)
			s		
Low	1.862**	1.519**	1.217**	0.783**	0.18**
	(56.777)	(59.398)	(47.576)	(32.902)	(8.238)
2	1.704**	1.369**	1.073**	0.747**	0.263**
	(70.507)	(63.982)	(44.657)	(27.755)	(11.658)
3	1.548**	1.267**	0.963**	0.7**	0.171**
	(76.289)	(61.051)	(41.051)	(27.875)	(6.08)
4	1.465**	1.144**	0.871**	0.648**	0.258**
	(72.986)	(58.1)	(40.088)	(27.104)	(11.011)
High	1.579**	1.306**	1.084**	0.822**	0.434**
	(73.95)	(60.291)	(41.228)	(25.609)	(12.687)
			h		
Low	-0.897**	-1.166**	-1.124**	-1.098**	-1.028**
	(-24.623)	(-41.049)	(-39.534)	(-41.572)	(-42.437)
2	-0.482**	-0.586**	-0.556**	-0.588**	-0.604**
	(-17.96)	(-24.662)	(-20.827)	(-19.665)	(-24.131)
3	-0.304**	-0.31**	-0.263**	-0.315**	-0.374**
	(-13.5)	(-13.464)	(-10.106)	(-11.279)	(-11.978)
4	-0.136**	-0.119**	-0.096**	-0.09**	-0.074**

Book-to-market ratio quintile	Size quintile				
	Small	2	3	4	Big
	(-6.081)	(-5.428)	(-3.958)	(-3.404)	(-2.852)
High	0.069**	0.051**	0.082**	0.046	0.16**
	(2.897)	(2.127)	(2.804)	(1.276)	(4.222)
			Adj_R^2		
Low	0.94	0.96	0.952	0.946	0.934
2	0.957	0.96	0.94	0.917	0.925
3	0.964	0.955	0.93	0.917	0.866
4	0.96	0.954	0.933	0.914	0.901
High	0.959	0.954	0.924	0.882	0.825

1. *, ** indicate significant at the 10% and 5% levels, respectively.
2. The t-statistics are in parentheses.

Table 6
The most recent estimated breakpoint

Portfolios		Breakpoint	The Left observations	The Shortest Estimation Window
Small	Low	2003/12	61	36
	2	2001/7	90	10
	3	2002/8	77	10
	4	2003/12	61	14
	High	2004/3	58	10
2	Low	2003/3	70	10
	2	2003/12	61	10
	3	2001/9	88	10
	4	2003/11	62	10
	High	2003/4	69	11
3	Low	2002/12	73	16
	2	2001/8	89	10
	3	2004/4	57	23
	4	2001/7	90	10
	High	2002/4	81	10
4	Low	2001/8	89	13
	2	2002/7	78	10
	3	2002/6	79	10
	4	2001/8	89	13
	High	2003/10	63	10
Big	Low	2000/8	101	10
	2	2001/6	91	12
	3	2002/6	79	10
	4	2002/6	79	10
	High	2003/12	61	10

The point of forecast is January 2009.

Table 7
After the most recent break, regressions on the interest rate changes, the orthogonalized market factor, and the mimicking returns for the size and the book-to-market factors

$$R_{i,t} = \alpha_i + (-ED_i)\Delta I_t + \beta_i RMO_t + s_i R_{smb,t} + h_i R_{hml,t} + \varepsilon_{i,t}$$

Book-to-market ratio quintile	Size quintile				
	Small	2	3	4	Big
			α		
Low	-0.643**	-0.075	-0.023	0.06	-0.011
	(-3.386)	(-0.5)	(-0.142)	(0.515)	(-0.122)
2	-0.131	0.226*	0.118	0.024	0.167
	(-0.956)	(1.846)	(0.923)	(0.179)	(1.185)
3	-0.188	0.161	0.68**	-0.194	-0.264*
	(-1.448)	(1.361)	(3.937)	(-1.01)	(-1.707)
4	-0.339**	0.121	0.065	0.14	-0.289**
	(-2.265)	(0.833)	(0.371)	(0.783)	(-2.207)
High	-0.284	0.038	0.314	-0.36**	0.447**
	(-1.647)	(0.218)	(1.388)	(-2.073)	(2.011)
			ED		
Low	3.093**	0.918	1.606**	4.038**	3.363**
	(3.863)	(1.561)	(2.512)	(8.687)	(8.896)
2	3.794**	1.957**	3.394**	1.695**	3.185**
	(6.871)	(3.792)	(6.639)	(3.12)	(5.584)
3	1.469**	2.428**	2.909**	2.967**	1.931**
	(2.814)	(5.071)	(4.074)	(3.824)	(3.09)
4	1.268**	-0.217	4.402**	5.274**	2.366**
	(2.008)	(-0.353)	(6.263)	(7.345)	(4.486)
High	2.798**	0.114	1.886**	1.035	1.862*
	(3.922)	(0.166)	(2.05)	(1.397)	(1.986)
			β		
Low	1.132**	1.055**	1.154**	1.073**	0.927**
	(22.575)	(26.335)	(26.999)	(39.046)	(42.804)
2	1.066**	0.948**	0.971**	1.081**	0.888**
	(32.676)	(29.341)	(32.11)	(32.255)	(26.544)
3	0.893**	0.878**	0.93**	1.174**	0.963**
	(27.69)	(30.844)	(20.218)	(25.174)	(25.66)
4	0.723**	0.934**	0.974**	1.06**	0.95**
	(18.281)	(24.186)	(23.465)	(24.957)	(29.969)
High	1.002**	0.943**	1.023**	1.102**	1.082**
	(21.741)	(20.172)	(18.933)	(23.913)	(18.422)
			s		
Low	1.955**	1.823**	1.524**	1.012**	0.232**
	(23.092)	(28.848)	(22.208)	(23.878)	(7.094)
2	1.548**	1.576**	1.095**	1.07**	0.268**
	(31.247)	(28.871)	(23.469)	(18.893)	(5.374)
3	1.522**	1.386**	1.385**	0.993**	0.421**
	(27.373)	(31.82)	(17.845)	(12.36)	(6.508)
4	1.5**	1.588**	0.987**	0.952**	0.397**
	(22.473)	(24.552)	(15.654)	(14.531)	(7.263)
High	1.716**	1.833**	1.08**	0.88**	0.684**
	(22.104)	(24.857)	(11.878)	(11.444)	(6.893)
			h		
Low	-0.156	-0.139*	-0.319**	-0.602**	-0.676**
	(-1.6)	(-1.758)	(-3.851)	(-11.901)	(-23.367)
2	-0.174**	0.106*	-0.201**	-0.14**	-0.065
	(-2.977)	(1.69)	(-3.615)	(-2.148)	(-1.085)
3	0.094	0.161**	0.06	-0.072	0.131*
	(1.483)	(3.087)	(0.682)	(-0.766)	(1.733)
4	0.551**	0.487**	0.254**	0.11	0.399**

Book-to-market ratio quintile	Size quintile				
	Small	2	3	4	Big
	(7.169)	(6.497)	(3.413)	(1.412)	(6.276)
High	0.753**	0.947**	0.269**	0.702**	0.466**
	(8.515)	(10.196)	(2.491)	(7.807)	(4.081)
			Adj_R^2		
Low	0.945	0.957	0.945	0.964	0.963
2	0.96	0.966	0.95	0.948	0.895
3	0.953	0.959	0.929	0.911	0.902
4	0.938	0.954	0.906	0.912	0.929
High	0.95	0.944	0.867	0.927	0.871

1. *, ** indicate significant at the 10% and 5% levels, respectively.
2. The t-statistics are in parentheses.

Exhibit 1
Equity durations in regressions of interest rate changes

$$R_{i,t} = \alpha_i + (-ED_i)\,\Delta I_t + \varepsilon_{i,t}$$

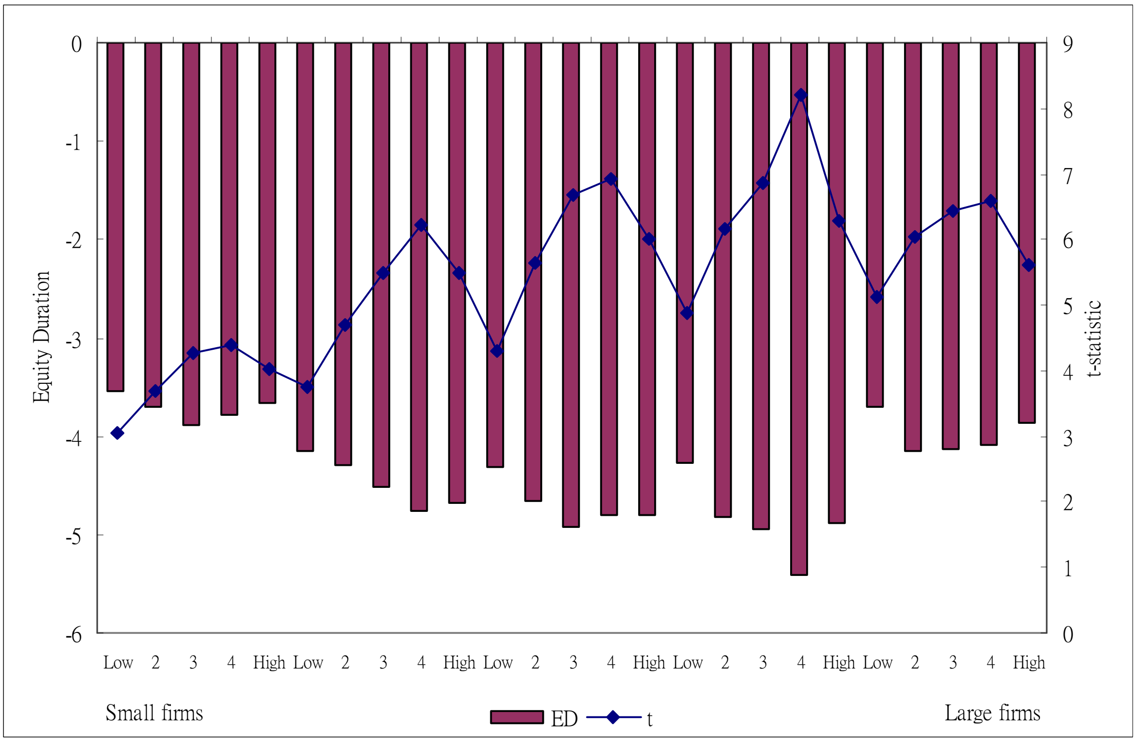


Exhibit 2
Equity durations in regressions of
the interest rate change and the market excess return

$$R_{i,t} = \alpha_i + (-ED_i)\Delta I_t + \beta_i R_{m,t} + \varepsilon_{i,t}$$

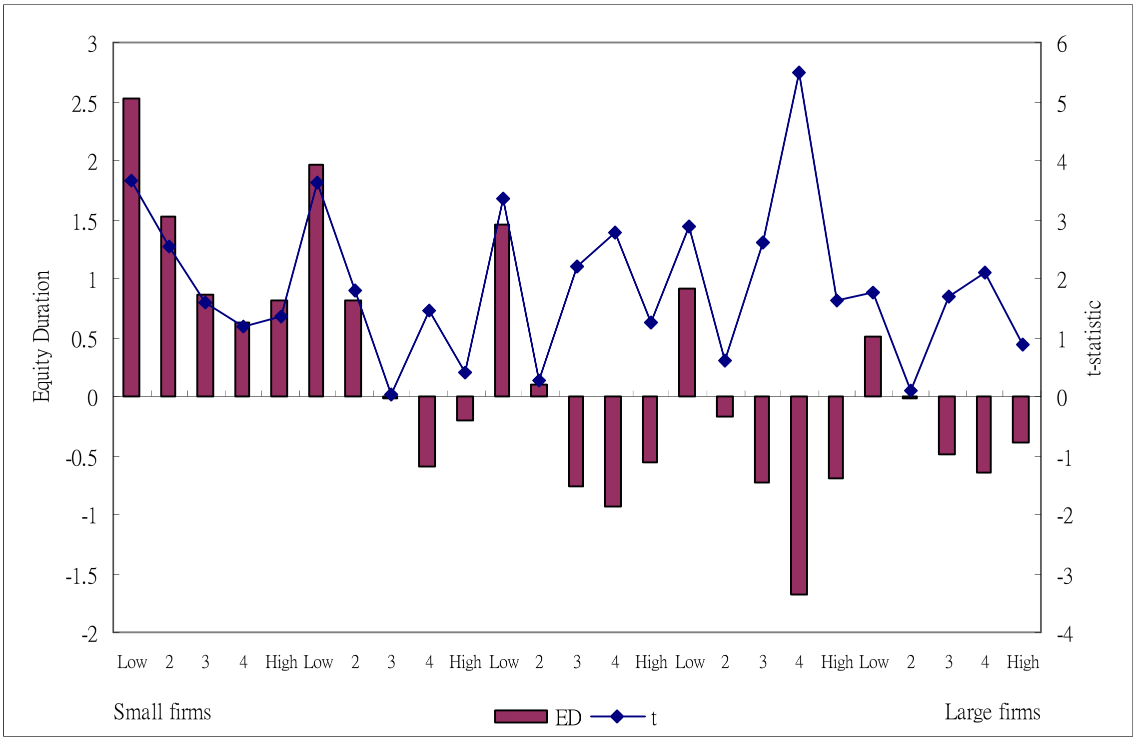


Exhibit 3

Equity durations in regressions of

the interest rate change, the market excess return, the size and book-to-market factors

$$R_{i,t} = \alpha_i + \left(-ED_i\right)\Delta I_t + \beta_i R_{m,t} + s_i R_{smb,t} + h_i R_{hml,t} + \varepsilon_{i,t}$$

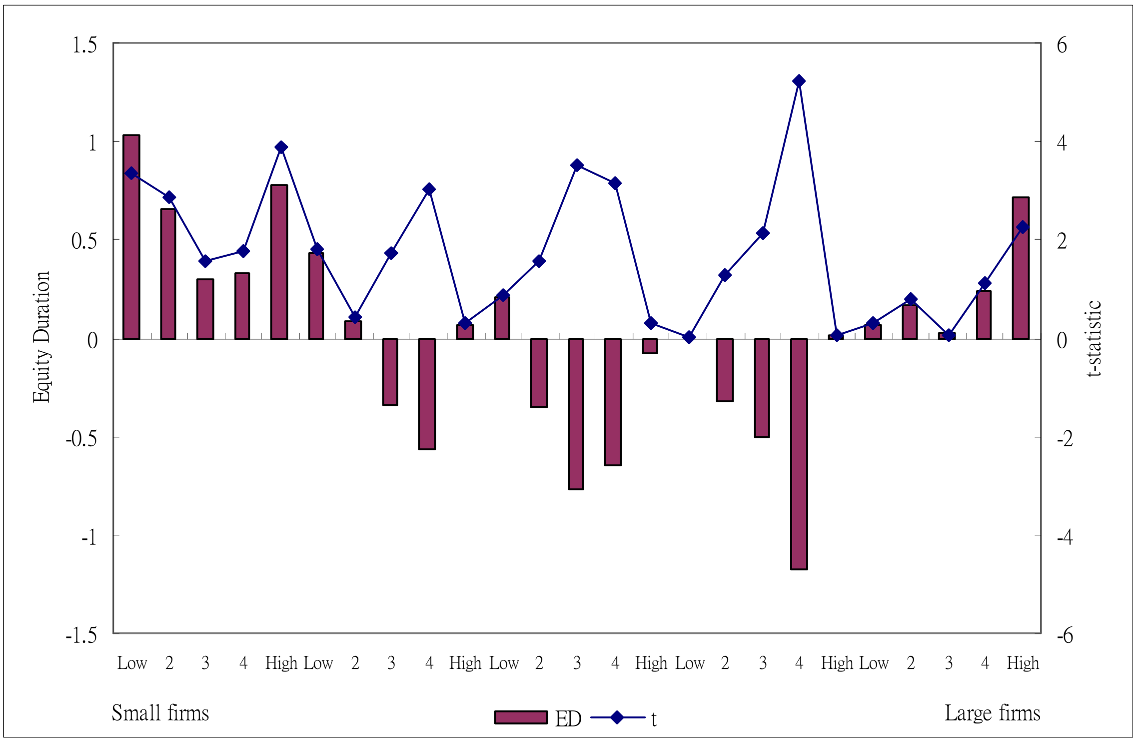


Exhibit 4

Equity durations in regressions of

the interest rate change, the orthogonalized market factor, the size and book-to-market factors

$$R_{i,t} = \alpha_i + \left(-ED_i\right)\Delta I_t + \beta_i RMO_t + s_i R_{smb,t} + h_i R_{hml,t} + \varepsilon_{i,t}$$

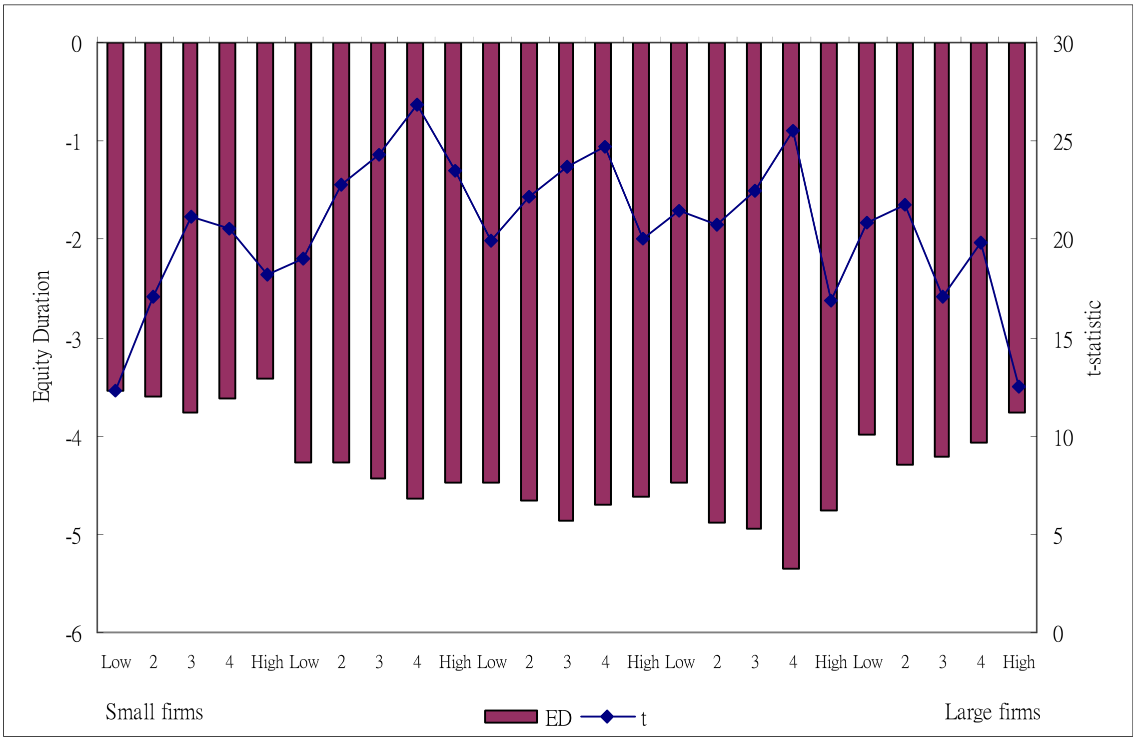


Exhibit 5

The estimated equity durations and the market βs in regressions including the orthogonalized market factor

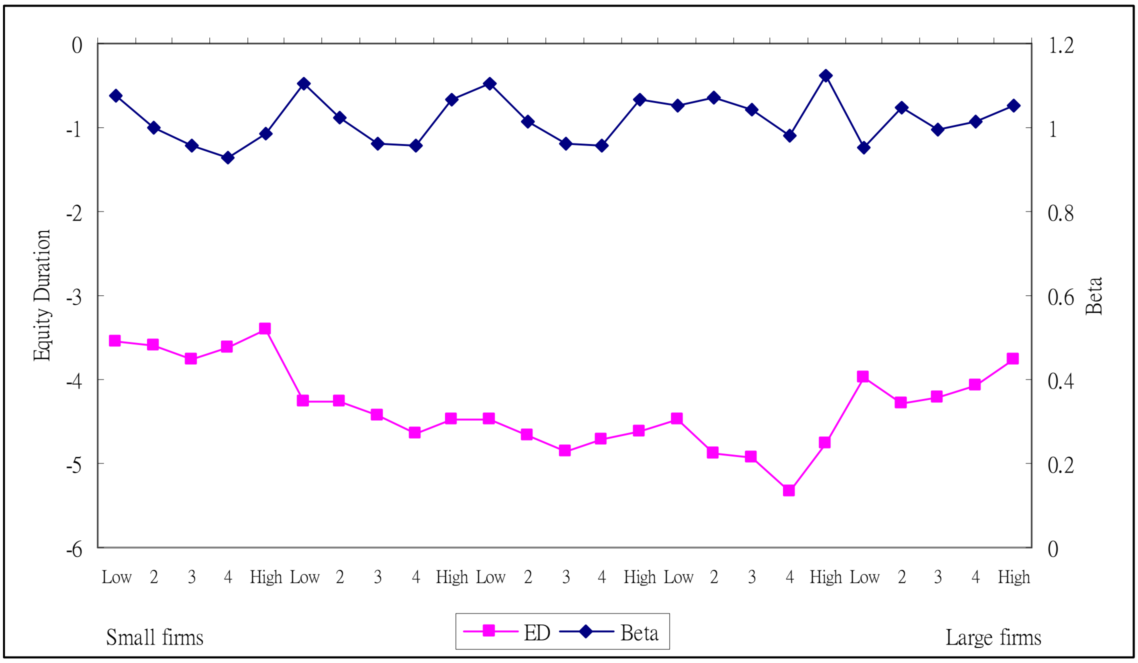
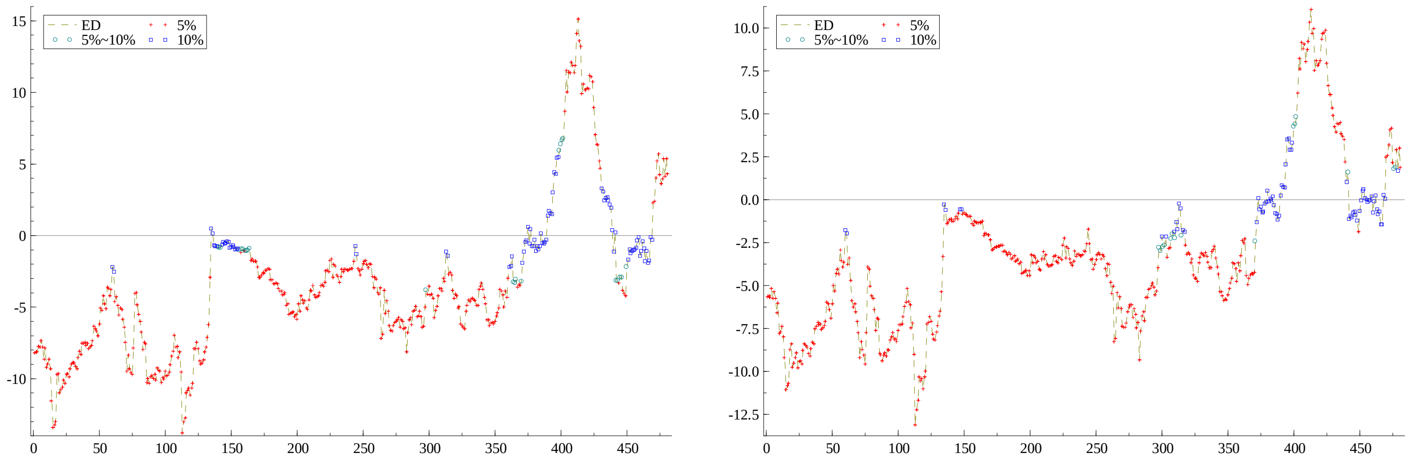


Exhibit 6

The 36-month Moving Average Equity Duration of 25 stock portfolios formed on size and B/M

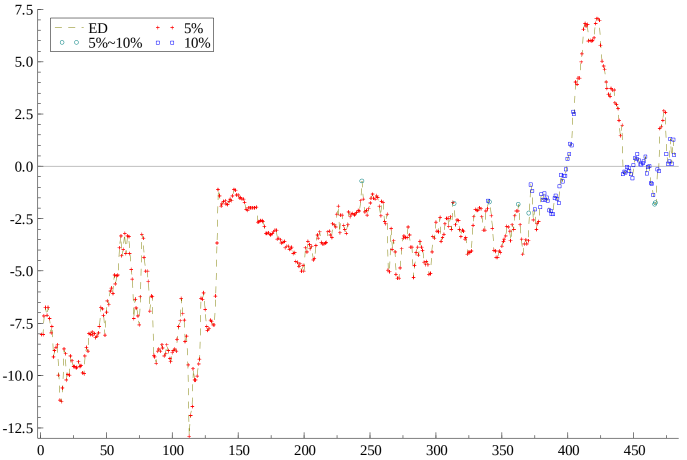
Small-size and lowest-B/M

Small-size and 2nd-B/M

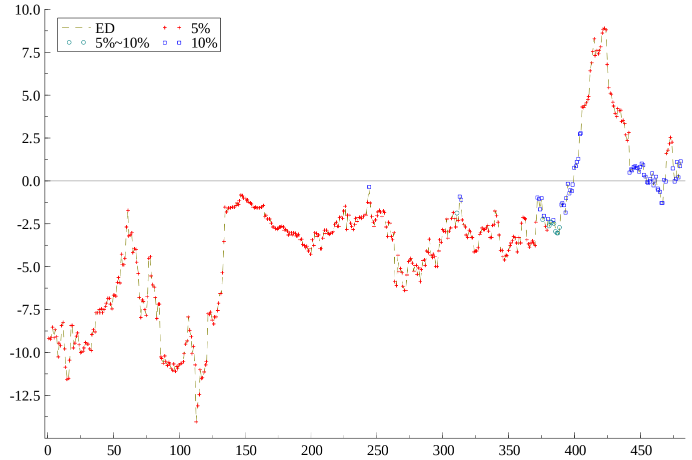


Small-size and 3rd-B/M

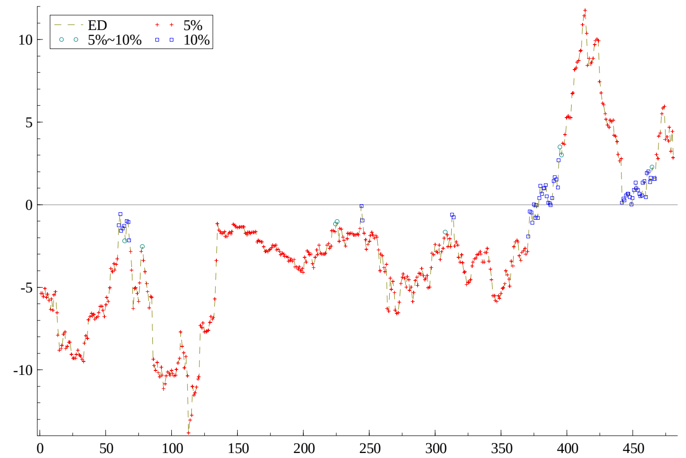
Small-size and 4th-B/M



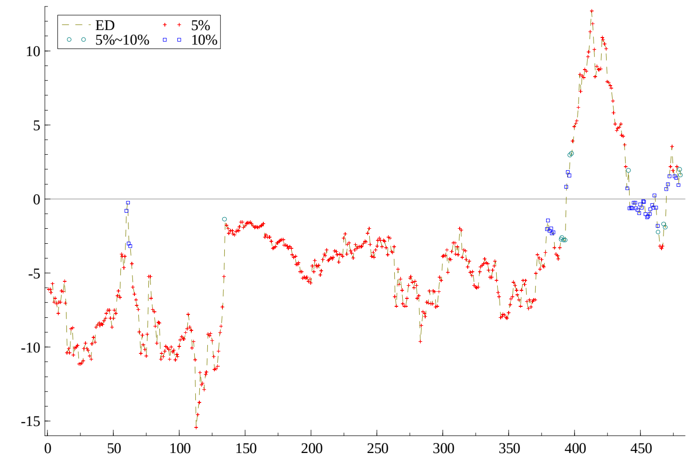
Small-size and highest-B/M



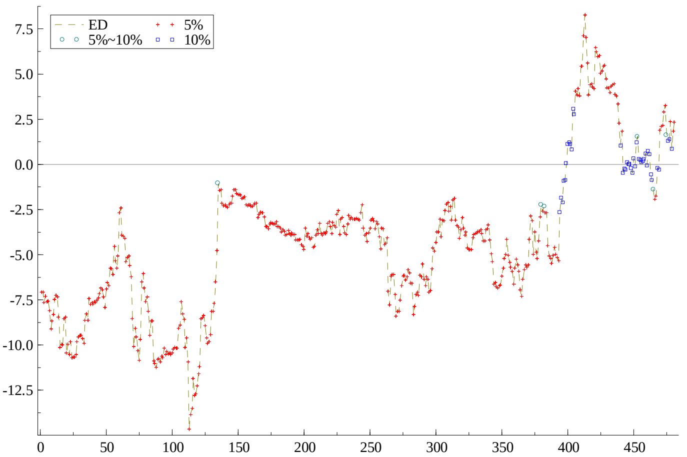
Second-size and lowest-B/M



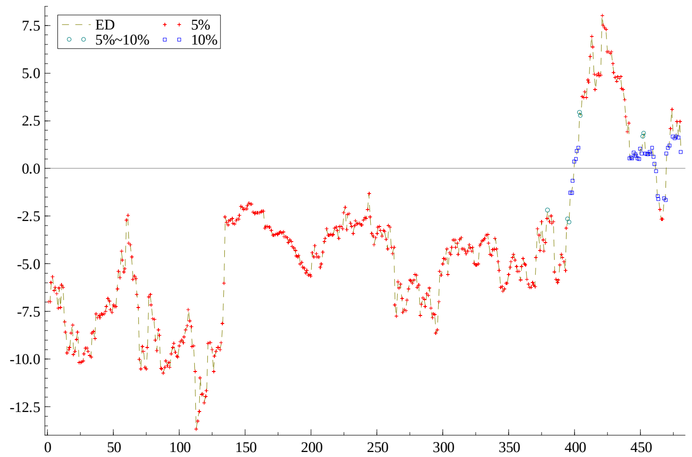
Second-size and 2nd-B/M



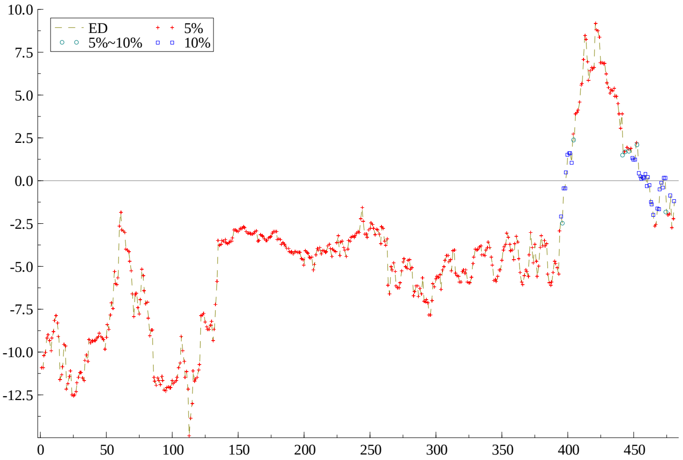
Second-size and 3rd-B/M



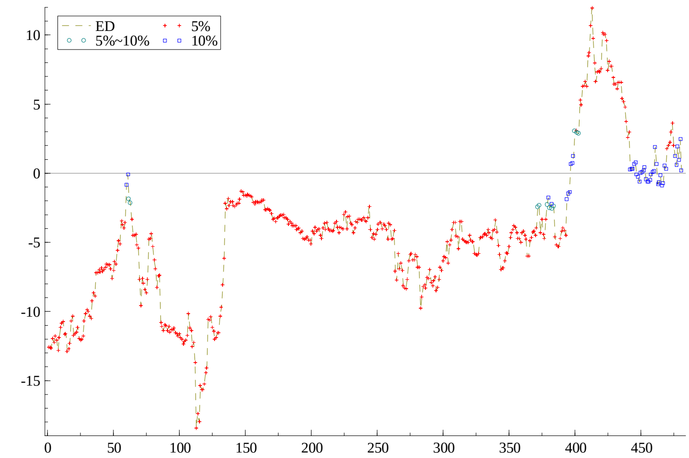
Second-size and 4th-B/M



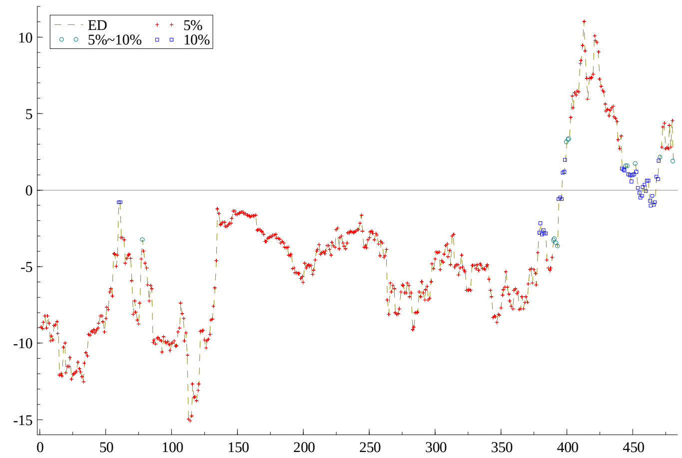
Second-size and highest-B/M



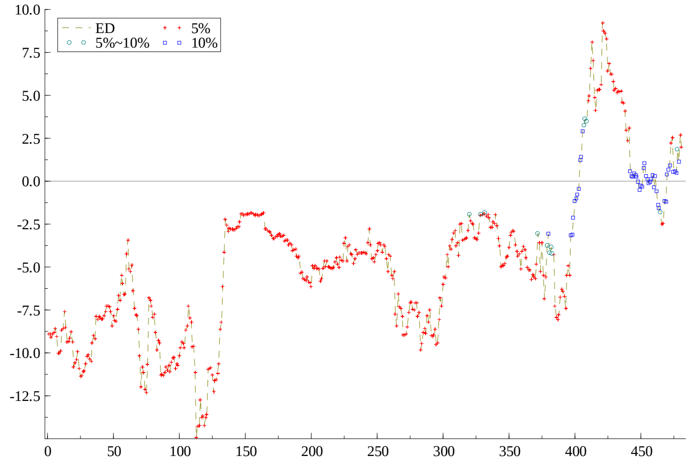
Third-size and lowest-B/M



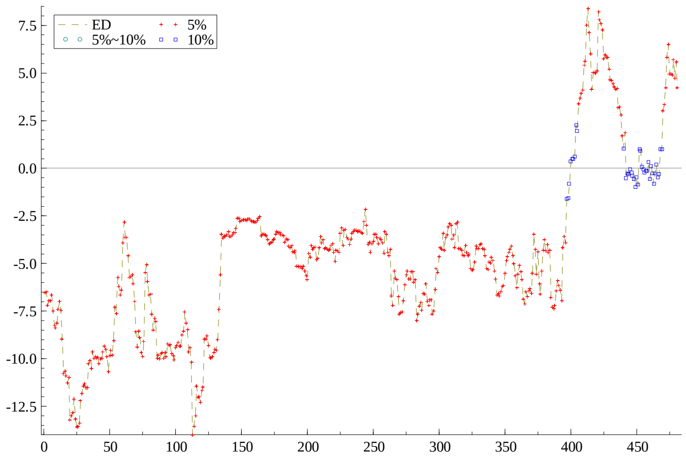
Third-size and 2nd-B/M



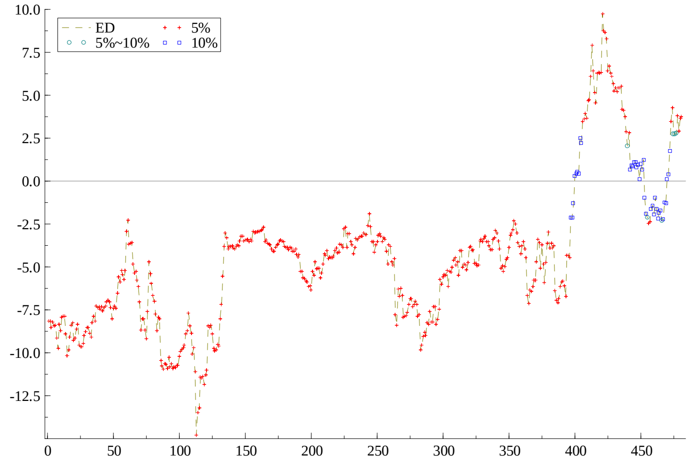
Third-size and 3rd-B/M



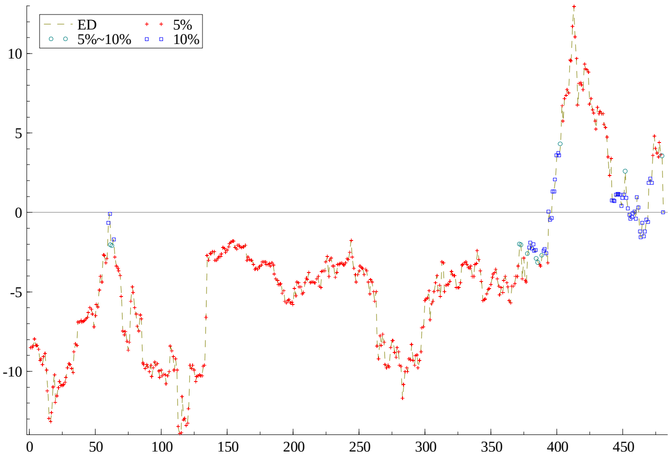
Third-size and 4th-B/M



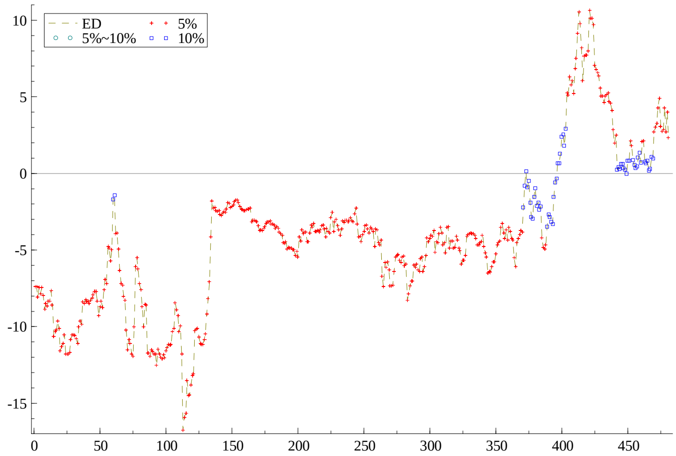
Third-size and highest-B/M



Fourth-size and lowest-B/M

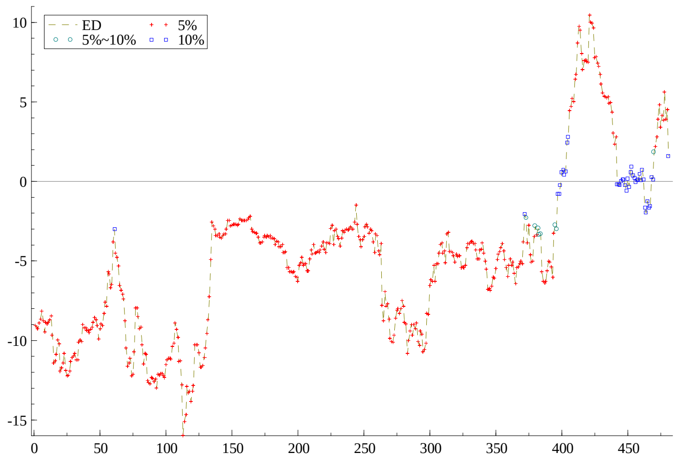


Fourth-size and 2nd-B/M

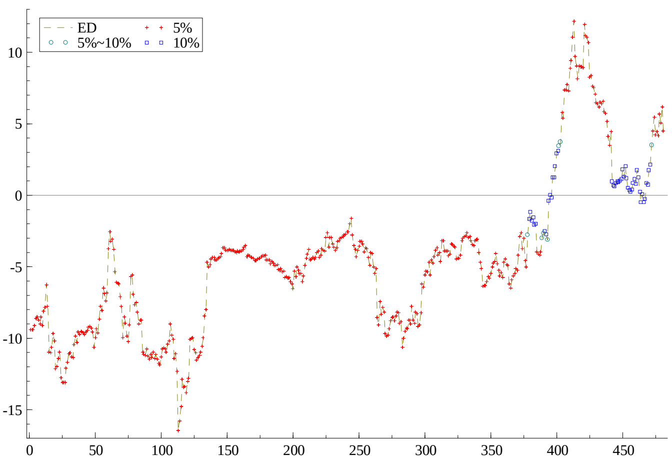


Fourth-size and 3rd-B/M

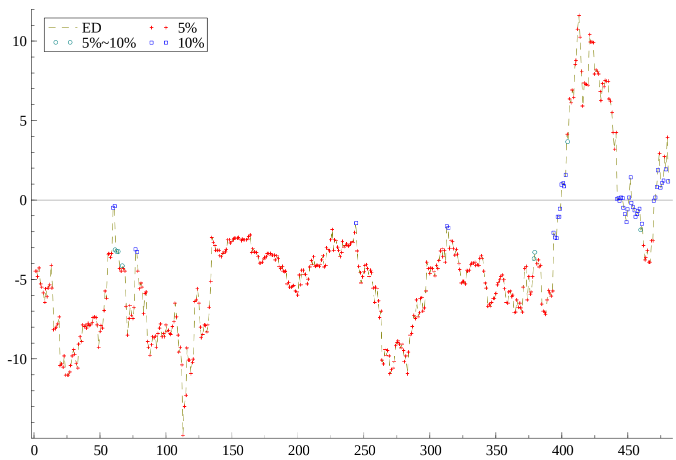
Fourth-size and 4th-B/M



Fourth-size and highest-B/M

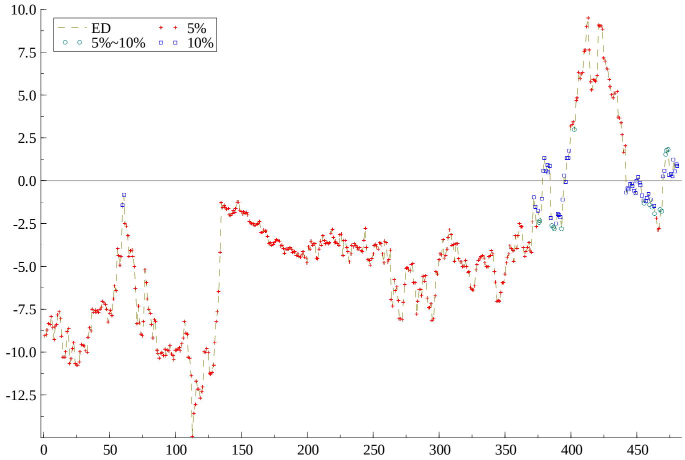


Largest-size and lowest-B/M

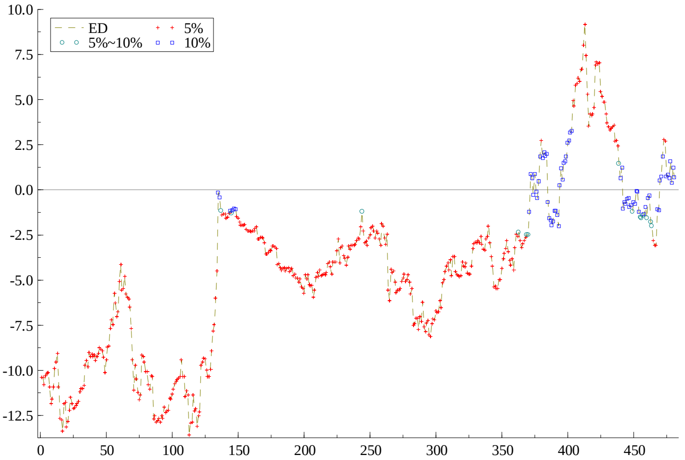


Largest-size and 2nd-B/M

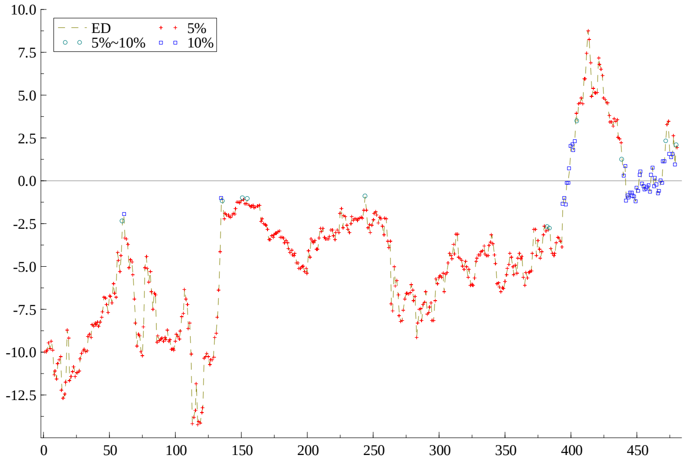
Largest-size and 3rd-B/M



Largest-size and 4th-B/M



Largest-size and highest-B/M



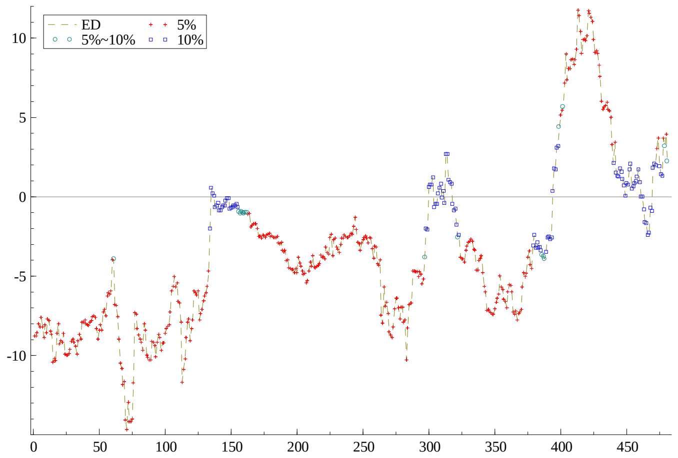
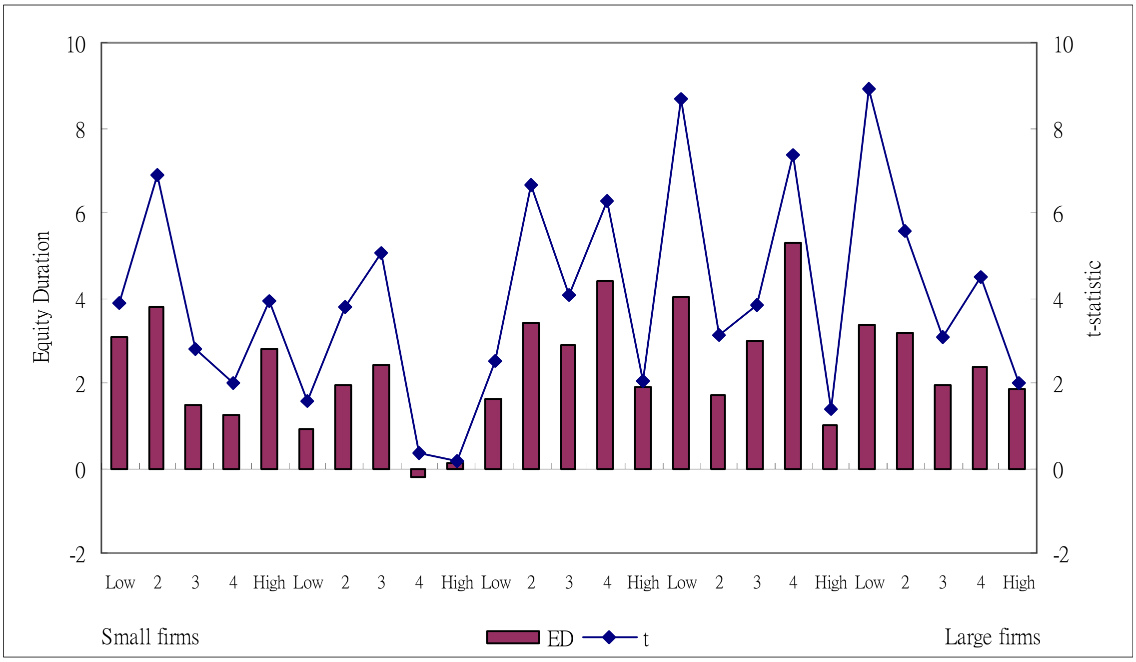
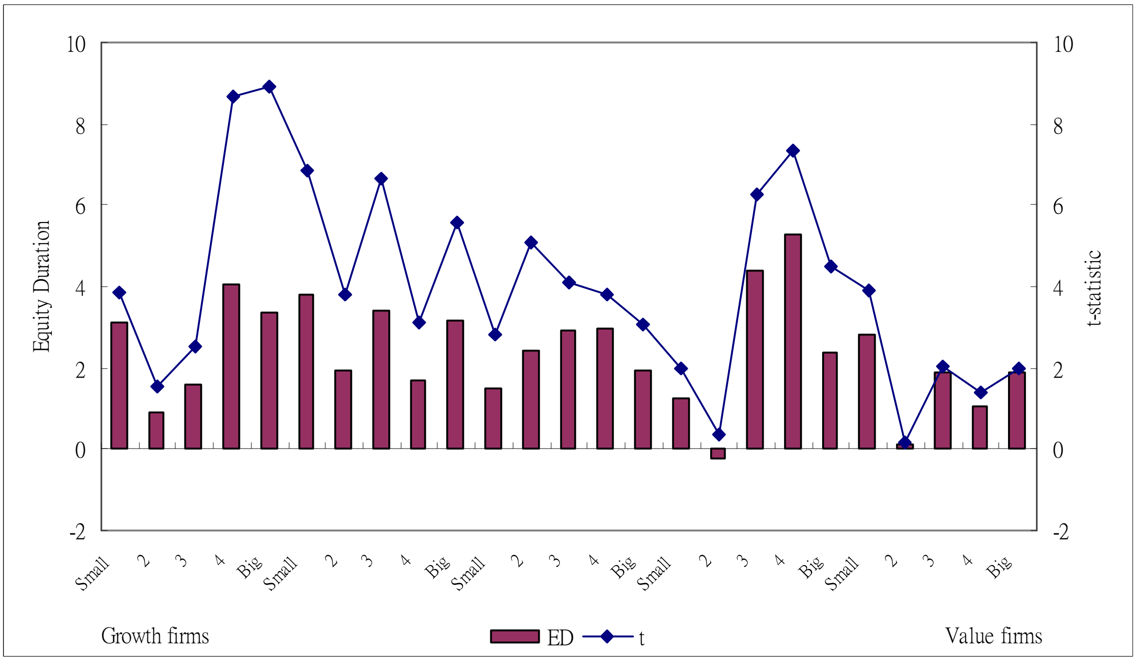


Exhibit 7
Equity durations in regressions of
the interest rate change, the orthogonalized market factor, the size and book-to-market factors



(a) arranged first by size and then by book-to-market ratio.



(b) arranged first by book-to-market ratio and then by size.

國科會補助計畫衍生研發成果推廣資料表

日期:2011/01/19

<table>
<tr><td rowspan="3">國科會補助計畫</td><td>計畫名稱: 權益期限結構之估計與其結構性變化之研究</td></tr>
<tr><td>計畫主持人: 郭維裕</td></tr>
<tr><td>計畫編號: 98-2410-H-004-060-　　　學門領域: 財務</td></tr>
<tr><td colspan="2">無研發成果推廣資料</td></tr>
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98 年度專題研究計畫研究成果彙整表

計畫主持人：郭維裕			計畫編號：98-2410-H-004-060-				
計畫名稱：權益期限結構之估計與其結構性變化之研究							
成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	1	1	100%		
		研討會論文	1	1	100%		本研究之論文初稿已於去年的台灣財務金融學會年會報告過。目前正持續修改中，近期內將投稿至國外學術期刊。
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	0	0	100%	人次	
		博士生	1	1	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	1	1	100%		
		研討會論文	1	1	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	1	1	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	無

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估 ■達成目標 □未達成目標（請說明，以 100 字為限） □實驗失敗 □因故實驗中斷 □其他原因 說明：
2. 研究成果在學術期刊發表或申請專利等情形： 論文：□已發表 ■未發表之文稿 □撰寫中 □無 專利：□已獲得 □申請中 ■無 技轉：□已技轉 □洽談中 ■無 其他：（以 100 字為限） 去年參加過 2010 年台灣財務金融學會年會後，持續修改文稿中，準備投稿至國外期刊。
3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限） 本研究的成果有助於學術界相關研究人員對於股票權益存續期間與其結構性變化之間的互動關係，並協助實務界進一步估計與預測該存續期間的變化，以利進行適當的投資和避險策略。