The Cross Section of Expected Stock Returns Revisited

by

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Abstract

We review and extend two important empirical financial studies: Fama and MacBeth [1973] and Fama and French [1992].

Fama and MacBeth [1973] sort stocks on the New York Stock Exchange into 20 portfolios based on their market β. They test for, and conclude that, β does in fact explain the cross-sectional variation in average stock returns for the 1926-1968 period. After we replicate the results in their study we extend their work to the most current data. The coefficients and t-statistics for five-year sub-periods exhibit roughly the same properties during the last half of the century as they did during the period originally studied. Fama and MacBeth report statistically significant results for their overall period (1935-1968) as well. When we run the same test on the all the data currently available (1935-1998) we find that the t-statistics are lower, instead of higher, than they were for the 1935-1968 period.

We run several variations on the Fama and MacBeth [1973] paper. For example, we vary the exchanges (NYSE, AMEX, and/or NASDAQ) and indexes (value-weighted or equally-weighted) employed. We also study the effect of using robust (least absolute deviation) regressions instead of ordinary least squares. In all cases, the results are similar to those described above.

Fama and French [1993] show that, when size is controlled for, market β does not explain the cross-sectional variation in returns for the 1963-1990 period. They find that two other variables, size (market equity) and book-to-market equity, combine to capture the cross-sectional variation in average stock returns during the same period. After replicating their results, we update the study to the most current data. We find that the t-statistics for size and book-to-market equity are more significant during the 1963-1998 period than they were for the 1963-1990 period. We also confirm that β is statistically insignificant during the 1963-1998 period.

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I would also like to single out Antti Petajisto for his contributions to my education in finance. He helped me get a grip on the fundamentals of the CAPM, the I-CAPM, and numerous other theories in the field. He also had to endure, as I did, all too many hours of checking, double-checking, and re-checking code and results in our quest for a perfect match.

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Contents

List of Tables

Chapter 1

Fama-MacBeth Revisited

The relationship between risk and return is an important problem in financial economics. In the last four decades diverse models have been developed to describe this relationship under market equilibrium. The first model was created almost simultaneously by Sharpe [1963, 1964] and Treynor [1961]. Later, Mossin [1966], Lintner [1965, 1969], and Black [1972] expanded on their ideas. This model is usually referred to as the Capital Asset Pricing Model (CAPM) and proposes that the equilibrium rates of return on all risky assets are a function of their covariance with the market portfolio.

In part, the purpose of our research is to investigate the empirical evidence and the validity of this model. Fama and MacBeth [1973] present empirical tests of the CAPM up to 1968. One of the goals of this paper is to replicate and extend the Fama and MacBeth [1973] paper to test if their conclusions are still statistically significant. We also look at variations of the Fama-MacBeth procedure in an effort to test the robustness of their model.

1.1 Testable Implications of the CAPM

The Capital Asset Pricing Model was the first explicit relationship proposed between risk and return. It is based on Markowitz's work on portfolio selection. He argued that investors would optimally hold a mean-variance effective portfolio. That is, a

portfolio with the highest expected return for a given level of variance. Sharpe and Linter built on his work and showed that if investor's have homogeneous expectations and optimally hold mean-variance efficient portfolios, then in the absence of market frictions, the market portfolio will itself be a mean-variance efficient portfolio. The CAPM is a direct implication of the mean-variance efficiency of the market portfolio.

The original paper tests the relationship between risk and return for common stocks on the New York Stock Exchange. More specifically, the authors test three hypothesis of the Capital Asset Pricing Model

$$E(R_i) = E(R_f) + [E(R_m) - E(R_f)]\beta_i \tag{1.1}$$

where $E(R_i)$ is the expected return on stock i, $E(R_f)$ is the expected risk-free rate, $E(R_m)$ is the expected return on the market, and β_i measures the extent to which returns on the security i and the market move together.

The three major (testable) assumptions of the standard CAPM follow.

1. The relationship between the expected return on a security and its risk is linear.

2. β_i is a complete measure of the risk of a security i; no other measure of the risk of i appears in (1.1).

3. In a market of risk-averse investors, higher risk should be associated with higher expected return; that is, $E(R_m - E(R_f)) > 0$.

For these assumptions to hold we must assume that the capital market is efficient. Second, we assume that all available information is costless from which all investors derive the same and correct conclusions about the future value of any asset. In other words, assume homogeneous expectations. Last, short selling is allowed.

Fama and MacBeth propose the following stochastic generalization of (1.1):

$$R_{it} = \gamma_{0t} + \gamma_{1t}\beta_i + \gamma_{2t}\beta_i^2 + \gamma_{3t}s_i + \eta_{it} \tag{1.2}$$

where β_i is as defined in equation (1.1), η_{it} is the standard normal error term, and s_i

is the standard deviation of ϵ_{it} in

$$R_{it} = a_i + \beta_i R_{mt} + \epsilon_{it}. \tag{1.3}$$

To test the hypotheses stated above, Fama and MacBeth run equation (1.2) in the manner described in section 1.3 and use regression output to show

1. Linearity: $E(\hat{\gamma}_{2t}) = 0$.
2. No systematic effects of non-β risk: $E(\hat{\gamma}_{3t}) = 0$.
3. Positive expected return-risk tradeoff: $E(\hat{\gamma}_{1t}) = E(R_{mt}) - E(R_f) > 0$.

The t-statistics of the gammas indicate whether they are statistically significant. For example, in the standard CAPM, $\hat{\gamma}_1$ in (1.2) is interpreted as the expected excess monthly return on the market portfolio $E[R_{mt} - R_f]$, $\hat{\gamma}_0$ as the risk-less rate R_f, and $\hat{\gamma}_2$ and $\hat{\gamma}_3$ should both be zero. The results of their experiment are discussed below.

1.2 The Data

Fama and MacBeth use monthly percentage returns (including dividends and capital gains) for all common stocks traded on the New York Stock Exchange between January 1926 to June 1968. The data are from the University of Chicago's Center for Research in Security Prices (CRSP).

Each observation in our data is a particular stock (identified by its PERMNO) on a particular month. We set the observation's return variable to missing if it is less than -1. Only stocks that have at least 48 months of non-missing return data in the formation period[1] and at least 60 months of non-missing return data in the estimation period are included in any of the three periods. The formation, estimation, and testing periods are described in detail below.

[1]The first formation period is treated differently since it is only 4 years (instead of 7 years) long. We require at least 40 months (instead of 48 months) of non-missing return data to be included in the sample. The first estimation period is 5 years, as are the others, so the data requirement is the same.

1.3 The Procedure

Here, we describe the Fama-MacBeth procedure as outlined in their 1973 article. A large majority of the details in the following steps are taken directly (i.e. without interpretation), from the paper. The authors, however, did not explicitly state every detail. In those selected cases we choose the most reasonable solution. These particular issues will be addressed following our description of the procedure.

There are three periods in the Fama-MacBeth procedure: the portfolio formation period, the estimation period, and the testing period. Each formation period is 7 years in length, except the first which is 4 years. Each estimation period is 5 years long. Finally, each testing period spans 4 years, except the last which is one and a half years long (1967 to June of 1968). For completeness, the portfolio formation periods are 1926-29, 1927-33, 1931-37, and so on until 1955-61. The estimation periods are 1930-34, 1934-38, and so on until 1962-66. The testing periods are 1935-38, 1939-42, and so on until 1963-66, 1967-68.

1. For each stock i that meets the data requirements mentioned above run the following regression in the first formation period:

$$R_{it} = a_i + \beta_i R_{mt} + \epsilon_{it}. \tag{1.4}$$

   where R_{it} is the monthly return on stock i, R_{mt} is the monthly return on the market portfolio[2], and the regression coefficient $\hat{\beta}_i$ is an estimate of the CAPM beta of stock i.

2. Create 20 portfolios sorted on the $\hat{\beta}_i$ calculated above. Let N be the total number of stocks and let $int(N/20)$ be the largest integer greater than or equal to $N/20$. The middle 18 portfolios each get $int(N/20)$ stocks. If N is even, the first and the last portfolio each gets $int(N/20) + \frac{1}{2}(N - 20int(N/20))$ stocks. If N is odd, the last portfolio (the one with the highest betas) gets an additional

[2]Fama and MacBeth take the market to be the equally-weighted return (including dividends) for all NYSE stocks that month. This variable is included in the CRSP monthly stock index file.

stock. Once each stock is assigned a portfolio the formation period $\hat{\beta}_i$'s are no longer of any use and can be discarded.

3. For each stock i that meets the data requirements mentioned above run regression (1.4) in the first estimation period.

4. Compute $\hat{\sigma}_{\hat{\epsilon}_{it}}$, the non-market risk for stock i (i.e. the standard deviation of the regression residuals $\hat{\epsilon}_{it}$).

5. For each portfolio calculate $\hat{\beta}_{pt}$, the equally-weighted average of the individual stock betas. Include only the $\hat{\beta}_i$s that have returns greater than -1[3] in December of the final year of the estimation period. These $\hat{\beta}_{pt}$s are for the first month of the testing period.

6. To calculate the $\hat{\beta}_{pt}$s for the second month of the testing period find the equally-weighted average of the individual stock betas $\hat{\beta}_i$ that have not delisted in the first month. In other words, to be included, the stock must have returns greater than -1 in the previous month.

7. The above procedure is repeated for each month in the first year of the testing period.

8. To compute the $\hat{\beta}_{pt}$s for the first month of the second year of the testing period it is necessary to recalculate the individual stock betas $\hat{\beta}_i$. Run regression (1.4) using all five years of the estimation period and the first year of the testing period. The $\hat{\beta}_{pt}$s are now calculated in the same way as before. For example, the $\hat{\beta}_{pt}$ for first month of the second year of the testing period is the equally-weighted average of the $\hat{\beta}_i$s that have returns greater than -1 in December of the first year of the testing period.

9. The remaining $\hat{\beta}_{pt}$s for the third and fourth years of the testing period can be calculated by incorporating the previous 7 and 8 years of data respectively in

[3]Some returns in the CRSP database are missing or less than -1. Returns on stocks cannot be less than -1 since they have limited liability. This restriction filters out some of the bad data

regression (1.4) and following the procedure above.

10. As was done for the $\hat{\beta}_{pt}$s, calculate the non-market risk term for each month and each portfolio $\hat{s}_{pt}$ during the testing period. This requires adjusting for stock delistings and recalculating the individual stock $\hat{\sigma}_{\hat{\epsilon}_i}$s every year with the most current data available.

11. As was done for the $\hat{\beta}_{pt}$s, calculate the mean of the portfolio beta squared $\hat{\beta}^2_{pt}$ for each month during the testing period. The $\hat{\beta}^2_{pt}$ are constructed from the square of the individual stock betas $\hat{\beta}^2_i$. More specifically, first calculate $\hat{\beta}^2_i$ and then take the mean to find each portfolio's $\hat{\beta}^2_{pt}$. The order of the operations is important. Taking the square of the means of the $\hat{\beta}_i$s, instead of the mean of the squared $\hat{\beta}_i$s, will produce incorrect results.

12. Repeat all the steps above for the remaining portfolio formation, estimation, and testing periods.

13. For each month of the testing period, run the following four regressions:

$$R_{pt} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{pt-1} + \eta_{pt} \quad \forall p \tag{1.5}$$

$$R_{pt} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{pt-1} + \gamma_{2t}\hat{\beta}^2_{pt-1} + \eta_{pt} \quad \forall p \tag{1.6}$$

$$R_{pt} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{pt-1} + \gamma_{3t}\hat{s}_{pt-1} + \eta_{pt} \quad \forall p \tag{1.7}$$

$$R_{pt} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{pt-1} + \gamma_{2t}\hat{\beta}^2_{pt-1} + \gamma_{3t}\hat{s}_{pt-1} + \eta_{pt} \quad \forall p \tag{1.8}$$

where R_{pt} is the equally-weighted average return on the stocks in portfolio p at time t, $\hat{\beta}_{pt}$ is the portfolio beta estimate, $\hat{\beta}^2_{pt}$ is the portfolio beta squared estimate, and $\hat{s}_{pt}$ is the portfolio standard deviation term. The result is a time series of the $\hat{\gamma}_{0t}$, $\hat{\gamma}_{1t}$, $\hat{\gamma}_{2t}$, and $\hat{\gamma}_{3t}$ from each of the regressions (1.5) - (1.8).

14. Table 3 in the Fama-MacBeth [1973] paper present their results for various lengths of sub-periods (i.e. 33, 10, and 5 years). In this paper we calculate and present the results for the 5-year sub-periods. The calculations for the other sub-periods are straight forward after the explanation that follows. Take

a five-year sub-period (e.g. 1935-1940) and compute the mean, variance, and t-statistic for each gamma.

$$\hat{\gamma}_1 = \frac{1}{T}\sum_{t=1}^{T}\hat{\gamma}_{1t} \tag{1.9}$$

$$\hat{\sigma}^2_{\hat{\gamma}_{1t}} = \frac{1}{T-1}\sum_{t=1}^{T}(\hat{\gamma}_{1t}-\hat{\gamma}_1)^2 \tag{1.10}$$

$$t_{\hat{\gamma}_1} = \frac{\hat{\gamma}_1}{\hat{\sigma}_{\hat{\gamma}_{1t}}/\sqrt{T}} \tag{1.11}$$

where T denotes the total number of months in the testing period (usually 60). For the other regression coefficients $\hat{\gamma}_{0t}$, $\hat{\gamma}_{2t}$, and $\hat{\gamma}_{3t}$, use the same formulas, simply change the subscript of gamma from 1 to 0, 2, or 3.

1.4 Procedural Issues

As mentioned above, there are a number of points which were unclear in the original paper. The aim of this section is to explicitly state the parts we interpreted. While our results are very close to the published results, we expect that the following ambiguities and/or differences caused us to fail in our attempt to replicate the Fama-MacBeth [1973] results exactly.

Fama and MacBeth use "Fisher's Arithmetic Index" as a proxy for the market. It is an equally-weighted average of the returns on all stocks listed on the New York Stock Exchange. We assume that this is the same as the equally-weighted NYSE index that CRSP includes in its monthly stock index files.

In their paper the authors state that each security included in the first month of the testing period must also be included in all five years of the corresponding estimation period and at least four years of the corresponding portfolio formation period. We interpreted this as, the security must have 60 months (5×12 months) and at least 48 months (4×12 months) of entries in the estimation and formation periods respectively. To get the number of stocks we use in testing period to match

the number in the paper more closely, we also required that the securities have at least 48 months of return data greater than -1 in both the estimation and formation periods. It is clear, from a visual inspection of the raw data, that a similar restriction, although not stated, must have been employed by the authors. There are a number of stocks that do not have any non-missing returns for the entire estimation period and therefore could not be included in the portfolio beta estimation.

There is an exception to our rule, however. The first portfolio formation period is three years shorter than the rest. When we imposed the same restriction on the data we found that we eliminated far too many stock as compared to the published results (Table 1 of Fama-MacBeth [1973]). By trial and error, we discovered that requiring at least 40 months of entries with at least 30 of them having return data greater than -1 we achieved a very close match to the number of stocks used by Fama and MacBeth. See Table 1.1.

The results presented in this paper include securities with missing return information. However, it is possible that Fama and MacBeth replaced some of these missing values with zeros. We ran a scenario where we changed returns with missing values to returns equal to zero only if the security had no more than 10 consecutive observations (i.e. 10 months) of missing returns after at least one return greater than -1.

Finally, in this paper, we include a stock in the portfolio formation period only if it meets the data requirements of both the formation and estimation periods. In the Fama-MacBeth paper, the authors say that they form their portfolios based on 4-years of monthly return data. They do not mention checking the estimation period data. After running the algorithm both ways we found that our results more closely matched theirs when we employed our current rule. Therefore, we assume that they must have included a similar rule.

Table 1.1: **NYSE: Portfolio Formation, Estimation, and Testing Periods**

For a security to be included in the sample it must meet the following minimum requirements: 1) 48 months of of non-missing return data in the formation period and 2) 60 months of non-missing return data in the estimation period. This applies to all testing periods except the first. Since the first formation period is 4 years long, instead of 7, we require only 40 months of non-missing return data.

The number of securities that meet the data requirement (Fama) is in reference to the published figures in Table 1 of Fama and MacBeth [1973]. The number of securities meeting the data requirement (Us) is in reference to the number of securities this paper used in its replications and extensions. Difference is the difference between the two.

Formation period	1926-29	1927-33	1931-37	1935-41	1939-45	1943-49	1947-53	1951-57	1955-61
Estimation period	1930-34	1934-38	1938-42	1942-46	1946-50	1950-54	1954-58	1958-62	1962-66
Testing period	1935-38	1939-42	1943-46	1947-50	1951-54	1955-58	1959-62	1963-66	1967-70
Number of securities meeting the data requirement (Fama)	435	576	607	704	751	802	856	858	845
Number of securities meeting the data requirement (Us)	437	577	607	705	752	805	860	867	849
Difference	2	1	0	1	1	3	4	9	4

Formation period	1959-65	1963-69	1967-73	1971-77	1975-81	1979-85	1983-89
Estimation period	1966-70	1970-74	1974-78	1978-82	1982-86	1986-90	1990-94
Testing period	1971-74	1975-78	1979-82	1983-86	1987-90	1991-94	1995-98
Number of securities meeting the data requirement (Fama)	—	—	—	—	—	—	—
Number of securities meeting the data requirement (Us)	811	916	1050	1126	1007	919	994
Difference	—	—	—	—	—	—	—

1.5 The Results: 1935-1968

Fama and MacBeth test the above hypotheses for 10 periods: 1935-6/68, 1935-45, 1946-55, 1956-6/68, five five-year sub-periods starting with 1935-40, and finally 1961-6/68. The results are shown in Table 3 of their paper (not shown). We obtained almost identical results as seen in Table A.1[4]. (We discuss the differences (Table 2.1) and possible explanations for the differences in section 2.1.) For each sub-period the table shows the average of the month-by-month regression coefficient estimates $\bar{\hat{\gamma}}_j$ along with other standard regression output. Panel D of Table A.1 is based on (1.2). Panel A only includes γ_0 and γ_1 from (1.2). Panel B and C are the same as D, except they suppress γ_3 and γ_2 respectively.

The first hypothesis, which says that the relationship between expected returns and β is linear (i.e. $E(\gamma_{2t}) = 0$) is not rejected. Panels B and D provide the evidence. In panel B, the value of $t(\bar{\hat{\gamma}}_2)$ is close to zero except when the sub-period includes the period from 1951-55. The same holds for panel D.

The hypothesis that there is no systematic effects of non-β risk on returns (i.e. $E(\gamma_{3t}) = 0$) is not rejected based on the results of the tests. The values of $t(\bar{\hat{\gamma}}_3)$ in panels C and D are small, and the signs change randomly.

The third, and crucial, hypothesis that there is a positive expected return-risk tradeoff (i.e. $E(\gamma_{1t}) = E(R_{mt}) - E(R_f) > 0$) also holds up well. For the overall period 1935-68 $t(\bar{\hat{\gamma}}_1)$ is large (see Table A.2). Furthermore, for all sub-periods, except 1956-60, the values of $t(\bar{\hat{\gamma}}_1)$ are positive but not large.

The following two hypothesis were also tested in the original paper, however we did not try and replicate these particular tests. A summary of the results is included here for completeness.

The most efficient test of the Sharpe-Lintner (S-L) hypothesis (i.e. $E(\gamma_{0t}) = R_{ft}$) are provided by the one-variable model of panel A since the values of $s(\gamma_0)$ are smaller than those of the other models. The evidence (not shown) points to rejecting the S-L

[4]We replicated the results for all 5-year sub-periods starting with 1935-40 and ending with 1956-60. Sub-periods following 1960 are part of our extension.

hypothesis since $\overline{\gamma_0 - R_f}$ is positive and $t(\overline{\gamma_0 - R_f})$ is large for all periods but the last.

Table 3 of Fama-MacBeth [1973] provides evidence to support that the capital market is efficient. The serial correlations $\rho_M(\gamma_1)$, $\rho_0(\gamma_2)$, and $\rho_0(\gamma_3)$ (not displayed here) are low in terms of explanatory power and generally low in terms of statistical significance.

In conclusion, Fama and MacBeth do not reject the pricing of securities with the two-parameter model for expected returns. There seems to be a positive tradeoff between risk and return as well as a linear relationship between a security's risk and expected return. Further, the behavior of returns is consistent through time with an efficient capital market.

Chapter 2

Extensions and Variations

In part, the goal of this paper is to extend and update the Fama-MacBeth work. After replicating the published results as best we could we pressed on and ran the same model and some variations on more recent data. This section describes some of the validation and internal checking we performed as well as variants on the model we investigated.

2.1 Validation of the Model

Before updating the Fama-MacBeth results, it was important to check if our algorithm did what we expected it to do (i.e. follow the procedure detailed in section 1.3). If we could not replicate the published results within a reasonable margin of error it would be difficult to make comparisons between the results published in 1973 and more recent data.

Table 1.1 shows all the portfolio formation, estimation, and testing periods used in Fama-MacBeth [1973] and our paper. The last testing period both papers have in common is 1963-66. The fourth line of the table shows the number of securities Fama and MacBeth use in each of their testing periods. We report our results immediately afterwards. We observe that our algorithm includes more, and never less, securities than Fama-MacBeth. Put another way, the Fama-MacBeth results serve as a lower bound on the number of stocks meeting the data requirement.

There are two reason for this. First, as described in section 1.4, since Fama and MacBeth did not explicitly state all of their inclusion rules we had to set somewhat arbitrary rules as to which observations in our data we deemed valid. We choose the criteria such that our results came as close to the published results as we could get them.

The second, and more subtle reason, is the almost certain difference of the input data sets. Although both papers use data from CRSP, the data we use were released roughly 30 years later giving CRSP the opportunity to backfill some of data. This explanation is consistent with what we report for two reasons. First, we would expect that the oldest data (1926-29) would change the least. This is in fact what we see. In the first testing period we include 2 extra securities (less than a 1% increase). In Fama and MacBeth's second to last testing period we include 9 extra securities (greater than a 10% increase). By the time Fama and MacBeth ran their model in the early 1970s, CRSP had plenty of time to backfill data from the 1920s and 1930s. They would not have had time and/or the information, however, to backfill data from the late 1950s and 1960s. When we received the data in the late 1990s, CRSP had time to update the entire series that Fama and MacBeth used. We expect that in 30 years time, researchers attempting to replicate our results from the 1980s and 1990s will encounter the same problem. Finally, backfilling is a plausible explanation since the results published in 1973 serve as lower bound. Backfilling returns data (e.g. updating missing returns to some value greater than -1) produces more securities meeting the data requirements.

After we found the rules for security inclusion we turned our attention to fine tuning the details of the procedure. Some of these open issues were discussed earlier in section 1.4. Our final results presented in Table A.1 are qualitatively similar to those already published. In some cases, we were able to obtain an exact match with Fama and MacBeth. In the cases where we were not able to, the results are generally the same order of magnitude and almost always the same sign. Table 2.1 presents the discrepancies between our Table A.1 and Fama-MacBeth's Table 3. The errors are systematically small and their signs appear to be evenly and randomly distributed.

Table 2.1: **NYSE: Discrepancy with Fama-MacBeth [1973]**
This table expresses the cell-by-cell discrepancy, in absolute terms, between Table A.1 and Table 3 in Fama and MacBeth [1973]. The errors are systematically small and their signs appear to be evenly and randomly distributed. It is interesting to note that as we increase the number of factors in our model, from panel A to panel D, the average size of the errors also increases.

Period	$\bar{\gamma}_0$	$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0004	-0.0008	.	.	0.003	0.002	.	.	0.04	-0.08	.	.
1941-45	-0.0012	0.0015	.	.	0.001	0.001	.	.	-0.32	0.12	.	.
1946-50	0.0002	-0.0003	.	.	0.001	-0.001	.	.	-0.06	-0.03	.	.
1951-55	0.0001	-0.0001	.	.	0.000	0.000	.	.	0.09	-0.03	.	.
1956-60	0.0000	-0.0001	.	.	0.000	0.001	.	.	0.03	-0.02	.	.
Panel B:												
1935-40	0.0046	-0.0115	-0.0055	.	-0.006	-0.013	-0.004	.	0.54	0.49	0.58	.
1941-45	0.0021	-0.0069	0.0041	.	0.000	-0.021	0.011	.	0.30	-0.59	0.31	.
1946-50	0.0006	-0.0015	0.0006	.	0.000	0.003	0.001	.	0.16	0.08	0.14	.
1951-55	0.0003	-0.0004	-0.0001	.	-0.001	-0.001	-0.001	.	0.07	0.00	0.08	.
1956-60	0.0003	-0.0010	0.0004	.	-0.001	0.000	0.000	.	0.12	0.09	0.10	.
Panel C:												
1935-40	0.0020	0.0022	.	-0.0353	0.009	0.010	.	0.025	0.18	0.11	.	0.41
1941-45	-0.0023	-0.0013	.	0.0392	0.005	0.000	.	0.086	0.31	-0.22	.	0.18
1946-50	-0.0001	-0.0001	.	0.0044	-0.006	-0.002	.	0.183	0.19	0.01	.	0.32
1951-55	0.0001	-0.0002	.	0.0009	-0.001	-0.001	.	0.038	0.17	-0.01	.	-0.06
1956-60	0.0004	0.0001	.	-0.0099	-0.001	0.003	.	-0.048	0.19	0.09	.	-0.06
Panel D:												
1935-40	0.0101	-0.0139	0.0095	-0.0569	0.000	-0.015	-0.012	0.029	0.77	-0.57	0.79	-0.60
1941-45	0.0043	-0.0083	0.0055	-0.0259	0.010	0.023	0.019	0.095	0.39	-0.88	0.74	-0.28
1946-50	-0.0005	0.0008	-0.0004	-0.0026	0.002	0.007	0.012	0.013	0.09	-0.01	0.18	0.05
1951-55	-0.0005	0.0000	-0.0005	0.0183	-0.002	0.000	-0.001	-0.075	0.08	0.02	-0.17	0.14
1956-60	0.0012	-0.0001	0.0003	-0.0271	-0.006	0.007	-0.001	-0.079	0.35	0.04	0.06	-0.12

It is interesting to note that as we increase the number of factors in our model, from panel A to panel D, the average size of the errors also increases.

When we ran the same models with missing return data set to zero, as described in section 1.4, our results did not change significantly (around 1%) for panel A (not shown). However, the parameter estimates and t-statistics do appear considerably different when we included all the regressors in panel D. This is expected since the security's β could be altered significantly with the presence of zeros in the return series. Not only would the composition of the portfolios change with a change in the βs, but the presence of β^2 in panel D helps to magnify these difference, thus producing less robust results.

2.2 Extensions: 1969-1998

Once we obtained a reasonable approximation to the original Fama-MacBeth model, we proceeded with extending the tests on more current data. In this section we focus on the results for stocks only on the New York Stock Exchange. For the sake of consistency with the original paper, the market index we use in this analysis is equally-weighted index of NYSE stocks only. Stocks on the American Stock Exchange and the NASDAQ will be examined later. The new portfolio formation, estimation, and testing periods as well as the number of stocks used in the testing periods can be found in Table 1.1.

The first hypothesis, that the relationship between expected returns and β is linear (i.e. $E(\gamma_{2t}) = 0$), is not rejected upon inspection of panels B and D in Table A.1. We observe that for all sub-periods (1961-65 through 1995-98) the γ_1s are small and the value of $t(\bar{\hat{\gamma}}_2)$s is systematically close to zero. This is consistent with the CAPM and the results in Fama-MacBeth [1973].

The hypothesis that there is no systematic effects of non-β risk on returns (i.e. $E(\gamma_{3t}) = 0$) is not rejected based on the results of the tests. The values of $t(\bar{\hat{\gamma}}_3)$ in panels C and D are small, and the signs change randomly. The one exception is the sub-period spanning the late 1980s in panel C. There, the t-statistic is large.

The third hypothesis, that there is a positive expected return-risk tradeoff (i.e. $E(\gamma_{1t}) = E(R_{mt}) - E(R_f) > 0$), is not rejected but is slightly less convincing here than it was in 1973. The γ_1s are largely positive although a greater share of them are negative. All the negative γ_1s have t-statistics close to zero and are statically insignificant. All γ_1s with large t-statistics, panel A 1961-65 for instance, are positive.

When we combine the data from both this extension and the 1973 paper (i.e. 1935-98) we expect to see more significant results. In fact, we observe the opposite. Table A.2 illustrates this. The sub-period Fama and MacBeth studied (1935-68), as mentioned before, produces significant and positive t-statistics for the γ_1s. This is consistent with the assumptions of the CAPM. However, the period from 1969 to 1998 produces much smaller t-statistics, and in the case of panel D it is negative. For this reason, when we look at the overall period from 1935 to 1998 we see that the t-statistics are much lower, instead of higher as we would have expected, then when Fama and MacBeth wrote their paper in the early 70s.

Overall, our conclusions derived from the updated version of the Fama-MacBeth tests agree with their published conclusions. For large capitalization stocks (i.e. NYSE firms) in the 1935-98 time-frame, there seems to be a linear relationship between expected returns and β, there does not appear to be systematic effects of non-β risk, and finally, there is a non-negative risk-return tradeoff.

2.3 Variations: Adding Other Exchanges

It is accepted that the larger capitalization companies are more liquid, more diversified, there is more known about them, and are less volatile then their small cap counterparts. On the whole, they behave more like the market than any other subset of stocks. It is not surprising, therefore, that the CAPM passed the Fama-MacBeth tests when we restrict the data to the mostly large capitalization stocks of the NYSE. In this section, we explore how the CAPM will fare in tests when we include the, on average smaller, stocks from the American Stock Exchange and NASDAQ.

In the previous section we defined the market to be just the stocks listed on the

NYSE and used the equally-weighted index as a proxy for the market. Here we will use the value-weighted NYSE, AMEX, and NASDAQ market index and define three other markets:

1. NASDAQ
2. NYSE and AMEX
3. NYSE and AMEX and NASDAQ

We will also examine the effects of having value-weighted portfolios verse the equally-weighted portfolios we studied before. Value-weighted portfolios emphasize the larger capitalization companies compared to the equally-weighted portfolios since there are a far great number of small companies on the exchanges (especially when we add the AMEX and NASDAQ).

Table B.1 shows the Fama-MacBeth results from just including the securities listed on the NASDAQ. We decided to study the companies listed on the NASDAQ separately for a couple of reasons. First, although in recent years the NASDAQ has listed some of the largest companies in the world, on average most of the securities have smaller market capitalizations than those on the NYSE. As mentioned above, smaller companies are generally less liquid. Second, and more important, trading on NASDAQ is markedly different than trading on other exchanges since 1) there is no trading floor and 2) there is no single specialist for a particular security.

The NASDAQ opened in 1971. Therefore, after including the requisite portfolio formation and estimation periods, our first testing period is not until the 1983. Even with this abbreviated data set, we did not change the Fama-MacBeth procedure when we studied these securities. Namely, we kept the same portfolio formation, estimation and testing periods.

Again, we see in panels B and D of Table B.1 that there appears to be a linear relationship between expected returns and β. Statistically, the t-statistics are for the $\bar{\tilde{\gamma}}_2$s (the coefficient for the non-linear β^2 term in equations 1.7 and 1.8) are small. We observe that, for the most part, the values of $t(\bar{\tilde{\gamma}}_3)$ are small indicating that there

is little evidence of systematic effects of non-β risk on returns. The only cause of concern is found in panel D during the 1991-95 sub-period. There, the value of $t(\bar{\tilde{\gamma}}_3)$ is positive and significant. Finally, we do not reject the null hypothesis that there is a positive return-risk tradeoff since all but one of the $t(\bar{\tilde{\gamma}}_1)$s are positive, although none are large. In all cases, the numbers are roughly the same magnitude and sign as those found when we examined only NYSE securities.

Table B.2 presents a variant of the model we ran above. Now, instead of using equally-weighted returns for the portfolios and market index, we switch to a value-weighted scheme. This shifts the emphasis from small companies to the larger ones. Qualitatively, our results are the same and the conclusions described above still hold. However, there are some slight differences we can attribute to the heavier weighting of the large companies. For example, the values of $t(\bar{\tilde{\gamma}}_2)$s are smaller and less significant than before providing more credence that there is a linear relationship between expected returns and β. The large and significant t-statistic for $\bar{\tilde{\gamma}}_3$ we saw earlier in panel D of Table B.1 is now smaller and insignificant in Table B.2.

When we examine NYSE and AMEX stocks (Tables C.1 and C.2) we find that the results are again qualitatively similar to those presented before[1]. In fact all the remaining tables (including those where we include stocks on all three exchanges) are qualitatively similar to Table A.1. There are fluctuations from year to year, some results are more significant than others but on the whole the conclusions are the same. The three hypothesis of the CAPM we test do not seem too sensitive to how we define the market. However, the CAPM model assumes that the market includes all wealth held by investors. The closest approximation we have of this is the the value-weighted NYSE, AMEX, and NASDAQ market index. This is in fact what Fama and French do and how we will proceed in chapter 3.

[1]If we make a direct comparison to Table A.1 we see that the first 5 sub-periods are exactly the same since the AMEX was yet not in operation.

2.4 Variations: Robust Regressions

In this section we run the same procedure outlined in section 1.3 with one distinction; when we estimate the βs in the portfolio formation and estimation periods we minimize the absolute deviation of the error terms instead of minimizing the squared error. The final regressions (i.e. equations 1.5-1.8) are still run using least squares. Least absolute deviation regressions, or robust regressions, are useful for minimizing the effect of outliers.

The results from these tests are roughly the same as what was described before. The parameter estimates differ by approximately 10-30% in Panel A and C. Panels B and D are significantly different due to the addition of beta squared.

Chapter 3

Fama-French Revisited

Since the early 1980's there have been a vast number of empirical studies providing evidence that the CAPM does not hold. Beta, these papers point out, does not fully explain the cross-sectional differences in stock returns. Around the same time these studies became popular, a second, more general, equilibrium pricing model was developed by Ross [1976] called the Arbitrage Pricing Theory (APT). It is similar to the CAPM, but it permits several (unspecified) linear factors to explain the equilibrium return of a risky asset. Since then, hundreds of variables, and ratios of variables, were empirically tested in the search for statistically significant factors. Fama and French [1992] empirically test such a model and conclude that size (market equity) and book-to-market equity successfully capture the cross-sectional variation in average stock returns for the 1963-1990 period. This chapter describes their methodology, summarizes their results, and extends their work to the most current data.

3.1 The Data

Fama and French use all non-financial firms in the intersection of the CRSP NYSE, AMEX, NASDAQ Monthly Stock File and the COMPUSTAT Industrial Annual File. The COMPUSTAT Industrial Annual File is a composite of Primary, Supplementary, and Tertiary files. The Primary File contains the largest companies on the New York and American Stock Exchanges, including all companies comprising the S&P

Industrial Index. The Supplementary and Tertiary files contain companies listed on major exchanges. In addition, the Tertiary File includes utility subsidiaries that were once S&P constituents and presents approximately 300 non-industrial companies in a format comparable to industrial companies. The first year of COMPUSTAT data used is 1962 since, before that time, book value of common equity is not generally available. The first year of CRSP data used is 1958 (for firms which also have COMPUSTAT data in 1962) since, as with the Fama-MacBeth procedure described in the previous chapter, we only use CRSP individual monthly returns to determine the portfolios during the formation period.

The authors define several variables in their 1992 paper. Table 3.1 shows the combination of CRSP or COMPUSTAT variables needed to create the appropriate Fama-French variables[1]. Book equity (BE), is the book value of common equity plus balance-sheet deferred taxes. Total assets (A), is total book assets. Earnings (E), is income before extraordinary items plus income-statement deferred taxes minus preferred dividends. Firms size (ME), is price times shares outstanding measured in June of year t.

Table 3.1: **Variable Definitions**
Book equity (BE) is the book value of common equity plus balance-sheet defered taxes. Total assets (A) is total book assets. Earnings (E) is income before extraordinary items plus income-statement deferred taxes minus preferred dividends. Firms size (ME) is price times shares outstanding measured in June of year t.

F-F Variable	Data Source	Definition
Book-Equity	COMPUSTAT	data60+data70
Earnings	COMPUSTAT	data18+data50-data19
Total Assets	COMPUSTAT	data6
Market Equity	CRSP	(prc)(shrout)

3.2 The Procedure

This section briefly describes how to put the CRSP/COMPUSTAT merged data set together and then details the Fama-French procedure. At the time of this paper

[1]Fama and French use slightly different definitions for some of the variables in their 1996 paper

CRSP has released a CRSP/COMPUSTAT merged product. It is therefore possible to to simply purchase access to this data set and avoid the complicated process of trying to merge the data. The difficulty arises because CRSP and COMPUSTAT use different identifiers for their stocks. CRSP has CUSIPs and PERMNOs while COMPUSTAT uses GVKEY, CNUM, and CICs. CNUM and the first 2 digits of the three digit CIC can be concatenated to form the CUSIP. However, CUSIPs are not consistent across different releases of the data. A match with PERMNO is ideal.

1. Merge the CRSP Monthly Stock File with the COMPUSTAT Industrial Annual File. The COMPUSTAT data is merged to the CRSP data with a 6-month gap. More precisely, COMPUSTAT accounting data from year $t-1$ is merged to CRSP return data from July of year t to June of year $t+1$. For example, returns for CRSP data between July 1991 and June 1992 get merged with COMPUSTAT data from 1990.

2. Delete COMPUSTAT data before 1962.

3. Delete all financial services firms. Financial services firms have SIC codes between 6000 and 6999 inclusive.

4. The first pre-ranking estimation period is defined for the 60 months from July 1958 to June 1963.

5. To qualify for the pre-ranking estimation period, securities must satisfy *all* of the following requirements:

   (a) a CRSP stock *price* in December 1962 *and* June 1963

   (b) monthly CRSP *returns* for at least 24 of the 60 months

   (c) COMPUSTAT data on total assets, book-equity, and earnings as defined in Table 3.1 for its fiscal year ending in any month of 1962.

6. For each stock in the pre-ranking period run the following regression

$$R_{it} = a_i + \beta_{i_1} R_{mt} + \beta_{i_2} R_{mt-1} + \epsilon_{it}. \tag{3.1}$$

where R_{it} is the return (including dividends) on stock i in month t, R_{mt} and R_{mt-1} are the CRSP value-weighted returns in months t and $t-1$ on the NYSE, AMEX, and NASDAQ market portfolio.

7. Calculate the pre-ranking CAPM β of stock i as the sum of the regression coefficient estimates: $\hat{\beta}_i = \hat{\beta}_{i1} + \hat{\beta}_{i2}$.

8. Calculate portfolio decile breakpoints for size from all stocks on the NYSE based on their market equity in June of 1963.

9. Within each of the size deciles calculate portfolio decile breakpoints from all stocks that meet the CRSP/COMPUSTAT requirements for their pre-ranking beta, $\hat{\beta}_i$.

10. For each of the 100 portfolios created above (10 beta-sorted portfolios for each of the 10 size-sorted portfolios) calculate the equally-weighted monthly return for the 12 months starting July 1963 and ending June 1964. Use the ranks assigned to each security in June 1963.

11. Shift the window of observation for the data one year and repeat steps (4)-(10). In other words, the next period used for the pre-ranking betas is July 1959 to June 1964 and the corresponding portfolio returns are calculated for July 1964 to June 1965. Continue this procedure until 1990 (or the last year of data). Since the last year has data until December of 1990 instead of June 1991 portfolio returns can only be computed for 6 months.

12. For each portfolio p run the following regression across all 330 months of data (June 1963 to December 1990).

$$R_{pt} = a_p + \beta_{p_1} R_{mt} + \beta_{p_2} R_{mt-1} + \epsilon_{pt}. \tag{3.2}$$

where R_{pt} is the monthly return of portfolio p and R_{mt} and R_{mt-1} are defined as before in equation (3.1).

13. Calculate the post-ranking CAPM β of portfolio p as the sum of the regression coefficient estimates: $\hat{\beta}_p = \hat{\beta}_{p1} + \hat{\beta}_{p2}$.

14. Assign the post-ranking beta of each portfolio to each of the stocks within the portfolio.

15. For each of the accounting variables (except market-equity) set the values of the top and bottom 0.5 percent equal to the top and bottom 0.5 percentile respectively.

16. Run the Fama-MacBeth regressions for the linear asset pricing model using the full 330 months of return data. In other words, run the following regression across all stocks i for each for each month t:

$$R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln(ME)_{it} + \gamma_{3t}\ln(BE/ME)_{it} + ... + \eta_{it} \tag{3.3}$$

where R_{it} is the return on stock i and $\hat{\beta}_{it}$ is the post-ranking beta for stock i at month t. Other explanatory variables may be chosen to test other pricing models.

17. Regression equation (3.3) produces a time series of regression coefficients $\hat{\gamma}_{0t}$, $\hat{\gamma}_{1t}$, ... , which cover 330 months. Compute the mean, variance, and t-statistic of each gamma as explained in the description of the Fama-MacBeth procedure.

$$\hat{\gamma}_1 = \frac{1}{T}\sum_{t=1}^{T}\hat{\gamma}_{1t} \tag{3.4}$$

$$\hat{\sigma}^2_{\hat{\gamma}_{1t}} = \frac{1}{T-1}\sum_{t=1}^{T}(\hat{\gamma}_{1t} - \hat{\gamma}_1)^2 \tag{3.5}$$

$$t_{\hat{\gamma}_1} = \frac{\hat{\gamma}_1}{\hat{\sigma}_{\hat{\gamma}_{1t}}/\sqrt{T}} \tag{3.6}$$

3.3 The Results: 1963-1990

In their 1992 paper, Fama and French find that size (ME) and book-to-market equity combine to capture the cross-sectional variation in average stock returns for the 1963-

1990 period. In the process they also show that market β no longer explains cross-sectional variation in average stock returns during the same period.

Table 3.2 is a excerpt of Table III in the 1992 article. It reports that the average slope of monthly regression returns on size ($\ln(ME)$) alone is -0.15%, with a t-statistic of -2.58. This is consistent with Banz [1981] who reports a strong negative relation between average return and size. Even when other independent variables are added to the regression (e.g. $\ln(BE/ME)$), the significant negative relation between size and average returns persists.

Table 3.2: **Average Slopes (t-statistics) from Month-by-Month Regressions of Stock Returns on β, Size, Book-to-Market Equity, and Leverage (published): July 1963 to December 1990**
As published in Fama and French's 'The Cross-Section of Expected Stock Returns', *Journal of Finance, 47, 2* (June 1992) page 439.
Each stock is assigned the post-ranking β of the portfolio it is in at the end of June of year t. In the regressions the values of the independent variables are matched up with CRSP returns from July of year t to June of year $t+1$. Book equity (BE), total book assets (A), and firm size (ME) are defined in Table 3.1. The average slope is the times-series average of the monthly regression slopes from July 1963 to December 1990, and the t-statistic is the average slope divided by its time-series standard error.

β	$\ln(ME)$	$\ln(BE/ME)$	$\ln(A/ME)$	$\ln(A/BE)$
0.15				
(0.46)				
	-0.15			
	(-2.58)			
-.37	-0.17			
(-1.21)	(-3.41)			
		0.50		
		(5.71)		
			0.50	-0.57
			(5.69)	(-5.34)
	-0.11	0.35		
	(-1.99)	(4.44)		
	-0.11		0.35	-0.50
	(-2.06)		(4.32)	(-4.56)

The book-to-market equity ratio was shown to have a positive relation to average returns by Stattman [1980] and Rosenberg, Reid, and Lanstein [1985]. This result is confirmed again in Fama and French [1992]. The book-to-market equity effect in

Table 3.2 is even stronger than the size effect during the same time period. The average slope of monthly regression returns on $\ln(BE/ME)$ alone is positive (0.50) and very significant (5.71 standard deviations from 0). While the book-to-market equity effect is strong, it does not replace size. When the two variables are included in the same regression, the slope on size is still negative and almost two standard deviations from zero (-1.99). The slope on book-to-market equity is still positive and still very significant (4.44).

Fama and MacBeth [1973] show that there is a positive and significant relationship between market β and average returns during the 1926-1968 period. However, as other have discovered (e.g. Reinganum [1981]), Fama and French find this relationship seems to disappear during the 1963-1990 period. Fama and French conclude that market β, when size is controlled for, has no power in explaining average returns. The average slope of monthly regression returns on β alone is small (0.15) and statistically insignificant from zero. When size is also included as an explanatory variable the average slope on β is negative and statistically insignificant.

3.4 Validation of the Model

As we did with the Fama and MacBeth [1973] paper, it is important to check the integrity of our model replication. Fama and French [1992] provide a more detailed summary of their description however the underlying data is more questionable. The CRSP database is fairly consistent from year to year. There are a number of new companies added, and some of the data maybe updated or backfilled, but on the whole it seems to be fairly reliable. This is especially true when we consider that there has not been much time (roughly 10 years) between their paper and ours. One issue that we did not double check ourselves, but were made aware of by the technical support staff at Wharton Research Data Services (WRDS) where we got our data, is the change over time of the value-weighted index. According to a source there, the average value of the CRSP value-weighted index has changed between the 1990 and 1999 release of the data, in the third decimal place, for the 1963-1990 time period. If

this is true, it would adversely affect our pre-ranking and post-ranking β estimates which in turn would affect our pre-ranking β deciles.

Unlike CRSP, COMPUSTAT keeps track of only a subset of the companies listed on the major exchanges. They systematically add companies to their database and backfill the data. For example, if they start tracking company XYZ in 1990 they will backfill XYZ's accounting data to at least 1988. Therefore, researchers using the database in 1989 and 1991 will observe different companies in the 'same' database for 1988.

Table 3.3: **Properties of Size Portfolios: July 1963 to December 1990**
Ten portfolios are formed on size (ME), using NYSE breakpoints, in June of t. We calculate each portfolio's monthly eqaully-weighted return for July of year t to June of year $t+1$. Return is the time-series average of monthly equally-weighted portfolio returns, in percent. $\ln(ME)$ is measured in June of year t, with ME denominated in millions of dollars. Book equity (BE), total book assets (A), and firm size (ME) are defined in Table 3.1. BE and A are for each firm's last fiscal year ending in year $t-1$. The accouting ratios are measured using ME in December of $t-1$. Firms is the average number of stocks in the portfolio each month.

Decile	Return	β	$\ln(ME)$	$\ln(BE/ME)$	$\ln(A/ME)$	$\ln(A/BE)$	Firms
1	1.43	1.35	2.22	-0.01	0.73	0.76	1344
2	1.16	1.34	3.73	-0.24	0.49	0.72	296
3	1.18	1.32	4.21	-0.27	0.45	0.69	218
4	1.21	1.35	4.63	-0.31	0.43	0.71	186
5	1.17	1.28	5.04	-0.35	0.36	0.69	165
6	1.08	1.24	5.44	-0.39	0.31	0.69	141
7	1.06	1.21	5.86	-0.40	0.28	0.68	134
8	1.10	1.17	6.36	-0.41	0.31	0.71	133
9	0.99	1.09	6.93	-0.46	0.25	0.71	124
10	0.91	0.97	8.03	-0.66	0.00	0.66	120

These issues pose a big problem for replicating any study some time after it is published. The following tables detail the accuracy of our replication. Table 3.3 is our best replication of Table II, panel A in Fama French [1992]. Table 3.4 reports the cell-by-cell discrepancy in percentage terms of our Table 3.3 and the published work. When we exclude the variable Firms, 67% of the parameters in Table 3.3 are within 5% of the published results and nearly 90% are within a 10% margin of error. The variable Firms, is substantially larger since COMPUSTAT updates their database

Table 3.4: **Discrepancy with Fama-French [1992]**
This table expresses the cell-by-cell discrepancy, in percentage terms, between Table 3.3 and Table II, panel A in Fama and French [1992]. Book equity (BE), total book assets (A), and firm size (ME) are defined in Table 3.1. The substantial increase in the number of firms now tracked by COMPUSTAT (as compared to the 1990 release of the data) for the same period of time, has a significant impact on the Firms variable, most directly, but also on Return and the other accounting variables.

Decile	Return	β	$\ln(ME)$	$\ln(BE/ME)$	$\ln(A/ME)$	$\ln(A/BE)$	Firms
1	-6.0%	-6.0%	-1%	-90%	18%	3.0%	40%
2	-10.0%	-4.0%	3%	3%	7%	5.0%	26%
3	-5.0%	-2.0%	3%	5%	4%	0.7%	28%
4	-3.0%	0.4%	3%	-4%	16%	4.0%	29%
5	-9.0%	2.0%	3%	-1%	12%	3.0%	18%
6	-8.0%	0.8%	3%	8%	-3%	2.0%	10%
7	-0.5%	3.0%	2%	-9%	17%	2.0%	7%
8	-0.4%	8.0%	2%	3%	6%	4.0%	12%
9	4.0%	5.0%	2%	9%	-6%	1.0%	8%
10	2.0%	6.0%	1%	13%	-97%	2.0%	-3%

from year to year. The market over the last ten years has grown dramatically thereby increasing the number of 'large' firms COMPUSTAT tracks. If they backfilled the data to the 1980's these large companies would appear in the lower size deciles of our study. This is in fact what we see. The smallest decile has a monthly average of 40% more companies now than before. This is probably the single largest factor contributing to the discrepancies in our replication.

Since the inputs are slightly different (i.e. Table 3.3) our outputs are slightly different as well. Table 3.5 is our best replication of Table III in Fama and French [1992]. An excerpt of the published table can be found in Table 3.2. Eleven of the 12 parameter estimates, have the same sign as the published results. The only parameter which switches from negative to positive (the average slope of β in the β, $\ln(ME)$ regression) is small and statistically indistinguishable from zero in either case. In all cases the magnitude of the average slopes and t-statistics is the same. All statistically significant results in Table 3.2 are statistically significant in our replication. The same is true for all statistically insignificant results. More importantly, all the inferences and conclusions made in the original paper are still valid and applicable here.

Table 3.5: **Average Slopes (t-statistics) from Month-by-Month Regressions of Stock Returns on β, Size, Book-to-Market Equity, and Leverage: July 1963 to December 1990**
Each stock is assigned the post-ranking β of the portfolio it is in at the end of June of year t. In the regressions the values of the independent variables are matched up with CRSP returns from July of year t to June of year $t+1$. Book equity (BE), total book assets (A), and firm size (ME) are defined in Table 3.1. The average slope is the times-series average of the monthly regression slopes from July 1963 to December 1990, and the t-statistic is the average slope divided by its time-series standard error.

β	$\ln(ME)$	$\ln(BE/ME)$	$\ln(A/ME)$	$\ln(A/BE)$
0.15				
(0.68)				
	-0.14			
	(-2.58)			
0.08	-0.14			
(0.37)	(-2.96)			
		0.39		
		(5.54)		
			0.39	-0.49
			(5.48)	(-5.20)
	-0.11	0.27		
	(-2.10)	(3.77)		
	-0.12		0.26	-0.44
	(-2.16)		(3.65)	(-4.48)

3.5 Extensions: 1963-1998

It is now safe to proceed and extend Fama and French's earlier to work to the most current data. For the sake of consistency we do not modify any aspect of the procedure. We simply run the same algorithm and include an additional 8 years of data. Table 3.6 summarizes the data by size deciles.

As anticipated, the average number of firms each month, for all deciles, increases. This is most dramatically seen in the largest size portfolio of Table 3.6 where we observe a 65% increase in the number of firms. Average return for each portfolio is consistently up as well. Returns on the largest firms (based on ME) increased by 9.9% when we add the last 8 years of data. Returns on the smallest firms increased, on average, by over 13%. The bull market of the 1990 also provided an increase in the average $\ln(ME)$ for all deciles. The largest decile increased to an average of 8.28 from

Table 3.6: **Properties of Size Portfolios: July 1963 to December 1998**
Ten portfolios are formed on size (ME), using NYSE breakpoints, in June of t. We calculate each portfolio's monthly eqaully-weighted return for July of year t to June of year $t+1$. Return is the time-series average of monthly equally-weighted portfolio returns, in percent. $\ln(ME)$ is measured in June of year t, with ME denominated in millions of dollars. Book equity (BE), total book assets (A), and firm size (ME) are defined in Table 3.1. BE and A are for each firm's last fiscal year ending in year $t-1$. The accouting ratios are measured using ME in December of $t-1$. Firms is the average number of stocks in the portfolio each month.

Decile	Return	β	$\ln(ME)$	$\ln(BE/ME)$	$\ln(A/ME)$	$\ln(A/BE)$	Firms
1	1.62	1.38	2.34	-0.08	0.68	0.76	1519
2	1.22	1.36	3.90	-0.33	0.40	0.71	381
3	1.21	1.32	4.42	-0.35	0.36	0.69	259
4	1.24	1.34	4.86	-0.40	0.33	0.70	213
5	1.26	1.26	5.28	-0.43	0.30	0.69	180
6	1.15	1.23	5.68	-0.46	0.25	0.70	156
7	1.16	1.19	6.12	-0.47	0.23	0.70	146
8	1.14	1.14	6.61	-0.49	0.24	0.73	143
9	1.08	1.07	7.20	-0.53	0.20	0.73	131
10	1.00	0.98	8.28	-0.72	-0.01	0.71	198

8.03 while the smallest added average of 0.12 to 2.22. The increase in ME during the period led to a decrease in the BE/ME and A/ME accounting ratios. In percentage terms these differences are sharp but the absolute differences are small. The two parameters that do not seem affected by the market over the last 8 years are the post-ranking portfolio β's and $\ln(A/BE)$. In both cases there is no clear increasing or decreasing pattern in the average values of the parameters.

The results of the final regressions are in Table 3.7. The inferences made in 1992 by Fama and French can still be made today. We find that size and book-to-market are still statistically significant in explaining the cross-sectional variation in average stock returns during the 1963-1998 period. We also show that market β has no explanatory power during the same period.

The average coefficient on size alone (-0.15) in Table 3.7 during the 1963-1998 period is roughly equal to what we saw in Table 3.5 (-0.14) during the 1963-1990 period. The difference is that the negative relationship is now stronger than before. The t-statistic increased by nearly 30% to -3.31 from -2.58. Size also plays an important

Table 3.7: **Average Slopes (t-statistics) from Month-by-Month Regressions of Stock Returns on β, Size, Book-to-Market Equity, and Leverage: July 1963 to December 1998**

Each stock is assigned the post-ranking β of the portfolio it is in at the end of June of year t. In the regressions the values of the independent variables are matched up with CRSP returns from July of year t to June of year $t+1$. Book equity (BE), total book assets (A), and firm size (ME) are defined in Table 3.1. The average slope is the times-series average of the monthly regression slopes from July 1963 to December 1990, and the t-statistic is the average slope divided by its time-series standard error.

β	$\ln(ME)$	$\ln(BE/ME)$	$\ln(A/ME)$	$\ln(A/BE)$
0.32				
(1.79)				
	-0.15			
	(-3.31)			
0.28	-0.15			
(1.57)	(-3.58)			
		0.35		
		(6.01)		
			0.35	-0.42
			(5.92)	(-5.42)
	-0.13	0.24		
	(-2.72)	(4.00)		
	-0.13		0.23	-0.38
	(-2.78)		(3.86)	(-4.61)

role when we consider other explanatory variables such as $\ln(BE/ME)$, $\ln(A/ME)$, and $\ln(A/BE)$. In each of the models where we include size we find that the average slope is negative and significant. In all cases the absolute value of the t-statistic is larger than what we observe in Table 3.5.

A similar story plays out for book-to-market equity. The relationship between book-to-market equity and returns is positive and roughly the same magnitude with our without the additional 8 years of data. The average slope of book-to-market alone dips by approximately 10% to 0.35 from 0.39 but the t-statistic increases by 8.5% to 6.01. When we study size and book-to-market equity together we find that, as before, both average slopes are significant.

Although the t-statistic increased by 163%, β still has little to no power in explaining average returns. Both the average slope and the t-statistic increased on β

alone to 0.32 (1.79) from 0.15 (.68). When size is included β is still insignificantly different from zero, the t-statistic decreases to 1.57 from the univariate test value of 1.79.

These tests are interesting and significant since, although most of the data overlaps, there are 8 years of out-of-sample data that help increase the power of the Fama and French results.

3.6 Criticisms of the Model

Since the Fama and French [1992] paper was published there has been an ongoing debate in the academic literature for and against their proposed factors. Proponents argue that size and book-to-market are statistically significant, not only in-sample, as we just reported, but in out-of-sample tests as well. Thus, they claim, these factors must have some economic significance. The economic interpretation, however, is still in question.

Many studies have also been published providing evidence against the proposed factors. Loughram [1997] reports that Fama and French's findings are driven by anomalies in the data. "In the largest quintile of all firms (accounting for 73% of the total market value of all publicly traded firms), book-to-market has no significant explanatory power on the cross-section of realized returns during the 1963-1995 period." He goes on to explain that once January is removed from the sample, both size and book-to-market explain none of the cross-sectional variation in returns for 94% of the market (in terms of market capitalization) during the same period. This study is corroborated by Davis [1994] who performs the same test on out-of-sample data and shows that book-to-market has no significance outside of January during the 1940-1963 period.

Hawawini and Keim [1998] offer evidence against the proponents stand that the premia are compensation for risk in the international markets (i.e. out-of-sample tests). They report that correlation of the premia across international markets is not significantly different from zero making it possible to diversify the risk.

Finally Shumway and Warther [1999] show that there is a strong delisting bias in CRSP's NASDAQ data which in turn fabricated significant results in the Fama and French [1992] study. After collecting return data on stocks that delisted, the authors rerun the Fama and French tests and show that size has no effect on NASDAQ. This is damaging since Banz [1981] shows that the size effect is the most pronounced among the smallest firms. Since there is no size effect on the NASDAQ, once delistings have been corrected for, there is little reason to believe that there is any economic importance of the size effect.

Appendix A

Fama-MacBeth: NYSE

Table A.1: **NYSE (Equal-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0020	0.0117	.	.	0.061	0.114	.	.	0.28	0.87	.	.
1941-45	0.0068	0.0214	.	.	0.033	0.068	.	.	1.59	2.43	.	.
1946-50	0.0048	0.0032	.	.	0.030	0.048	.	.	1.21	0.51	.	.
1951-55	0.0122	0.0025	.	.	0.019	0.035	.	.	4.97	0.56	.	.
1956-60	0.0148	-0.0058	.	.	0.020	0.033	.	.	5.65	-1.35	.	.
1961-65	-0.0013	0.0152	.	.	0.033	0.044	.	.	-0.30	2.67	.	.
1966-70	0.0080	-0.0014	.	.	0.039	0.055	.	.	1.60	-0.20	.	.
1971-75	0.0001	0.0064	.	.	0.039	0.064	.	.	0.01	0.78	.	.
1976-80	0.0002	0.0209	.	.	0.033	0.068	.	.	0.05	2.39	.	.
1981-85	0.0176	-0.0014	.	.	0.034	0.051	.	.	3.97	-0.21	.	.
1986-90	0.0205	-0.0129	.	.	0.043	0.062	.	.	3.69	-1.62	.	.
1991-95	0.0059	0.0097	.	.	0.034	0.050	.	.	1.34	1.49	.	.
1991-98	0.0083	0.0067	.	.	0.032	0.050	.	.	2.52	1.31	.	.
Panel B:												
1935-40	-0.0033	0.0256	-0.0072	.	0.075	0.173	0.079	.	-0.38	0.26	-0.77	.
1941-45	0.0127	0.0072	0.0067	.	0.050	0.090	0.062	.	1.98	0.62	0.84	.
1946-50	-0.0002	0.0137	-0.0045	.	0.037	0.101	0.031	.	-0.04	1.06	-1.10	.
1951-55	0.0001	0.0285	-0.0123	.	0.031	0.086	0.036	.	0.03	2.55	-2.64	.
1956-60	0.0125	-0.0005	-0.0024	.	0.030	0.072	0.029	.	3.26	-0.05	-0.64	.
1961-65	0.0018	0.0082	0.0034	.	0.070	0.143	0.072	.	0.20	0.44	0.37	.
1966-70	0.0019	0.0127	-0.0068	.	0.070	0.156	0.066	.	0.21	0.63	-0.81	.
1971-75	0.0075	-0.0117	0.0094	.	0.104	0.214	0.112	.	0.56	-0.42	0.66	.
1976-80	0.0035	0.0128	0.0044	.	0.109	0.266	0.111	.	0.25	0.37	0.30	.
1981-85	0.0107	0.0142	-0.0075	.	0.064	0.145	0.056	.	1.30	0.76	-1.03	.
1986-90	0.0078	0.0191	-0.0164	.	0.069	0.187	0.086	.	0.87	0.79	-1.47	.
1991-95	0.0127	-0.0102	0.0117	.	0.047	0.108	0.062	.	2.07	-0.74	1.47	.
1991-98	0.0131	-0.0073	0.0081	.	0.045	0.105	0.053	.	2.84	-0.68	1.50	.
Panel C:												
1935-40	0.0016	0.0097	.	0.0183	0.073	0.095	.	0.719	0.19	0.86	.	0.22
1941-45	0.0017	0.0098	.	0.1661	0.056	0.052	.	1.005	0.23	1.47	.	1.28
1946-50	0.0070	0.0082	.	-0.0964	0.040	0.068	.	0.687	1.37	0.94	.	-1.09
1951-55	0.0149	0.0071	.	-0.1194	0.030	0.044	.	0.740	3.88	1.25	.	-1.25
1956-60	0.0123	-0.0082	.	0.0827	0.038	0.042	.	1.212	2.49	-1.49	.	0.53
1961-65	-0.0036	0.0126	.	0.0768	0.039	0.051	.	0.891	-0.71	1.90	.	0.67
1966-70	0.0117	0.0050	.	-0.1456	0.046	0.063	.	0.974	1.99	0.61	.	-1.16
1971-75	-0.0064	-0.0052	.	0.2244	0.053	0.084	.	1.367	-0.93	-0.48	.	1.27
1976-80	-0.0078	0.0020	.	0.3056	0.052	0.059	.	1.208	-1.15	0.26	.	1.96
1981-85	0.0237	0.0109	.	-0.2141	0.049	0.091	.	1.344	3.75	0.93	.	-1.23
1986-90	0.0257	0.0069	.	-0.3084	0.049	0.096	.	0.915	4.09	0.56	.	-2.61
1991-95	0.0040	0.0041	.	0.0922	0.039	0.050	.	0.616	0.79	0.63	.	1.16
1991-98	0.0066	0.0024	.	0.0729	0.038	0.050	.	0.629	1.70	0.48	.	1.14
Panel D:												
1935-40	-0.0092	0.0295	-0.0124	0.0594	0.112	0.186	0.097	0.797	-0.70	1.35	-1.08	0.63
1941-45	-0.0028	0.0156	-0.0041	0.2026	0.082	0.086	0.053	1.086	-0.27	1.40	-0.59	1.44
1946-50	0.0016	0.0133	-0.0036	-0.0339	0.045	0.099	0.030	0.577	0.27	1.04	-0.91	-0.46
1951-55	0.0028	0.0277	-0.0107	-0.0626	0.039	0.085	0.035	0.726	0.56	2.51	-2.37	-0.67
1956-60	0.0091	-0.0046	-0.0023	0.1250	0.055	0.071	0.033	1.365	1.28	-0.51	-0.55	0.71
1961-65	-0.0011	0.0066	0.0029	0.0824	0.074	0.147	0.073	0.916	-0.12	0.35	0.31	0.70
1966-70	0.0113	0.0035	0.0013	-0.1259	0.106	0.172	0.085	1.275	0.83	0.16	0.12	-0.77
1971-75	-0.0069	-0.0060	-0.0000	0.2447	0.110	0.213	0.105	1.122	-0.48	-0.22	-0.00	1.69
1976-80	-0.0026	-0.0073	0.0057	0.2801	0.122	0.228	0.109	1.041	-0.17	-0.25	0.41	2.08
1981-85	0.0145	0.0268	-0.0089	-0.1698	0.073	0.179	0.059	1.424	1.54	1.16	-1.17	-0.92
1986-90	0.0231	0.0079	-0.0014	-0.2647	0.107	0.217	0.138	1.211	1.67	0.28	-0.08	-1.69
1991-95	0.0118	-0.0097	0.0110	0.0133	0.062	0.104	0.061	0.655	1.47	-0.72	1.41	0.16
1991-98	0.0117	-0.0072	0.0073	0.0267	0.059	0.101	0.053	0.669	1.94	-0.69	1.36	0.39

Table A.2: **NYSE (Equal-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-68	0.0064	0.0084	.	.	0.037	0.065	.	.	3.50	2.61	.	.
1969-98	0.0094	0.0027	.	.	0.037	0.059	.	.	4.76	0.86	.	.
1935-98	0.0078	0.0057	.	.	0.037	0.062	.	.	5.82	2.54	.	.
Panel B:												
1935-68	0.0034	0.0150	-0.0031	.	0.054	0.121	0.056	.	1.27	2.50	-1.11	.
1969-98	0.0087	0.0036	-0.0001	.	0.078	0.183	0.084	.	2.11	0.37	-0.02	.
1935-98	0.0059	0.0096	-0.0017	.	0.066	0.153	0.071	.	2.45	1.75	-0.66	.
Panel C:												
1935-68	0.0054	0.0068	.	0.0255	0.048	0.063	.	0.885	2.27	2.18	.	0.58
1969-98	0.0091	0.0031	.	-0.0105	0.049	0.075	.	1.106	3.51	0.79	.	-0.18
1935-98	0.0072	0.0051	.	0.0086	0.049	0.069	.	0.995	4.07	2.04	.	0.24
Panel D:												
1935-68	-0.0013	0.0165	-0.0060	0.0778	0.075	0.125	0.061	0.948	-0.35	2.66	-1.99	1.66
1969-98	0.0109	-0.0008	0.0027	-0.0229	0.096	0.186	0.095	1.131	2.15	-0.08	0.55	-0.38
1935-98	0.0044	0.0084	-0.0019	0.0306	0.086	0.156	0.078	1.038	1.43	1.49	-0.67	0.82

Table A.3: **NYSE (Value-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0067	0.0049	.	.	0.071	0.081	.	.	0.80	0.51	.	.
1941-45	0.0081	0.0143	.	.	0.034	0.050	.	.	1.86	2.23	.	.
1946-50	0.0044	0.0028	.	.	0.031	0.042	.	.	1.11	0.52	.	.
1951-55	0.0111	0.0034	.	.	0.019	0.032	.	.	4.54	0.81	.	.
1956-60	0.0151	-0.0066	.	.	0.020	0.040	.	.	5.82	-1.27	.	.
1961-65	-0.0019	0.0146	.	.	0.035	0.044	.	.	-0.42	2.59	.	.
1966-70	0.0086	-0.0014	.	.	0.042	0.047	.	.	1.57	-0.22	.	.
1971-75	-0.0003	0.0060	.	.	0.041	0.058	.	.	-0.06	0.80	.	.
1976-80	-0.0013	0.0181	.	.	0.041	0.065	.	.	-0.25	2.15	.	.
1981-85	0.0203	-0.0037	.	.	0.036	0.051	.	.	4.32	-0.56	.	.
1986-90	0.0182	-0.0100	.	.	0.042	0.066	.	.	3.31	-1.17	.	.
1991-95	0.0047	0.0107	.	.	0.038	0.054	.	.	0.96	1.53	.	.
1991-98	0.0070	0.0079	.	.	0.036	0.055	.	.	1.91	1.41	.	.
Panel B:												
1935-40	-0.0039	0.0235	-0.0067	.	0.086	0.144	0.038	.	-0.39	1.39	-1.50	.
1941-45	0.0148	0.0026	0.0042	.	0.063	0.085	0.039	.	1.82	0.24	0.83	.
1946-50	-0.0029	0.0148	-0.0042	.	0.050	0.095	0.025	.	-0.46	1.20	-1.28	.
1951-55	0.0002	0.0239	-0.0085	.	0.035	0.082	0.034	.	0.04	2.26	-1.97	.
1956-60	0.0076	0.0121	-0.0095	.	0.032	0.083	0.042	.	1.82	1.13	-1.75	.
1961-65	-0.0162	0.0460	-0.0150	.	0.066	0.122	0.054	.	-1.89	2.93	-2.16	.
1966-70	0.0043	0.0072	-0.0037	.	0.069	0.130	0.049	.	0.48	0.43	-0.59	.
1971-75	0.0018	0.0008	0.0026	.	0.120	0.211	0.099	.	0.12	0.03	0.20	.
1976-80	0.0087	-0.0008	0.0081	.	0.105	0.193	0.070	.	0.64	-0.03	0.90	.
1981-85	0.0131	0.0121	-0.0073	.	0.069	0.137	0.051	.	1.46	0.69	-1.11	.
1986-90	-0.0008	0.0379	-0.0248	.	0.071	0.174	0.074	.	-0.09	1.69	-2.62	.
1991-95	0.0116	-0.0087	0.0111	.	0.054	0.126	0.073	.	1.65	-0.54	1.18	.
1991-98	0.0104	-0.0019	0.0059	.	0.053	0.125	0.065	.	1.94	-0.15	0.88	.
Panel C:												
1935-40	0.0057	0.0038	.	0.0179	0.084	0.067	.	0.755	0.57	0.48	.	0.20
1941-45	0.0017	0.0022	.	0.2184	0.047	0.050	.	0.865	0.28	0.34	.	1.96
1946-50	0.0052	0.0077	.	-0.0879	0.034	0.054	.	0.572	1.18	1.11	.	-1.19
1951-55	0.0135	0.0081	.	-0.1228	0.026	0.038	.	0.657	4.00	1.66	.	-1.45
1956-60	0.0192	0.0005	.	-0.1776	0.030	0.041	.	0.800	4.98	0.10	.	-1.72
1961-65	0.0121	0.0275	.	-0.4095	0.045	0.047	.	0.994	2.07	4.56	.	-3.19
1966-70	0.0072	-0.0031	.	0.0614	0.052	0.047	.	1.052	1.07	-0.52	.	0.45
1971-75	-0.0047	-0.0035	.	0.1910	0.050	0.069	.	1.303	-0.72	-0.39	.	1.14
1976-80	-0.0038	0.0002	.	0.2669	0.044	0.077	.	0.856	-0.68	0.02	.	2.41
1981-85	0.0198	-0.0088	.	0.0699	0.045	0.073	.	0.930	3.45	-0.94	.	0.58
1986-90	0.0212	0.0049	.	-0.2254	0.047	0.090	.	0.713	3.52	0.42	.	-2.45
1991-95	0.0042	0.0065	.	0.0580	0.040	0.052	.	0.558	0.80	0.97	.	0.80
1991-98	0.0059	0.0041	.	0.0594	0.039	0.057	.	0.626	1.47	0.72	.	0.93
Panel D:												
1935-40	-0.0167	0.0280	-0.0109	0.1226	0.170	0.166	0.060	1.467	-0.83	1.43	-1.53	0.71
1941-45	-0.0028	0.0067	-0.0022	0.2495	0.074	0.079	0.035	0.869	-0.29	0.66	-0.49	2.22
1946-50	-0.0004	0.0148	-0.0032	-0.0556	0.057	0.095	0.026	0.564	-0.05	1.20	-0.95	-0.76
1951-55	0.0031	0.0229	-0.0069	-0.0648	0.039	0.081	0.033	0.585	0.61	2.19	-1.61	-0.86
1956-60	0.0133	0.0149	-0.0080	-0.1612	0.040	0.085	0.040	0.835	2.58	1.36	-1.55	-1.50
1961-65	0.0021	0.0464	-0.0096	-0.3793	0.079	0.125	0.058	1.036	0.21	2.88	-1.28	-2.84
1966-70	0.0048	0.0021	-0.0020	0.0542	0.085	0.130	0.051	1.100	0.44	0.12	-0.30	0.38
1971-75	-0.0221	0.0203	-0.0116	0.2955	0.124	0.202	0.091	1.132	-1.38	0.78	-0.99	2.02
1976-80	-0.0082	0.0082	-0.0036	0.2700	0.130	0.203	0.084	1.005	-0.49	0.31	-0.33	2.08
1981-85	0.0043	0.0110	-0.0123	0.1973	0.084	0.137	0.054	0.955	0.39	0.62	-1.77	1.60
1986-90	-0.0061	0.0477	-0.0326	0.0545	0.098	0.188	0.092	0.792	-0.48	1.97	-2.75	0.53
1991-95	0.0103	-0.0061	0.0095	0.0069	0.064	0.122	0.070	0.574	1.25	-0.39	1.05	0.09
1991-98	0.0080	-0.0007	0.0042	0.0390	0.061	0.123	0.063	0.627	1.30	-0.05	0.65	0.61

Table A.4: **NYSE (Equal-Weights): Summary Results - Robust**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0061	0.0080	.	.	0.065	0.119	.	.	0.81	0.57	.	.
1941-45	0.0089	0.0203	.	.	0.033	0.073	.	.	2.07	2.16	.	.
1946-50	0.0057	0.0023	.	.	0.028	0.054	.	.	1.60	0.33	.	.
1951-55	0.0114	0.0035	.	.	0.017	0.034	.	.	5.25	0.80	.	.
1956-60	0.0140	-0.0052	.	.	0.019	0.034	.	.	5.63	-1.20	.	.
1961-65	-0.0005	0.0151	.	.	0.033	0.045	.	.	-0.12	2.62	.	.
1966-70	0.0094	-0.0030	.	.	0.038	0.053	.	.	1.93	-0.44	.	.
1971-75	0.0008	0.0058	.	.	0.041	0.065	.	.	0.16	0.69	.	.
1976-80	0.0016	0.0200	.	.	0.033	0.068	.	.	0.38	2.28	.	.
1981-85	0.0188	-0.0027	.	.	0.033	0.050	.	.	4.37	-0.41	.	.
1986-90	0.0160	-0.0083	.	.	0.039	0.060	.	.	3.15	-1.08	.	.
1991-95	0.0062	0.0096	.	.	0.035	0.052	.	.	1.37	1.43	.	.
1991-98	0.0081	0.0071	.	.	0.033	0.052	.	.	2.42	1.33	.	.
Panel B:												
1935-40	0.0035	0.0149	-0.0041	.	0.092	0.221	0.118	.	0.32	0.57	-0.30	.
1941-45	0.0130	0.0127	0.0030	.	0.067	0.168	0.117	.	1.51	0.59	0.20	.
1946-50	0.0013	0.0131	-0.0054	.	0.036	0.103	0.047	.	0.28	0.99	-0.89	.
1951-55	0.0028	0.0233	-0.0099	.	0.028	0.078	0.037	.	0.79	2.31	-2.09	.
1956-60	0.0109	0.0027	-0.0039	.	0.027	0.074	0.034	.	3.08	0.28	-0.89	.
1961-65	-0.0041	0.0239	-0.0046	.	0.064	0.139	0.072	.	-0.50	1.33	-0.50	.
1966-70	0.0031	0.0132	-0.0084	.	0.076	0.167	0.076	.	0.31	0.61	-0.86	.
1971-75	0.0058	-0.0069	0.0068	.	0.087	0.186	0.097	.	0.52	-0.29	0.55	.
1976-80	0.0006	0.0219	-0.0007	.	0.089	0.227	0.100	.	0.05	0.75	-0.06	.
1981-85	0.0091	0.0211	-0.0122	.	0.051	0.126	0.050	.	1.37	1.30	-1.88	.
1986-90	0.0076	0.0155	-0.0132	.	0.065	0.205	0.105	.	0.91	0.59	-0.97	.
1991-95	0.0130	-0.0107	0.0118	.	0.046	0.117	0.073	.	2.19	-0.71	1.25	.
1991-98	0.0136	-0.0093	0.0094	.	0.046	0.115	0.063	.	2.92	-0.79	1.46	.
Panel C:												
1935-40	0.0013	0.0025	.	0.0795	0.077	0.115	.	0.622	0.14	0.18	.	1.08
1941-45	0.0012	0.0084	.	0.1901	0.059	0.061	.	0.911	0.16	1.08	.	1.62
1946-50	0.0071	0.0056	.	-0.0596	0.035	0.053	.	0.522	1.58	0.81	.	-0.88
1951-55	0.0143	0.0077	.	-0.1134	0.031	0.038	.	0.794	3.53	1.59	.	-1.11
1956-60	0.0147	-0.0042	.	-0.0291	0.034	0.037	.	0.982	3.35	-0.87	.	-0.23
1961-65	-0.0001	0.0157	.	-0.0156	0.041	0.056	.	0.975	-0.01	2.17	.	-0.12
1966-70	0.0163	0.0048	.	-0.2144	0.054	0.057	.	1.105	2.35	0.65	.	-1.50
1971-75	-0.0009	0.0037	.	0.0493	0.063	0.079	.	1.457	-0.11	0.37	.	0.26
1976-80	-0.0006	0.0159	.	0.0694	0.044	0.080	.	0.989	-0.11	1.55	.	0.54
1981-85	0.0173	-0.0050	.	0.0397	0.056	0.075	.	1.130	2.38	-0.52	.	0.27
1986-90	0.0212	0.0032	.	-0.2036	0.051	0.086	.	0.994	3.24	0.29	.	-1.59
1991-95	0.0028	0.0018	.	0.1357	0.043	0.047	.	0.732	0.50	0.29	.	1.44
1991-98	0.0043	0.0001	.	0.1309	0.042	0.049	.	0.761	0.99	0.02	.	1.68
Panel D:												
1935-40	-0.0049	0.0175	-0.0091	0.0881	0.102	0.227	0.115	0.630	-0.40	0.65	-0.67	1.19
1941-45	-0.0008	0.0178	-0.0062	0.1836	0.058	0.155	0.096	0.818	-0.10	0.89	-0.50	1.74
1946-50	0.0022	0.0141	-0.0051	-0.0291	0.042	0.100	0.047	0.534	0.40	1.09	-0.84	-0.42
1951-55	0.0028	0.0237	-0.0100	-0.0114	0.044	0.079	0.039	0.773	0.49	2.31	-2.00	-0.11
1956-60	0.0151	-0.0006	-0.0009	-0.0763	0.051	0.072	0.036	1.081	2.28	-0.06	-0.20	-0.55
1961-65	-0.0045	0.0278	-0.0062	-0.0262	0.063	0.165	0.077	1.042	-0.55	1.31	-0.62	-0.19
1966-70	0.0065	0.0203	-0.0093	-0.1330	0.094	0.170	0.079	1.138	0.53	0.92	-0.91	-0.91
1971-75	0.0025	-0.0045	0.0045	0.0471	0.108	0.207	0.099	1.442	0.18	-0.17	0.35	0.25
1976-80	-0.0001	0.0192	-0.0002	0.0317	0.086	0.259	0.103	1.044	-0.01	0.57	-0.01	0.24
1981-85	0.0083	0.0170	-0.0113	0.0402	0.061	0.179	0.056	1.346	1.06	0.74	-1.55	0.23
1986-90	0.0106	0.0198	-0.0130	-0.0914	0.072	0.195	0.096	0.810	1.14	0.78	-1.05	-0.87
1991-95	0.0075	-0.0072	0.0068	0.0944	0.062	0.105	0.063	0.784	0.93	-0.53	0.83	0.93
1991-98	0.0084	-0.0098	0.0065	0.1090	0.059	0.108	0.057	0.799	1.40	-0.89	1.12	1.34

Table A.5: **NYSE (Value-Weights): Summary Results - Robust**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0113	0.0019	.		0.080	0.078	.		1.19	0.21	.	.
1941-45	0.0113	0.0131	.		0.034	0.051	.		2.56	1.98	.	.
1946-50	0.0055	0.0021	.		0.029	0.044	.		1.47	0.37	.	.
1951-55	0.0097	0.0048	.		0.016	0.030	.		4.58	1.25	.	.
1956-60	0.0145	-0.0063	.		0.019	0.040	.		5.93	-1.22	.	.
1961-65	0.0006	0.0128	.		0.033	0.042	.		0.15	2.36	.	.
1966-70	0.0104	-0.0032	.		0.040	0.043	.		2.01	-0.58	.	.
1971-75	0.0016	0.0043	.		0.041	0.057	.		0.30	0.58	.	.
1976-80	0.0006	0.0171	.		0.034	0.059	.		0.14	2.23	.	.
1981-85	0.0209	-0.0044	.		0.034	0.049	.		4.82	-0.70	.	.
1986-90	0.0157	-0.0075	.		0.040	0.064	.		3.01	-0.91	.	.
1991-95	0.0053	0.0103	.		0.038	0.055	.		1.10	1.46	.	.
1991-98	0.0070	0.0080	.		0.035	0.055	.		1.96	1.42	.	.
Panel B:												
1935-40	0.0110	0.0027	-0.0003	.	0.111	0.182	0.067	.	0.84	0.13	-0.04	.
1941-45	0.0249	-0.0128	0.0104	.	0.069	0.108	0.056	.	2.81	-0.92	1.45	.
1946-50	-0.0018	0.0159	-0.0056	.	0.041	0.086	0.031	.	-0.33	1.42	-1.39	.
1951-55	0.0031	0.0179	-0.0057	.	0.032	0.074	0.031	.	0.77	1.87	-1.42	.
1956-60	0.0120	0.0007	-0.0037	.	0.028	0.079	0.043	.	3.27	0.07	-0.67	.
1961-65	0.0077	-0.0042	0.0086	.	0.059	0.126	0.071	.	1.01	-0.26	0.93	.
1966-70	0.0090	-0.0004	-0.0012	.	0.075	0.165	0.070	.	0.93	-0.02	-0.13	.
1971-75	0.0002	0.0064	-0.0006	.	0.104	0.180	0.079	.	0.01	0.28	-0.06	.
1976-80	0.0124	-0.0073	0.0110	.	0.086	0.164	0.064	.	1.12	-0.34	1.34	.
1981-85	0.0151	0.0090	-0.0064	.	0.057	0.123	0.049	.	2.07	0.57	-1.01	.
1986-90	0.0013	0.0317	-0.0212	.	0.068	0.202	0.099	.	0.15	1.21	-1.66	.
1991-95	0.0081	0.0032	0.0040	.	0.053	0.124	0.070	.	1.18	0.20	0.44	.
1991-98	0.0075	0.0074	0.0004	.	0.048	0.111	0.060	.	1.53	0.66	0.06	.
Panel C:												
1935-40	0.0067	0.0036	.	-0.0052	0.090	0.071	.	0.609	0.63	0.43	.	-0.07
1941-45	-0.0026	0.0004	.	0.2831	0.066	0.044	.	0.987	-0.31	0.06	.	2.22
1946-50	0.0057	0.0018	.	0.0072	0.037	0.045	.	0.494	1.18	0.32	.	0.11
1951-55	0.0138	0.0089	.	-0.1350	0.033	0.031	.	0.896	3.21	2.23	.	-1.17
1956-60	0.0170	-0.0043	.	-0.0682	0.032	0.040	.	0.781	4.16	-0.83	.	-0.68
1961-65	0.0020	0.0154	.	-0.0527	0.047	0.040	.	0.879	0.33	2.97	.	-0.46
1966-70	0.0058	-0.0062	.	0.1299	0.057	0.040	.	0.979	0.79	-1.19	.	1.03
1971-75	0.0018	0.0040	.	-0.0017	0.054	0.058	.	1.011	0.26	0.54	.	-0.01
1976-80	-0.0061	-0.0011	.	0.3089	0.040	0.058	.	0.820	-1.18	-0.15	.	2.92
1981-85	0.0205	-0.0072	.	0.0377	0.043	0.055	.	0.670	3.73	-1.02	.	0.44
1986-90	0.0207	0.0066	.	-0.2384	0.046	0.081	.	0.650	3.50	0.62	.	-2.84
1991-95	0.0039	0.0025	.	0.1108	0.042	0.049	.	0.580	0.73	0.40	.	1.48
1991-98	0.0069	0.0039	.	0.0517	0.041	0.050	.	0.596	1.63	0.77	.	0.85
Panel D:												
1935-40	0.0047	0.0049	-0.0007	0.0105	0.149	0.205	0.078	0.708	0.27	0.20	-0.08	0.13
1941-45	0.0073	-0.0160	0.0069	0.2630	0.059	0.121	0.049	0.965	0.96	-1.02	1.09	2.11
1946-50	-0.0055	0.0173	-0.0076	0.0770	0.053	0.087	0.033	0.538	-0.81	1.53	-1.79	1.11
1951-55	0.0077	0.0186	-0.0048	-0.1027	0.045	0.075	0.032	0.899	1.32	1.92	-1.18	-0.88
1956-60	0.0147	0.0009	-0.0030	-0.0564	0.037	0.081	0.042	0.774	3.11	0.09	-0.56	-0.56
1961-65	0.0101	-0.0040	0.0102	-0.0583	0.075	0.125	0.072	0.862	1.05	-0.25	1.10	-0.52
1966-70	0.0046	-0.0038	-0.0010	0.1304	0.088	0.162	0.070	0.979	0.41	-0.18	-0.10	1.03
1971-75	-0.0044	0.0119	-0.0034	0.0393	0.132	0.186	0.084	0.978	-0.26	0.49	-0.31	0.31
1976-80	-0.0031	-0.0030	0.0018	0.2692	0.103	0.169	0.071	0.899	-0.23	-0.14	0.19	2.32
1981-85	0.0084	0.0136	-0.0116	0.0952	0.073	0.129	0.056	0.700	0.89	0.82	-1.62	1.05
1986-90	0.0076	0.0274	-0.0157	-0.1053	0.104	0.244	0.145	0.889	0.57	0.87	-0.84	-0.92
1991-95	-0.0008	0.0143	-0.0071	0.1290	0.066	0.126	0.070	0.641	-0.10	0.88	-0.78	1.56
1991-98	0.0024	0.0145	-0.0064	0.0701	0.062	0.112	0.061	0.646	0.39	1.27	-1.02	1.06

Appendix B

Fama-MacBeth: NASDAQ

Table B.1: **NASDAQ (Equal-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1983-90	0.0130	-0.0019	.	.	0.033	0.049	.	.	3.85	-0.39	.	.
1991-95	0.0102	0.0136	.	.	0.049	0.077	.	.	1.63	1.37	.	.
1991-98	0.0116	0.0089	.	.	0.042	0.066	.	.	2.71	1.32	.	.
Panel B:												
1983-90	0.0038	0.0216	-0.0120	.	0.058	0.145	0.067	.	0.64	1.46	-1.75	.
1991-95	0.0107	0.0079	0.0049	.	0.043	0.115	0.085	.	1.94	0.53	0.44	.
1991-98	0.0120	0.0046	0.0035	.	0.039	0.098	0.067	.	3.05	0.46	0.52	.
Panel C:												
1983-90	0.0177	0.0033	.	-0.0888	0.048	0.057	.	0.578	3.62	0.57	.	-1.51
1991-95	0.0067	0.0060	.	0.0800	0.066	0.060	.	0.586	0.78	0.78	.	1.06
1991-98	0.0103	0.0048	.	0.0394	0.062	0.057	.	0.587	1.64	0.83	.	0.66
Panel D:												
1983-90	0.0082	0.0211	-0.0102	-0.0541	0.075	0.150	0.071	0.603	1.07	1.38	-1.41	-0.88
1991-95	-0.0068	0.0192	-0.0096	0.1710	0.073	0.110	0.078	0.638	-0.72	1.35	-0.95	2.08
1991-98	0.0022	0.0111	-0.0050	0.0976	0.077	0.096	0.064	0.672	0.28	1.13	-0.76	1.42

Table B.2: **NASDAQ (Value-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1983-90	0.0127	-0.0014	.	.	0.032	0.048	.	.	3.94	-0.29	.	.
1991-95	0.0085	0.0162	.	.	0.052	0.083	.	.	1.27	1.52	.	.
1991-98	0.0100	0.0112	.	.	0.045	0.071	.	.	2.19	1.54	.	.
Panel B:												
1983-90	0.0061	0.0150	-0.0082	.	0.050	0.125	0.063	.	1.21	1.18	-1.27	.
1991-95	0.0101	0.0102	0.0039	.	0.074	0.223	0.143	.	1.05	0.35	0.21	.
1991-98	0.0115	0.0051	0.0037	.	0.062	0.181	0.114	.	1.82	0.28	0.32	.
Panel C:												
1983-90	0.0181	0.0035	.	-0.0927	0.052	0.051	.	0.613	3.44	0.68	.	-1.48
1991-95	0.0053	0.0091	.	0.0713	0.068	0.064	.	0.512	0.60	1.10	.	1.08
1991-98	0.0088	0.0072	.	0.0366	0.060	0.058	.	0.463	1.45	1.23	.	0.78
Panel D:												
1983-90	0.0071	0.0211	-0.0107	-0.0365	0.107	0.158	0.095	0.856	0.65	1.30	-1.11	-0.42
1991-95	-0.0011	0.0222	-0.0066	0.0883	0.093	0.225	0.144	0.424	-0.09	0.76	-0.36	1.61
1991-98	0.0090	0.0097	-0.0001	0.0185	0.082	0.185	0.116	0.435	1.08	0.51	-0.01	0.42

Table B.3: **NASDAQ (Equal-Weights): Summary Results - Robust**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1983-90	0.0101	0.0017	.	.	0.032	0.050	.	.	3.10	0.33	.	.
1991-95	0.0103	0.0151	.	.	0.035	0.067	.	.	2.26	1.76	.	.
1991-98	0.0111	0.0105	.	.	0.034	0.061	.	.	3.19	1.67	.	.
Panel B:												
1983-90	0.0056	0.0176	-0.0094	.	0.042	0.107	0.065	.	1.30	1.62	-1.42	.
1991-95	0.0156	-0.0099	0.0167	.	0.032	0.114	0.094	.	3.78	-0.67	1.38	.
1991-98	0.0140	-0.0030	0.0093	.	0.036	0.106	0.079	.	3.78	-0.28	1.15	.
Panel C:												
1983-90	0.0156	0.0043	.	-0.0722	0.050	0.049	.	0.526	3.09	0.87	.	-1.35
1991-95	0.0063	0.0123	.	0.0486	0.067	0.055	.	0.495	0.73	1.73	.	0.76
1991-98	0.0119	0.0104	.	-0.0025	0.060	0.052	.	0.462	1.94	1.96	.	-0.05
Panel D:												
1983-90	0.0228	-0.0080	0.0104	-0.1216	0.071	0.132	0.086	0.592	3.13	-0.59	1.19	-2.01
1991-95	0.0152	-0.0090	0.0163	0.0002	0.073	0.112	0.082	0.524	1.62	-0.62	1.55	0.00
1991-98	0.0212	-0.0098	0.0140	-0.0485	0.077	0.110	0.074	0.525	2.69	-0.87	1.86	-0.90

Table B.4: **NASDAQ (Value-Weights): Summary Results - Robust**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1983-90	0.0097	0.0023	.	.	0.032	0.047	.	.	2.97	0.49	.	.
1991-95	0.0146	0.0101	.	.	0.029	0.059	.	.	3.94	1.33	.	.
1991-98	0.0142	0.0071	.	.	0.030	0.055	.	.	4.66	1.27	.	.
Panel B:												
1983-90	0.0056	0.0162	-0.0079	.	0.042	0.107	0.064	.	1.31	1.48	-1.21	.
1991-95	0.0188	-0.0125	0.0153	.	0.037	0.178	0.136	.	3.95	-0.54	0.88	.
1991-98	0.0159	-0.0022	0.0070	.	0.039	0.150	0.111	.	4.04	-0.14	0.62	.
Panel C:												
1983-90	0.0122	0.0033	.	-0.0314	0.042	0.046	.	0.382	2.87	0.72	.	-0.81
1991-95	0.0059	0.0050	.	0.0975	0.075	0.045	.	0.624	0.61	0.85	.	1.21
1991-98	0.0083	0.0034	.	0.0665	0.065	0.045	.	0.541	1.25	0.75	.	1.20
Panel D:												
1983-90	0.0064	0.0170	-0.0081	-0.0105	0.070	0.131	0.084	0.502	0.89	1.26	-0.95	-0.20
1991-95	0.0053	0.0083	-0.0025	0.0990	0.096	0.188	0.131	0.690	0.43	0.34	-0.15	1.11
1991-98	0.0058	0.0114	-0.0050	0.0750	0.082	0.157	0.106	0.590	0.69	0.71	-0.46	1.25

Appendix C

Fama-MacBeth: NYSE, AMEX

Table C.1: **NYSE, AMEX (Equal-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0020	0.0117	.	.	0.061	0.114	.	.	0.28	0.87	.	.
1941-45	0.0068	0.0214	.	.	0.033	0.068	.	.	1.59	2.43	.	.
1946-50	0.0048	0.0032	.	.	0.030	0.048	.	.	1.21	0.51	.	.
1951-55	0.0122	0.0025	.	.	0.019	0.035	.	.	4.97	0.56	.	.
1956-60	0.0148	-0.0058	.	.	0.020	0.033	.	.	5.65	-1.35	.	.
1961-65	-0.0015	0.0154	.	.	0.033	0.044	.	.	-0.35	2.73	.	.
1966-70	0.0079	-0.0013	.	.	0.039	0.055	.	.	1.57	-0.18	.	.
1971-75	0.0004	0.0060	.	.	0.039	0.066	.	.	0.08	0.70	.	.
1976-80	-0.0004	0.0233	.	.	0.036	0.069	.	.	-0.09	2.60	.	.
1981-85	0.0173	-0.0007	.	.	0.033	0.048	.	.	4.10	-0.11	.	.
1986-90	0.0230	-0.0163	.	.	0.041	0.054	.	.	4.37	-2.33	.	.
1991-95	0.0038	0.0129	.	.	0.038	0.057	.	.	0.77	1.75	.	.
1991-98	0.0075	0.0080	.	.	0.034	0.054	.	.	2.12	1.45	.	.
Panel B:												
1935-40	-0.0033	0.0256	-0.0072	.	0.075	0.173	0.079	.	-0.38	1.26	-0.77	.
1941-45	0.0127	0.0072	0.0067	.	0.050	0.090	0.062	.	1.98	0.62	0.84	.
1946-50	-0.0002	0.0137	-0.0045	.	0.037	0.101	0.031	.	-0.04	1.06	-1.10	.
1951-55	0.0001	0.0285	-0.0123	.	0.031	0.086	0.036	.	0.03	2.55	-2.64	.
1956-60	0.0125	-0.0005	-0.0024	.	0.030	0.072	0.029	.	3.26	-0.05	-0.64	.
1961-65	0.0026	0.0061	0.0046	.	0.068	0.140	0.070	.	0.30	0.34	0.51	.
1966-70	0.0021	0.0119	-0.0063	.	0.074	0.163	0.068	.	0.23	0.57	-0.72	.
1971-75	0.0082	-0.0123	0.0092	.	0.097	0.195	0.102	.	0.66	-0.49	0.70	.
1976-80	0.0109	-0.0017	0.0118	.	0.076	0.182	0.071	.	1.11	-0.07	1.29	.
1981-85	0.0070	0.0215	-0.0102	.	0.063	0.133	0.048	.	0.87	1.25	-1.64	.
1986-90	0.0101	0.0137	-0.0143	.	0.063	0.165	0.074	.	1.23	0.64	-1.49	.
1991-95	0.0139	-0.0161	0.0164	.	0.051	0.134	0.086	.	2.10	-0.93	1.49	.
1991-98	0.0134	-0.0088	0.0096	.	0.047	0.123	0.071	.	2.77	-0.70	1.32	.
Panel C:												
1935-40	0.0016	0.0097	.	0.0183	0.073	0.095	.	0.719	0.19	0.86	.	0.22
1941-45	0.0017	0.0098	.	0.1661	0.056	0.052	.	1.005	0.23	1.47	.	1.28
1946-50	0.0070	0.0082	.	-0.0964	0.040	0.068	.	0.687	1.37	0.94	.	-1.09
1951-55	0.0149	0.0071	.	-0.1194	0.030	0.044	.	0.740	3.88	1.25	.	-1.25
1956-60	0.0123	-0.0082	.	0.0827	0.038	0.042	.	1.212	2.49	-1.49	.	0.53
1961-65	-0.0037	0.0128	.	0.0758	0.039	0.051	.	0.889	-0.74	1.94	.	0.66
1966-70	0.0114	0.0047	.	-0.1360	0.045	0.065	.	0.979	1.96	0.55	.	-1.08
1971-75	-0.0057	-0.0073	.	0.2274	0.052	0.081	.	1.299	-0.85	-0.69	.	1.36
1976-80	-0.0042	0.0075	.	0.2031	0.045	0.074	.	0.882	-0.73	0.79	.	1.78
1981-85	0.0167	-0.0018	.	0.0169	0.040	0.070	.	0.741	3.21	-0.20	.	0.18
1986-90	0.0254	-0.0059	.	-0.1458	0.046	0.069	.	0.691	4.30	-0.66	.	-1.63
1991-95	0.0021	0.0009	.	0.1457	0.043	0.047	.	0.682	0.37	0.15	.	1.65
1991-98	0.0063	0.0005	.	0.0929	0.038	0.049	.	0.616	1.60	0.09	.	1.48
Panel D:												
1935-40	-0.0092	0.0295	-0.0124	0.0594	0.112	0.186	0.097	0.797	-0.70	1.35	-1.08	0.63
1941-45	-0.0028	0.0156	-0.0041	0.2026	0.082	0.086	0.053	1.086	-0.27	1.40	-0.59	1.44
1946-50	0.0016	0.0133	-0.0036	-0.0339	0.045	0.099	0.030	0.577	0.27	1.04	-0.91	-0.46
1951-55	0.0028	0.0277	-0.0107	-0.0626	0.039	0.085	0.035	0.726	0.56	2.51	-2.37	-0.67
1956-60	0.0091	-0.0046	-0.0023	0.1250	0.055	0.071	0.033	1.365	1.28	-0.51	-0.55	0.71
1961-65	-0.0005	0.0049	0.0038	0.0822	0.073	0.143	0.070	0.911	-0.05	0.27	0.42	0.70
1966-70	0.0098	0.0050	0.0002	-0.1081	0.106	0.176	0.086	1.245	0.72	0.22	0.02	-0.67
1971-75	-0.0073	-0.0069	-0.0013	0.2664	0.102	0.195	0.094	1.158	-0.56	-0.27	-0.11	1.78
1976-80	0.0052	-0.0123	0.0098	0.1928	0.087	0.174	0.071	0.934	0.47	-0.55	1.07	1.60
1981-85	0.0034	0.0178	-0.0114	0.0943	0.071	0.138	0.049	0.731	0.37	1.00	-1.78	1.00
1986-90	0.0130	0.0122	-0.0116	-0.0517	0.082	0.171	0.089	0.745	1.23	0.55	-1.00	-0.54
1991-95	0.0022	-0.0005	0.0002	0.1584	0.070	0.133	0.078	0.702	0.24	-0.03	0.02	1.75
1991-98	0.0056	0.0010	-0.0008	0.1077	0.062	0.122	0.065	0.630	0.88	0.08	-0.12	1.67

Table C.2: **NYSE, AMEX (Value-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0067	0.0049	.	.	0.071	0.081	.	.	0.80	0.51	.	.
1941-45	0.0081	0.0143	.	.	0.034	0.050	.	.	1.86	2.23	.	.
1946-50	0.0044	0.0028	.	.	0.031	0.042	.	.	1.11	0.52	.	.
1951-55	0.0111	0.0034	.	.	0.019	0.032	.	.	4.54	0.81	.	.
1956-60	0.0151	-0.0066	.	.	0.020	0.040	.	.	5.82	-1.27	.	.
1961-65	-0.0021	0.0148	.	.	0.035	0.043	.	.	-0.46	2.64	.	.
1966-70	0.0088	-0.0016	.	.	0.042	0.047	.	.	1.62	-0.27	.	.
1971-75	-0.0011	0.0067	.	.	0.040	0.061	.	.	-0.21	0.86	.	.
1976-80	-0.0016	0.0206	.	.	0.039	0.065	.	.	-0.32	2.44	.	.
1981-85	0.0190	-0.0022	.	.	0.033	0.048	.	.	4.48	-0.36	.	.
1986-90	0.0219	-0.0147	.	.	0.037	0.057	.	.	4.57	-2.02	.	.
1991-95	0.0035	0.0132	.	.	0.043	0.063	.	.	0.64	1.62	.	.
1991-98	0.0070	0.0085	.	.	0.038	0.060	.	.	1.78	1.38	.	.
Panel B:												
1935-40	-0.0039	0.0235	-0.0067	.	0.086	0.144	0.038	.	-0.39	1.39	-1.50	.
1941-45	0.0148	0.0026	0.0042	.	0.063	0.085	0.039	.	1.82	0.24	0.83	.
1946-50	-0.0029	0.0148	-0.0042	.	0.050	0.095	0.025	.	-0.46	1.20	-1.28	.
1951-55	0.0002	0.0239	-0.0085	.	0.035	0.082	0.034	.	0.04	2.26	-1.97	.
1956-60	0.0076	0.0121	-0.0095	.	0.032	0.083	0.042	.	1.82	1.13	-1.75	.
1961-65	-0.0165	0.0466	-0.0153	.	0.066	0.121	0.054	.	-1.93	2.97	-2.21	.
1966-70	0.0053	0.0054	-0.0030	.	0.073	0.135	0.051	.	0.56	0.31	-0.45	.
1971-75	0.0046	-0.0053	0.0055	.	0.118	0.205	0.097	.	0.30	-0.20	0.44	.
1976-80	0.0168	-0.0133	0.0137	.	0.090	0.168	0.063	.	1.45	-0.61	1.69	.
1981-85	0.0143	0.0082	-0.0046	.	0.064	0.123	0.044	.	1.71	0.51	-0.82	.
1986-90	0.0030	0.0288	-0.0209	.	0.066	0.167	0.066	.	0.35	1.34	-2.44	.
1991-95	0.0214	-0.0359	0.0271	.	0.063	0.166	0.108	.	2.62	-1.68	1.94	.
1991-98	0.0163	-0.0169	0.0142	.	0.058	0.149	0.091	.	2.77	-1.11	1.52	.
Panel C:												
1935-40	0.0057	0.0038	.	0.0179	0.084	0.067	.	0.755	0.57	0.48	.	0.20
1941-45	0.0017	0.0022	.	0.2184	0.047	0.050	.	0.865	0.28	0.34	.	1.96
1946-50	0.0052	0.0077	.	-0.0879	0.034	0.054	.	0.572	1.18	1.11	.	-1.19
1951-55	0.0135	0.0081	.	-0.1228	0.026	0.038	.	0.657	4.00	1.66	.	-1.45
1956-60	0.0192	0.0005	.	-0.1776	0.030	0.041	.	0.800	4.98	0.10	.	-1.72
1961-65	0.0119	0.0278	.	-0.4121	0.045	0.046	.	0.990	2.04	4.65	.	-3.23
1966-70	0.0077	-0.0032	.	0.0561	0.052	0.049	.	1.044	1.14	-0.51	.	0.42
1971-75	-0.0067	-0.0062	.	0.2389	0.051	0.063	.	1.210	-1.02	-0.76	.	1.53
1976-80	-0.0032	0.0015	.	0.2407	0.042	0.072	.	0.884	-0.60	0.17	.	2.11
1981-85	0.0189	-0.0039	.	0.0186	0.038	0.066	.	0.722	3.88	-0.45	.	0.20
1986-90	0.0254	-0.0035	.	-0.1706	0.041	0.068	.	0.549	4.86	-0.40	.	-2.41
1991-95	0.0024	-0.0013	.	0.1660	0.045	0.054	.	0.667	0.41	-0.19	.	1.93
1991-98	0.0072	0.0009	.	0.0784	0.042	0.056	.	0.656	1.66	0.15	.	1.17
Panel D:												
1935-40	-0.0167	0.0280	-0.0109	0.1226	0.170	0.166	0.060	1.467	-0.83	1.43	-1.53	0.71
1941-45	-0.0028	0.0067	-0.0022	0.2495	0.074	0.079	0.035	0.869	-0.29	0.66	-0.49	2.22
1946-50	-0.0004	0.0148	-0.0032	-0.0556	0.057	0.095	0.026	0.564	-0.05	1.20	-0.95	-0.76
1951-55	0.0031	0.0229	-0.0069	-0.0648	0.039	0.081	0.033	0.585	0.61	2.19	-1.61	-0.86
1956-60	0.0133	0.0149	-0.0080	-0.1612	0.040	0.085	0.040	0.835	2.58	1.36	-1.55	-1.50
1961-65	0.0022	0.0465	-0.0095	-0.3830	0.079	0.125	0.058	1.033	0.22	2.89	-1.27	-2.87
1966-70	0.0058	0.0006	-0.0014	0.0527	0.085	0.134	0.052	1.084	0.52	0.03	-0.21	0.38
1971-75	-0.0302	0.0239	-0.0154	0.4023	0.126	0.197	0.089	1.079	-1.86	0.94	-1.34	2.89
1976-80	0.0023	-0.0060	0.0039	0.2126	0.102	0.166	0.061	0.907	0.17	-0.28	0.49	1.81
1981-85	0.0053	0.0106	-0.0093	0.1383	0.080	0.124	0.048	0.780	0.52	0.66	-1.50	1.37
1986-90	0.0073	0.0281	-0.0199	-0.0589	0.091	0.171	0.082	0.714	0.62	1.27	-1.87	-0.64
1991-95	0.0044	-0.0055	0.0029	0.1535	0.070	0.124	0.080	0.746	0.49	-0.34	0.28	1.59
1991-98	0.0060	0.0027	-0.0008	0.0852	0.064	0.119	0.068	0.696	0.92	0.22	-0.12	1.20

Table C.3: **NYSE, AMEX (Equal-Weights): Summary Results - Robust**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0061	0.0080	.	.	0.065	0.119	.	.	0.81	0.57	.	.
1941-45	0.0088	0.0204	.	.	0.033	0.073	.	.	2.05	2.16	.	.
1946-50	0.0057	0.0023	.	.	0.028	0.054	.	.	1.60	0.34	.	.
1951-55	0.0114	0.0035	.	.	0.017	0.034	.	.	5.22	0.80	.	.
1956-60	0.0140	-0.0052	.	.	0.019	0.034	.	.	5.64	-1.20	.	.
1961-65	-0.0007	0.0153	.	.	0.032	0.044	.	.	-0.16	2.66	.	.
1966-70	0.0095	-0.0030	.	.	0.038	0.052	.	.	1.93	-0.44	.	.
1971-75	0.0003	0.0064	.	.	0.040	0.069	.	.	0.06	0.72	.	.
1976-80	0.0012	0.0229	.	.	0.034	0.071	.	.	0.27	2.50	.	.
1981-85	0.0176	-0.0010	.	.	0.031	0.049	.	.	4.40	-0.16	.	.
1986-90	0.0183	-0.0120	.	.	0.037	0.054	.	.	3.87	-1.72	.	.
1991-95	0.0037	0.0136	.	.	0.036	0.057	.	.	0.80	1.84	.	.
1991-98	0.0067	0.0092	.	.	0.033	0.055	.	.	2.02	1.64	.	.
Panel B:												
1935-40	0.0039	0.0138	-0.0035	.	0.093	0.222	0.118	.	0.36	0.53	-0.25	.
1941-45	0.0119	0.0158	0.0013	.	0.069	0.174	0.120	.	1.35	0.71	0.08	.
1946-50	0.0013	0.0130	-0.0054	.	0.036	0.103	0.047	.	0.28	0.98	-0.88	.
1951-55	0.0027	0.0235	-0.0100	.	0.027	0.078	0.036	.	0.76	2.34	-2.13	.
1956-60	0.0108	0.0030	-0.0040	.	0.027	0.074	0.033	.	3.03	0.31	-0.93	.
1961-65	-0.0041	0.0237	-0.0044	.	0.062	0.133	0.068	.	-0.51	1.38	-0.50	.
1966-70	0.0054	0.0072	-0.0052	.	0.078	0.171	0.078	.	0.54	0.33	-0.51	.
1971-75	0.0054	-0.0063	0.0066	.	0.087	0.181	0.100	.	0.48	-0.27	0.51	.
1976-80	0.0093	0.0032	0.0102	.	0.067	0.173	0.077	.	1.08	0.14	1.02	.
1981-85	0.0087	0.0201	-0.0103	.	0.050	0.111	0.044	.	1.34	1.39	-1.80	.
1986-90	0.0082	0.0151	-0.0143	.	0.054	0.171	0.081	.	1.18	0.69	-1.36	.
1991-95	0.0170	-0.0262	0.0228	.	0.050	0.148	0.101	.	2.64	-1.37	1.75	.
1991-98	0.0162	-0.0189	0.0160	.	0.047	0.136	0.085	.	3.37	-1.36	1.85	.
Panel C:												
1935-40	0.0014	0.0026	.	0.0779	0.077	0.115	.	0.632	0.15	0.19	.	1.05
1941-45	0.0001	0.0069	.	0.2131	0.059	0.059	.	0.907	0.02	0.91	.	1.82
1946-50	0.0070	0.0054	.	-0.0559	0.035	0.053	.	0.513	1.55	0.79	.	-0.84
1951-55	0.0144	0.0079	.	-0.1177	0.031	0.037	.	0.794	3.56	1.64	.	-1.15
1956-60	0.0150	-0.0039	.	-0.0388	0.035	0.037	.	1.001	3.35	-0.81	.	-0.30
1961-65	-0.0009	0.0153	.	0.0036	0.041	0.056	.	0.972	-0.17	2.13	.	0.03
1966-70	0.0172	0.0059	.	-0.2430	0.053	0.056	.	1.100	2.53	0.82	.	-1.71
1971-75	-0.0055	-0.0048	.	0.1937	0.060	0.074	.	1.323	-0.70	-0.50	.	1.13
1976-80	-0.0010	0.0160	.	0.0901	0.042	0.074	.	0.781	-0.18	1.67	.	0.89
1981-85	0.0200	0.0032	.	-0.0721	0.043	0.061	.	0.675	3.60	0.40	.	-0.83
1986-90	0.0260	0.0054	.	-0.2753	0.049	0.080	.	0.843	4.12	0.52	.	-2.53
1991-95	-0.0008	-0.0000	.	0.1882	0.044	0.048	.	0.760	-0.13	-0.00	.	1.92
1991-98	0.0028	-0.0008	.	0.1464	0.042	0.045	.	0.705	0.65	-0.17	.	2.03
Panel D:												
1935-40	-0.0047	0.0169	-0.0088	0.0879	0.104	0.230	0.116	0.650	-0.38	0.63	-0.64	1.15
1941-45	-0.0030	0.0202	-0.0083	0.2046	0.066	0.159	0.102	0.829	-0.36	0.98	-0.63	1.91
1946-50	0.0020	0.0140	-0.0051	-0.0250	0.042	0.100	0.047	0.525	0.37	1.08	-0.85	-0.37
1951-55	0.0029	0.0239	-0.0099	-0.0171	0.045	0.079	0.039	0.779	0.51	2.33	-1.99	-0.17
1956-60	0.0154	0.0002	-0.0012	-0.0882	0.053	0.073	0.037	1.116	2.25	0.03	-0.25	-0.61
1961-65	-0.0049	0.0273	-0.0060	-0.0151	0.061	0.166	0.075	1.072	-0.62	1.27	-0.62	-0.11
1966-70	0.0102	0.0162	-0.0061	-0.1790	0.097	0.177	0.083	1.152	0.82	0.71	-0.57	-1.20
1971-75	-0.0065	-0.0038	-0.0006	0.2093	0.105	0.184	0.098	1.206	-0.48	-0.16	-0.05	1.34
1976-80	0.0080	-0.0008	0.0104	0.0507	0.073	0.177	0.078	0.764	0.85	-0.03	1.04	0.51
1981-85	0.0098	0.0203	-0.0099	-0.0209	0.061	0.117	0.045	0.675	1.25	1.35	-1.72	-0.24
1986-90	0.0227	0.0092	-0.0029	-0.2413	0.070	0.162	0.074	0.827	2.51	0.44	-0.31	-2.26
1991-95	0.0067	-0.0166	0.0117	0.1429	0.060	0.130	0.081	0.735	0.86	-0.99	1.12	1.50
1991-98	0.0081	-0.0146	0.0089	0.1275	0.058	0.120	0.070	0.682	1.37	-1.19	1.25	1.83

Table C.4: **NYSE, AMEX (Value-Weights): Summary Results - Robust**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0114	0.0018	.	.	0.080	0.078	.	.	1.21	0.20	.	.
1941-45	0.0114	0.0130	.	.	0.034	0.051	.	.	2.58	1.98	.	.
1946-50	0.0056	0.0021	.	.	0.029	0.044	.	.	1.48	0.36	.	.
1951-55	0.0097	0.0048	.	.	0.016	0.030	.	.	4.57	1.25	.	.
1956-60	0.0146	-0.0063	.	.	0.019	0.040	.	.	5.98	-1.24	.	.
1961-65	0.0005	0.0130	.	.	0.033	0.042	.	.	0.11	2.40	.	.
1966-70	0.0106	-0.0034	.	.	0.041	0.043	.	.	2.01	-0.62	.	.
1971-75	0.0003	0.0057	.	.	0.039	0.059	.	.	0.05	0.76	.	.
1976-80	0.0015	0.0192	.	.	0.033	0.062	.	.	0.35	2.41	.	.
1981-85	0.0198	-0.0030	.	.	0.029	0.046	.	.	5.26	-0.50	.	.
1986-90	0.0189	-0.0121	.	.	0.036	0.055	.	.	4.09	-1.69	.	.
1991-95	0.0036	0.0136	.	.	0.039	0.061	.	.	0.71	1.72	.	.
1991-98	0.0064	0.0094	.	.	0.035	0.058	.	.	1.82	1.59	.	.
Panel B:												
1935-40	0.0117	0.0013	0.0002	.	0.110	0.180	0.067	.	0.90	0.06	0.03	.
1941-45	0.0238	-0.0103	0.0094	.	0.069	0.107	0.055	.	2.69	-0.74	1.31	.
1946-50	-0.0014	0.0151	-0.0053	.	0.041	0.086	0.031	.	-0.26	1.36	-1.33	.
1951-55	0.0031	0.0179	-0.0057	.	0.032	0.075	0.031	.	0.77	1.85	-1.41	.
1956-60	0.0119	0.0011	-0.0040	.	0.028	0.078	0.043	.	3.28	0.11	-0.72	.
1961-65	0.0081	-0.0056	0.0094	.	0.059	0.127	0.072	.	1.07	-0.34	1.02	.
1966-70	0.0104	-0.0032	0.0000	.	0.077	0.164	0.071	.	1.04	-0.15	0.00	.
1971-75	0.0005	0.0043	0.0009	.	0.104	0.180	0.082	.	0.04	0.18	0.08	.
1976-80	0.0164	-0.0116	0.0137	.	0.067	0.126	0.056	.	1.88	-0.71	1.89	.
1981-85	0.0101	0.0194	-0.0104	.	0.051	0.106	0.040	.	1.55	1.41	-2.03	.
1986-90	-0.0035	0.0458	-0.0300	.	0.060	0.168	0.073	.	-0.45	2.11	-3.16	.
1991-95	0.0171	-0.0228	0.0198	.	0.076	0.208	0.129	.	1.76	-0.85	1.19	.
1991-98	0.0122	-0.0047	0.0077	.	0.064	0.174	0.106	.	1.87	-0.27	0.72	.
Panel C:												
1935-40	0.0062	0.0030	.	0.0063	0.090	0.070	.	0.644	0.58	0.37	.	0.08
1941-45	-0.0033	-0.0001	.	0.2943	0.068	0.044	.	1.009	-0.37	-0.02	.	2.26
1946-50	0.0056	0.0015	.	0.0135	0.037	0.044	.	0.494	1.16	0.26	.	0.21
1951-55	0.0138	0.0091	.	-0.1379	0.034	0.032	.	0.951	3.12	2.23	.	-1.12
1956-60	0.0170	-0.0046	.	-0.0631	0.032	0.040	.	0.782	4.14	-0.89	.	-0.62
1961-65	0.0023	0.0158	.	-0.0625	0.046	0.040	.	0.850	0.39	3.08	.	-0.57
1966-70	0.0076	-0.0054	.	0.0882	0.052	0.040	.	0.873	1.13	-1.05	.	0.78
1971-75	-0.0001	0.0041	.	0.0175	0.055	0.056	.	1.077	-0.01	0.57	.	0.13
1976-80	-0.0022	0.0062	.	0.1780	0.038	0.051	.	0.682	-0.46	0.95	.	2.02
1981-85	0.0227	-0.0028	.	-0.0369	0.042	0.047	.	0.601	4.15	-0.46	.	-0.48
1986-90	0.0257	-0.0008	.	-0.2022	0.046	0.063	.	0.533	4.34	-0.09	.	-2.94
1991-95	0.0019	-0.0009	.	0.1663	0.044	0.056	.	0.775	0.33	-0.13	.	1.66
1991-98	0.0059	0.0009	.	0.0930	0.043	0.052	.	0.693	1.36	0.16	.	1.31
Panel D:												
1935-40	0.0048	0.0035	-0.0003	0.0193	0.150	0.203	0.078	0.740	0.27	0.15	-0.04	0.22
1941-45	0.0057	-0.0142	0.0060	0.2740	0.064	0.119	0.049	0.990	0.69	-0.92	0.94	2.14
1946-50	-0.0053	0.0166	-0.0074	0.0808	0.053	0.087	0.033	0.538	-0.78	1.48	-1.76	1.16
1951-55	0.0078	0.0183	-0.0046	-0.1021	0.048	0.075	0.032	0.963	1.27	1.88	-1.12	-0.82
1956-60	0.0143	0.0012	-0.0034	-0.0486	0.036	0.080	0.041	0.774	3.06	0.11	-0.64	-0.49
1961-65	0.0104	-0.0038	0.0102	-0.0680	0.073	0.126	0.071	0.830	1.11	-0.23	1.11	-0.63
1966-70	0.0071	-0.0041	-0.0004	0.0829	0.083	0.164	0.070	0.870	0.67	-0.19	-0.05	0.74
1971-75	-0.0015	0.0058	-0.0001	0.0239	0.131	0.187	0.084	1.052	-0.09	0.24	-0.01	0.18
1976-80	0.0109	-0.0103	0.0103	0.0842	0.085	0.134	0.060	0.766	0.99	-0.59	1.33	0.85
1981-85	0.0072	0.0217	-0.0133	0.0392	0.070	0.106	0.042	0.639	0.79	1.59	-2.44	0.47
1986-90	0.0026	0.0429	-0.0266	-0.0803	0.087	0.180	0.086	0.626	0.23	1.84	-2.39	-0.99
1991-95	-0.0030	0.0112	-0.0078	0.1854	0.079	0.168	0.094	0.769	-0.29	0.51	-0.64	1.87
1991-98	-0.0009	0.0168	-0.0097	0.1220	0.069	0.143	0.078	0.682	-0.13	1.15	-1.21	1.75

Appendix D

Fama-MacBeth: NYSE, AMEX, NASDAQ

Table D.1: **NYSE, AMEX, NASDAQ (Equal-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0020	0.0117	.	.	0.061	0.114	.	.	0.28	0.87	.	.
1941-45	0.0068	0.0214	.	.	0.033	0.068	.	.	1.59	2.43	.	.
1946-50	0.0048	0.0032	.	.	0.030	0.048	.	.	1.21	0.51	.	.
1951-55	0.0122	0.0025	.	.	0.019	0.035	.	.	4.97	0.56	.	.
1956-60	0.0148	-0.0058	.	.	0.020	0.033	.	.	5.65	-1.35	.	.
1961-65	-0.0015	0.0154	.	.	0.033	0.044	.	.	-0.35	2.73	.	.
1966-70	0.0079	-0.0013	.	.	0.039	0.055	.	.	1.57	-0.18	.	.
1971-75	0.0005	0.0059	.	.	0.040	0.066	.	.	0.11	0.69	.	.
1976-80	-0.0003	0.0231	.	.	0.036	0.069	.	.	-0.06	2.60	.	.
1981-85	0.0177	-0.0010	.	.	0.031	0.048	.	.	4.39	-0.16	.	.
1986-90	0.0156	-0.0099	.	.	0.030	0.046	.	.	4.01	-1.66	.	.
1991-95	0.0059	0.0138	.	.	0.039	0.063	.	.	1.16	1.70	.	.
1991-98	0.0092	0.0085	.	.	0.034	0.057	.	.	2.62	1.47	.	.
Panel B:												
1935-40	-0.0033	0.0256	-0.0072	.	0.075	0.173	0.079	.	-0.38	1.26	-0.77	.
1941-45	0.0127	0.0072	0.0067	.	0.050	0.090	0.062	.	1.98	0.62	0.84	.
1946-50	-0.0002	0.0137	-0.0045	.	0.037	0.101	0.031	.	-0.04	1.06	-1.10	.
1951-55	0.0001	0.0285	-0.0123	.	0.031	0.086	0.036	.	0.03	2.55	-2.64	.
1956-60	0.0125	-0.0005	-0.0024	.	0.030	0.072	0.029	.	3.26	-0.05	-0.64	.
1961-65	0.0026	0.0061	0.0046	.	0.068	0.140	0.070	.	0.30	0.34	0.51	.
1966-70	0.0022	0.0119	-0.0063	.	0.074	0.163	0.068	.	0.23	0.57	-0.72	.
1971-75	0.0084	-0.0126	0.0093	.	0.097	0.196	0.102	.	0.66	-0.50	0.70	.
1976-80	0.0094	0.0016	0.0102	.	0.077	0.182	0.072	.	0.95	0.07	1.11	.
1981-85	0.0102	0.0162	-0.0080	.	0.057	0.126	0.047	.	1.38	0.99	-1.32	.
1986-90	0.0005	0.0277	-0.0189	.	0.047	0.135	0.058	.	0.09	1.59	-2.54	.
1991-95	0.0157	-0.0148	0.0160	.	0.043	0.140	0.099	.	2.79	-0.82	1.25	.
1991-98	0.0152	-0.0095	0.0103	.	0.038	0.119	0.080	.	3.87	-0.79	1.27	.
Panel C:												
1935-40	0.0016	0.0097	.	0.0183	0.073	0.095	.	0.719	0.19	0.86	.	0.22
1941-45	0.0017	0.0098	.	0.1661	0.056	0.052	.	1.005	0.23	1.47	.	1.28
1946-50	0.0070	0.0082	.	-0.0964	0.040	0.068	.	0.687	1.37	0.94	.	-1.09
1951-55	0.0149	0.0071	.	-0.1194	0.030	0.044	.	0.740	3.88	1.25	.	-1.25
1956-60	0.0123	-0.0082	.	0.0827	0.038	0.042	.	1.212	2.49	-1.49	.	0.53
1961-65	-0.0037	0.0128	.	0.0758	0.039	0.051	.	0.889	-0.74	1.94	.	0.66
1966-70	0.0114	0.0047	.	-0.1360	0.045	0.065	.	0.979	1.96	0.55	.	-1.08
1971-75	-0.0056	-0.0074	.	0.2279	0.052	0.081	.	1.292	-0.84	-0.71	.	1.37
1976-80	-0.0053	0.0019	.	0.2718	0.047	0.072	.	0.954	-0.88	0.20	.	2.21
1981-85	0.0202	0.0014	.	-0.0499	0.041	0.066	.	0.716	3.83	0.17	.	-0.54
1986-90	0.0228	0.0028	.	-0.2036	0.044	0.063	.	0.599	4.02	0.35	.	-2.63
1991-95	0.0035	0.0028	.	0.1190	0.051	0.041	.	0.664	0.53	0.54	.	1.39
1991-98	0.0088	0.0033	.	0.0498	0.046	0.043	.	0.602	1.88	0.75	.	0.81
Panel D:												
1935-40	-0.0092	0.0295	-0.0124	0.0594	0.112	0.186	0.097	0.797	-0.70	1.35	-1.08	0.63
1941-45	-0.0028	0.0156	-0.0041	0.2026	0.082	0.086	0.053	1.086	-0.27	1.40	-0.59	1.44
1946-50	0.0016	0.0133	-0.0036	-0.0339	0.045	0.099	0.030	0.577	0.27	1.04	-0.91	-0.46
1951-55	0.0028	0.0277	-0.0107	-0.0626	0.039	0.085	0.035	0.726	0.56	2.51	-2.37	-0.67
1956-60	0.0091	-0.0046	-0.0023	0.1250	0.055	0.071	0.033	1.365	1.28	-0.51	-0.55	0.71
1961-65	-0.0005	0.0049	0.0038	0.0822	0.073	0.143	0.070	0.911	-0.05	0.27	0.42	0.70
1966-70	0.0099	0.0050	0.0002	-0.1083	0.106	0.176	0.086	1.245	0.72	0.22	0.02	-0.67
1971-75	-0.0072	-0.0068	-0.0014	0.2640	0.103	0.194	0.094	1.149	-0.54	-0.27	-0.11	1.78
1976-80	0.0017	-0.0131	0.0074	0.2654	0.088	0.176	0.072	0.996	0.15	-0.58	0.80	2.06
1981-85	0.0104	0.0148	-0.0080	0.0116	0.065	0.126	0.045	0.696	1.23	0.91	-1.39	0.13
1986-90	0.0126	0.0161	-0.0088	-0.1278	0.076	0.144	0.069	0.643	1.28	0.87	-0.99	-1.54
1991-95	-0.0035	0.0096	-0.0057	0.1837	0.073	0.114	0.075	0.771	-0.37	0.65	-0.59	1.85
1991-98	0.0046	0.0054	-0.0025	0.0954	0.066	0.101	0.061	0.702	0.68	0.52	-0.40	1.33

Table D.2: **NYSE, AMEX, NASDAQ (Value-Weights): Summary Results**

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0067	0.0049	.	.	0.071	0.081	.	.	0.80	0.51	.	.
1941-45	0.0081	0.0143	.	.	0.034	0.050	.	.	1.86	2.23	.	.
1946-50	0.0044	0.0028	.	.	0.031	0.042	.	.	1.11	0.52	.	.
1951-55	0.0111	0.0034	.	.	0.019	0.032	.	.	4.54	0.81	.	.
1956-60	0.0151	-0.0066	.	.	0.020	0.040	.	.	5.82	-1.27	.	.
1961-65	-0.0021	0.0148	.	.	0.035	0.043	.	.	-0.46	2.64	.	.
1966-70	0.0088	-0.0016	.	.	0.042	0.047	.	.	1.62	-0.27	.	.
1971-75	-0.0009	0.0066	.	.	0.040	0.060	.	.	-0.18	0.85	.	.
1976-80	-0.0018	0.0207	.	.	0.039	0.065	.	.	-0.36	2.47	.	.
1981-85	0.0187	-0.0020	.	.	0.032	0.048	.	.	4.60	-0.32	.	.
1986-90	0.0142	-0.0082	.	.	0.027	0.049	.	.	4.01	-1.31	.	.
1991-95	0.0067	0.0131	.	.	0.039	0.063	.	.	1.35	1.61	.	.
1991-98	0.0093	0.0086	.	.	0.034	0.058	.	.	2.69	1.45	.	.
Panel B:												
1935-40	-0.0039	0.0235	-0.0067	.	0.086	0.144	0.038	.	-0.39	1.39	-1.50	.
1941-45	0.0148	0.0026	0.0042	.	0.063	0.085	0.039	.	1.82	0.24	0.83	.
1946-50	-0.0029	0.0148	-0.0042	.	0.050	0.095	0.025	.	-0.46	1.20	-1.28	.
1951-55	0.0002	0.0239	-0.0085	.	0.035	0.082	0.034	.	0.04	2.26	-1.97	.
1956-60	0.0076	0.0121	-0.0095	.	0.032	0.083	0.042	.	1.82	1.13	-1.75	.
1961-65	-0.0165	0.0466	-0.0153	.	0.066	0.121	0.054	.	-1.93	2.97	-2.21	.
1966-70	0.0053	0.0054	-0.0030	.	0.073	0.135	0.051	.	0.56	0.31	-0.45	.
1971-75	0.0052	-0.0064	0.0059	.	0.118	0.205	0.097	.	0.34	-0.24	0.47	.
1976-80	0.0161	-0.0121	0.0133	.	0.087	0.164	0.060	.	1.43	-0.57	1.70	.
1981-85	0.0156	0.0058	-0.0036	.	0.062	0.119	0.047	.	1.97	0.37	-0.59	.
1986-90	-0.0021	0.0326	-0.0206	.	0.041	0.115	0.048	.	-0.39	2.20	-3.31	.
1991-95	0.0210	-0.0270	0.0219	.	0.063	0.200	0.131	.	2.57	-1.04	1.29	.
1991-98	0.0173	-0.0135	0.0121	.	0.053	0.164	0.106	.	3.18	-0.81	1.12	.
Panel C:												
1935-40	0.0057	0.0038	.	0.0179	0.084	0.067	.	0.755	0.57	0.48	.	0.20
1941-45	0.0017	0.0022	.	0.2184	0.047	0.050	.	0.865	0.28	0.34	.	1.96
1946-50	0.0052	0.0077	.	-0.0879	0.034	0.054	.	0.572	1.18	1.11	.	-1.19
1951-55	0.0135	0.0081	.	-0.1228	0.026	0.038	.	0.657	4.00	1.66	.	-1.45
1956-60	0.0192	0.0005	.	-0.1776	0.030	0.041	.	0.800	4.98	0.10	.	-1.72
1961-65	0.0119	0.0278	.	-0.4121	0.045	0.046	.	0.990	2.04	4.65	.	-3.23
1966-70	0.0077	-0.0032	.	0.0560	0.052	0.049	.	1.044	1.14	-0.51	.	0.42
1971-75	-0.0069	-0.0066	.	0.2467	0.051	0.063	.	1.214	-1.05	-0.81	.	1.57
1976-80	-0.0036	-0.0008	.	0.2712	0.042	0.073	.	0.883	-0.66	-0.09	.	2.38
1981-85	0.0219	-0.0007	.	-0.0448	0.043	0.061	.	0.671	3.98	-0.09	.	-0.52
1986-90	0.0217	0.0013	.	-0.1747	0.039	0.058	.	0.499	4.32	0.17	.	-2.71
1991-95	0.0047	0.0039	.	0.0986	0.049	0.040	.	0.538	0.74	0.76	.	1.42
1991-98	0.0092	0.0040	.	0.0412	0.044	0.041	.	0.486	2.05	0.95	.	0.83
Panel D:												
1935-40	-0.0167	0.0280	-0.0109	0.1226	0.170	0.166	0.060	1.467	-0.83	1.43	-1.53	0.71
1941-45	-0.0028	0.0067	-0.0022	0.2495	0.074	0.079	0.035	0.869	-0.29	0.66	-0.49	2.22
1946-50	-0.0004	0.0148	-0.0032	-0.0556	0.057	0.095	0.026	0.564	-0.05	1.20	-0.95	-0.76
1951-55	0.0031	0.0229	-0.0069	-0.0648	0.039	0.081	0.033	0.585	0.61	2.19	-1.61	-0.86
1956-60	0.0133	0.0149	-0.0080	-0.1612	0.040	0.085	0.040	0.835	2.58	1.36	-1.55	-1.50
1961-65	0.0022	0.0465	-0.0095	-0.3830	0.079	0.125	0.058	1.033	0.22	2.89	-1.27	-2.87
1966-70	0.0058	0.0006	-0.0014	0.0527	0.085	0.134	0.052	1.084	0.52	0.03	-0.21	0.38
1971-75	-0.0291	0.0219	-0.0146	0.4001	0.124	0.196	0.088	1.055	-1.82	0.87	-1.28	2.94
1976-80	-0.0004	-0.0045	0.0022	0.2479	0.102	0.163	0.061	0.922	-0.03	-0.21	0.28	2.08
1981-85	0.0156	0.0051	-0.0039	0.0108	0.098	0.124	0.062	0.904	1.24	0.32	-0.48	0.09
1986-90	0.0005	0.0343	-0.0221	-0.0338	0.099	0.149	0.082	0.819	0.04	1.78	-2.08	-0.32
1991-95	0.0039	0.0037	0.0001	0.1088	0.069	0.171	0.104	0.494	0.43	0.17	0.01	1.71
1991-98	0.0084	0.0044	-0.0001	0.0501	0.061	0.142	0.085	0.476	1.34	0.30	-0.01	1.03

Table D.3: NYSE, AMEX, NASDAQ (Equal-Weights): Summary Results - Robust

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0063	0.0078	.	.	0.064	0.119	.	.	0.83	0.55	.	.
1941-45	0.0088	0.0204	.	.	0.033	0.073	.	.	2.05	2.16	.	.
1946-50	0.0057	0.0024	.	.	0.028	0.054	.	.	1.58	0.34	.	.
1951-55	0.0114	0.0035	.	.	0.017	0.034	.	.	5.23	0.80	.	.
1956-60	0.0141	-0.0053	.	.	0.019	0.034	.	.	5.64	-1.21	.	.
1961-65	-0.0007	0.0153	.	.	0.032	0.044	.	.	-0.16	2.66	.	.
1966-70	0.0095	-0.0030	.	.	0.038	0.053	.	.	1.93	-0.44	.	.
1971-75	0.0005	0.0063	.	.	0.040	0.069	.	.	0.09	0.70	.	.
1976-80	0.0011	0.0230	.	.	0.034	0.071	.	.	0.27	2.53	.	.
1981-85	0.0180	-0.0014	.	.	0.028	0.047	.	.	4.91	-0.23	.	.
1986-90	0.0102	-0.0046	.	.	0.027	0.046	.	.	2.89	-0.78	.	.
1991-95	0.0083	0.0122	.	.	0.031	0.056	.	.	2.09	1.67	.	.
1991-98	0.0102	0.0080	.	.	0.028	0.054	.	.	3.55	1.46	.	.
Panel B:												
1935-40	0.0035	0.0154	-0.0045	.	0.091	0.217	0.116	.	0.33	0.60	-0.33	.
1941-45	0.0132	0.0122	0.0034	.	0.067	0.167	0.117	.	1.53	0.56	0.22	.
1946-50	0.0013	0.0130	-0.0053	.	0.036	0.102	0.047	.	0.28	0.99	-0.88	.
1951-55	0.0027	0.0235	-0.0100	.	0.027	0.078	0.036	.	0.76	2.34	-2.13	.
1956-60	0.0109	0.0028	-0.0040	.	0.027	0.074	0.033	.	3.07	0.30	-0.92	.
1961-65	-0.0042	0.0240	-0.0046	.	0.061	0.130	0.066	.	-0.53	1.43	-0.53	.
1966-70	0.0054	0.0071	-0.0051	.	0.077	0.168	0.077	.	0.55	0.33	-0.52	.
1971-75	0.0055	-0.0064	0.0066	.	0.086	0.178	0.098	.	0.50	-0.28	0.52	.
1976-80	0.0091	0.0036	0.0101	.	0.066	0.170	0.075	.	1.07	0.16	1.03	.
1981-85	0.0124	0.0135	-0.0076	.	0.045	0.105	0.046	.	2.13	0.99	-1.29	.
1986-90	-0.0014	0.0319	-0.0211	.	0.039	0.128	0.065	.	-0.29	1.93	-2.53	.
1991-95	0.0190	-0.0265	0.0236	.	0.033	0.123	0.097	.	4.49	-1.67	1.88	.
1991-98	0.0164	-0.0142	0.0138	.	0.032	0.109	0.082	.	5.04	-1.27	1.65	.
Panel C:												
1935-40	0.0011	0.0018	.	0.0841	0.076	0.115	.	0.611	0.13	0.13	.	1.17
1941-45	0.0006	0.0076	.	0.2046	0.060	0.061	.	0.938	0.08	0.97	.	1.69
1946-50	0.0066	0.0048	.	-0.0453	0.035	0.054	.	0.525	1.46	0.70	.	-0.67
1951-55	0.0143	0.0078	.	-0.1149	0.031	0.038	.	0.797	3.53	1.60	.	-1.12
1956-60	0.0147	-0.0042	.	-0.0286	0.035	0.038	.	1.011	3.30	-0.87	.	-0.22
1961-65	-0.0003	0.0159	.	-0.0152	0.042	0.056	.	0.994	-0.05	2.20	.	-0.12
1966-70	0.0169	0.0055	.	-0.2314	0.053	0.057	.	1.088	2.48	0.75	.	-1.65
1971-75	-0.0049	-0.0039	.	0.1776	0.059	0.073	.	1.233	-0.64	-0.42	.	1.12
1976-80	-0.0010	0.0165	.	0.0858	0.041	0.078	.	0.767	-0.19	1.64	.	0.87
1981-85	0.0223	0.0020	.	-0.0764	0.046	0.056	.	0.611	3.74	0.27	.	-0.97
1986-90	0.0173	0.0011	.	-0.1278	0.043	0.051	.	0.509	3.10	0.17	.	-1.94
1991-95	0.0018	0.0049	.	0.1194	0.052	0.039	.	0.483	0.27	0.98	.	1.91
1991-98	0.0070	0.0040	.	0.0627	0.048	0.040	.	0.470	1.43	0.98	.	1.31
Panel D:												
1935-40	-0.0055	0.0184	-0.0100	0.0927	0.100	0.223	0.112	0.618	-0.47	0.70	-0.76	1.27
1941-45	-0.0017	0.0179	-0.0066	0.1974	0.059	0.153	0.095	0.844	-0.22	0.91	-0.54	1.81
1946-50	0.0014	0.0141	-0.0055	-0.0141	0.042	0.100	0.046	0.532	0.25	1.09	-0.91	-0.21
1951-55	0.0027	0.0239	-0.0101	-0.0124	0.045	0.079	0.039	0.784	0.47	2.33	-2.01	-0.12
1956-60	0.0151	-0.0004	-0.0011	-0.0756	0.053	0.072	0.037	1.128	2.20	-0.04	-0.23	-0.52
1961-65	-0.0046	0.0289	-0.0064	-0.0363	0.061	0.161	0.073	1.085	-0.58	1.39	-0.69	-0.26
1966-70	0.0097	0.0159	-0.0063	-0.1640	0.094	0.173	0.080	1.124	0.79	0.71	-0.61	-1.13
1971-75	-0.0048	-0.0040	0.0003	0.1802	0.108	0.181	0.100	1.124	-0.35	-0.17	0.02	1.24
1976-80	0.0084	-0.0008	0.0108	0.0416	0.073	0.175	0.077	0.769	0.90	-0.03	1.09	0.42
1981-85	0.0135	0.0127	-0.0071	-0.0098	0.060	0.110	0.043	0.612	1.73	0.89	-1.28	-0.12
1986-90	0.0058	0.0208	-0.0128	-0.0560	0.088	0.181	0.102	0.736	0.51	0.89	-0.97	-0.59
1991-95	-0.0007	0.0104	-0.0041	0.1344	0.088	0.150	0.100	0.675	-0.06	0.53	-0.31	1.54
1991-98	0.0066	0.0063	-0.0017	0.0639	0.080	0.130	0.084	0.639	0.80	0.47	-0.20	0.98

Table D.4: NYSE, AMEX, NASDAQ (Value-Weights): Summary Results - Robust

Period	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$s(\hat{\gamma}_0)$	$s(\hat{\gamma}_1)$	$s(\hat{\gamma}_2)$	$s(\hat{\gamma}_3)$	$t(\hat{\gamma}_0)$	$t(\hat{\gamma}_1)$	$t(\hat{\gamma}_2)$	$t(\hat{\gamma}_3)$
Panel A:												
1935-40	0.0115	0.0018	.	.	0.080	0.078	.	.	1.21	0.20	.	.
1941-45	0.0114	0.0130	.	.	0.034	0.051	.	.	2.58	1.97	.	.
1946-50	0.0056	0.0021	.	.	0.029	0.044	.	.	1.48	0.36	.	.
1951-55	0.0097	0.0048	.	.	0.016	0.030	.	.	4.57	1.26	.	.
1956-60	0.0146	-0.0063	.	.	0.019	0.040	.	.	5.97	-1.24	.	.
1961-65	0.0004	0.0131	.	.	0.033	0.042	.	.	0.09	2.41	.	.
1966-70	0.0107	-0.0035	.	.	0.041	0.042	.	.	2.03	-0.64	.	.
1971-75	0.0002	0.0058	.	.	0.039	0.059	.	.	0.04	0.76	.	.
1976-80	0.0020	0.0188	.	.	0.033	0.061	.	.	0.47	2.39	.	.
1981-85	0.0194	-0.0027	.	.	0.027	0.044	.	.	5.56	-0.48	.	.
1986-90	0.0089	-0.0029	.	.	0.028	0.046	.	.	2.47	-0.48	.	.
1991-95	0.0110	0.0092	.	.	0.028	0.054	.	.	3.07	1.33	.	.
1991-98	0.0118	0.0064	.	.	0.026	0.050	.	.	4.38	1.24	.	.
Panel B:												
1935-40	0.0106	0.0038	-0.0008	.	0.111	0.185	0.068	.	0.80	0.17	-0.10	.
1941-45	0.0236	-0.0100	0.0092	.	0.068	0.107	0.055	.	2.68	-0.72	1.29	.
1946-50	-0.0015	0.0155	-0.0054	.	0.041	0.086	0.031	.	-0.29	1.39	-1.36	.
1951-55	0.0030	0.0182	-0.0058	.	0.032	0.075	0.031	.	0.74	1.88	-1.45	.
1956-60	0.0118	0.0013	-0.0041	.	0.028	0.079	0.043	.	3.22	0.13	-0.74	.
1961-65	0.0076	-0.0044	0.0089	.	0.058	0.124	0.070	.	1.03	-0.28	0.98	.
1966-70	0.0124	-0.0080	0.0024	.	0.080	0.173	0.076	.	1.21	-0.36	0.25	.
1971-75	0.0008	0.0035	0.0013	.	0.105	0.183	0.083	.	0.06	0.15	0.12	.
1976-80	0.0172	-0.0129	0.0140	.	0.066	0.123	0.054	.	2.04	-0.81	2.02	.
1981-85	0.0123	0.0150	-0.0085	.	0.042	0.091	0.039	.	2.30	1.27	-1.70	.
1986-90	-0.0065	0.0436	-0.0260	.	0.040	0.114	0.056	.	-1.25	2.96	-3.60	.
1991-95	0.0186	-0.0171	0.0159	.	0.033	0.111	0.080	.	4.41	-1.19	1.54	.
1991-98	0.0155	-0.0061	0.0078	.	0.034	0.100	0.070	.	4.43	-0.59	1.10	.
Panel C:												
1935-40	0.0049	0.0030	.	0.0130	0.088	0.071	.	0.635	0.47	0.36	.	0.17
1941-45	-0.0024	0.0004	.	0.2803	0.065	0.044	.	0.970	-0.28	0.07	.	2.24
1946-50	0.0056	0.0016	.	0.0112	0.037	0.044	.	0.495	1.17	0.28	.	0.17
1951-55	0.0142	0.0095	.	-0.1511	0.035	0.033	.	0.979	3.12	2.26	.	-1.20
1956-60	0.0169	-0.0046	.	-0.0619	0.032	0.040	.	0.782	4.13	-0.90	.	-0.61
1961-65	0.0024	0.0159	.	-0.0664	0.046	0.040	.	0.851	0.41	3.07	.	-0.60
1966-70	0.0078	-0.0054	.	0.0842	0.052	0.040	.	0.870	1.16	-1.06	.	0.75
1971-75	0.0000	0.0044	.	0.0131	0.055	0.055	.	1.056	0.01	0.62	.	0.10
1976-80	-0.0027	0.0033	.	0.2147	0.038	0.048	.	0.693	-0.54	0.53	.	2.40
1981-85	0.0238	-0.0045	.	-0.0245	0.048	0.045	.	0.567	3.82	-0.78	.	-0.33
1986-90	0.0199	0.0036	.	-0.1759	0.044	0.047	.	0.459	3.54	0.59	.	-2.97
1991-95	0.0035	0.0015	.	0.1299	0.053	0.038	.	0.530	0.50	0.31	.	1.90
1991-98	0.0079	0.0017	.	0.0728	0.049	0.038	.	0.494	1.57	0.43	.	1.44
Panel D:												
1935-40	0.0012	0.0075	-0.0021	0.0300	0.151	0.210	0.080	0.739	0.07	0.30	-0.22	0.34
1941-45	0.0071	-0.0147	0.0065	0.2588	0.059	0.124	0.051	0.956	0.94	-0.92	0.99	2.10
1946-50	-0.0054	0.0170	-0.0075	0.0797	0.053	0.087	0.033	0.542	-0.79	1.50	-1.78	1.14
1951-55	0.0081	0.0190	-0.0048	-0.1133	0.048	0.076	0.032	0.987	1.29	1.94	-1.17	-0.89
1956-60	0.0142	0.0014	-0.0035	-0.0478	0.037	0.082	0.041	0.774	3.01	0.13	-0.66	-0.48
1961-65	0.0102	-0.0023	0.0096	-0.0738	0.073	0.125	0.071	0.836	1.08	-0.15	1.04	-0.68
1966-70	0.0093	-0.0088	0.0020	0.0802	0.087	0.172	0.076	0.866	0.83	-0.40	0.20	0.72
1971-75	0.0009	0.0036	0.0018	-0.0026	0.135	0.191	0.088	1.021	0.05	0.14	0.16	-0.02
1976-80	0.0052	-0.0066	0.0062	0.1572	0.082	0.130	0.056	0.778	0.49	-0.39	0.86	1.56
1981-85	0.0090	0.0160	-0.0116	0.0608	0.072	0.093	0.042	0.639	0.97	1.34	-2.15	0.74
1986-90	0.0079	0.0238	-0.0123	-0.1080	0.077	0.159	0.083	0.593	0.80	1.16	-1.15	-1.41
1991-95	-0.0067	0.0244	-0.0149	0.1785	0.101	0.156	0.094	0.748	-0.52	1.21	-1.22	1.85
1991-98	-0.0009	0.0201	-0.0118	0.1165	0.087	0.132	0.078	0.651	-0.10	1.49	-1.49	1.75

Bibliography

[1] ADAMEK, P., LIM, T., LO, A., AND WANG, J. Trading volume and the minicrsp databases: An introduction and users' guide. manuscript, 1998.

[2] CAMPELL, J., LO, A., AND MACKINLAY, C. *Econometrics of Finacial Markets.* Princeton Unversity Press, 1997.

[3] CHAN, L., JEGADEESH, N., AND LAKONISHOK, J. Evaluating the performance of value versus glamour stocks: The impact of selection bias. *Journal of Financial Economics 38*, 3 (June 1995), 269–296.

[4] FAMA, E. F., AND FRENCH, K. R. The cross-section of expected stock returns. *Journal of Finance 47*, 2 (June 1992), 427–465.

[5] FAMA, E. F., AND MACBETH, J. D. Risk, return, and equilibrium: Empirical tests. *Journal of Politcal Economy 81*, 3 (May-June 1973), 607–636.

[6] HAWAWINI, G., AND KEIM, D. The cross section of common stock returns: A review of the evidence and some new findings. Working paper, Insead and University of Pennsylvania, Wharton School, 1998.

[7] LIM, T. A guide to managing large financial research databases. manuscript, http://amostuck.dartmouth.edu/guide.pdf, 1999.

[8] LO, A., AND WANG, J. Trading volume: Definitions, data analysis, and implications of portfolio theory. Working paper, Massachusetts Institute of Technology, Sloan School of Management, 1999.

[9] LOUGHRAM, T. Book-to-market across firm size, exchange, and seasonality: Is there and effect. *Journal of Financial and Quantitative Analysis 32*, 3 (Sept. 1997), 249–267.

[10] SHUMWAY, T., AND WARTHER, V. The delisting bias in crsp's nasdaq data and its implications for the size effect. *The Journal of Finance 54*, 6 (Dec. 1999), 2361–2379.