I Introduction

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Financial Market Efficiency Tests
Section 3.3.2: The presentation of a number of short-term summary statistics for the NYSE

The plan for the text of the chapter is as follows. The text consists of three major sections:

1. Theoretical Foundations
2. Empirical Results
3. Conclusions and Future Directions

Theoretical Foundations

Empirical Results

Conclusions and Future Directions

Acknowledgments

References

Appendix
2 Data Generation Mechanisms
For reference, the model in this context is the same as that used in previous studies. The model assumes that the returns on a portfolio of assets can be represented by a multivariate normal distribution with a mean vector and a covariance matrix. The mean vector represents the expected return on each asset, and the covariance matrix captures the interrelationships between the returns of different assets.

The model is specified as follows:

\[ R_t = \mu + \Sigma \epsilon_t \]

where \( R_t \) is the vector of asset returns, \( \mu \) is the vector of expected returns, and \( \Sigma \) is the covariance matrix. The vector \( \epsilon_t \) represents the vector of random shocks.

The covariance matrix \( \Sigma \) is estimated using historical data, and the expected returns \( \mu \) are estimated using various methods, such as the Capital Asset Pricing Model (CAPM) or the Fama-French three-factor model.

The model is used to estimate the risk and return characteristics of different portfolios, and to make investment decisions. It is a fundamental tool in modern finance and is widely used by financial analysts, portfolio managers, and investors.
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In this section we review some of the time series techniques and test statistics employed in the shorter-horizon returns framework. We start with a short summary of the fundamentals of the shorter-horizon returns framework. Then, we discuss the main empirical results of shorter-horizon returns studies. We conclude with a discussion of the implications of shorter-horizon returns studies for the Capital Asset Pricing Model (CAPM) and other asset pricing models.

Table 9.1: Real-world monthly percentage returns, shorter-horizon summary statistics

<table>
<thead>
<tr>
<th>Date</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
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<td>1.3</td>
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<td>1.1</td>
</tr>
</tbody>
</table>

Table 9.1: Real-world monthly percentage returns, shorter-horizon summary statistics

In Table 9.1, the real-world monthly percentage returns are reported from January 1991 to December 1991. The data are monthly returns on a portfolio of stocks. The table reports the mean, median, and standard deviation of the returns for each month. The returns are calculated as the difference between the closing price of the portfolio and the beginning price of the portfolio, divided by the beginning price of the portfolio.

In this section we review some of the time series techniques and test statistics employed in the shorter-horizon returns framework. We start with a short summary of the fundamentals of the shorter-horizon returns framework. Then, we discuss the main empirical results of shorter-horizon returns studies. We conclude with a discussion of the implications of shorter-horizon returns studies for the Capital Asset Pricing Model (CAPM) and other asset pricing models.

The results in Table 9.1 are consistent with the theory of shorter-horizon returns. The mean returns are positive for most of the months, indicating that the portfolio has tended to outperform the market. The standard deviations are relatively low, indicating that the returns are not very volatile.

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According to the model of theoretical and empirical analysis, the effect of the stock price on the financial market efficiency is significant. The model suggests that the stock price is positively correlated with the financial market efficiency. The correlation coefficient is 0.75, indicating a strong positive relationship. This finding supports the hypothesis that the stock market is efficient and that the prices accurately reflect the fundamental value of the underlying assets.
The results of the empirical investigation of the conditional structure of the data are presented in Table 2. These results provide strong evidence that the temporal dependence in the data is adequately captured by the model. The estimated coefficients of the lagged dependent variable are all statistically significant at the 5% level, indicating that past values of the variable are important predictors of future values. The estimated coefficients of the lagged independent variables are also significant, suggesting that the model is able to capture the dynamic relationships between the variables.

### Table 2: Estimated Coefficients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y(t-1)</td>
<td>0.75</td>
<td>0.05</td>
<td>15.04</td>
</tr>
<tr>
<td>X(t-2)</td>
<td>0.45</td>
<td>0.03</td>
<td>14.78</td>
</tr>
<tr>
<td>Z(t-3)</td>
<td>0.30</td>
<td>0.02</td>
<td>15.27</td>
</tr>
</tbody>
</table>

These results suggest that the model is a good fit for the data and that it can be used to make accurate predictions about future values of the variable of interest. The model is therefore a useful tool for understanding the dynamics of the system under study.
A Long-Term Test

require the valuation of the discounted future cash flows of the expected earnings from the project. The discounted cash flows are then compared to the cost of capital, and the project is accepted if the discounted cash flows exceed the cost of capital. The discount rate is determined by the company's cost of capital, which is a function of the risk-free rate and the risk premium.

Financial Market Efficiency Tests

To test the efficiency of the financial market, we can use various statistical methods to determine whether the market is pricing assets fairly. One common method is the Capital Asset Pricing Model (CAPM), which states that the expected return of an asset is equal to the risk-free rate plus a risk premium. The risk premium is determined by the market's required return, which is calculated using the beta of the asset.

The beta of an asset is a measure of its systematic risk, or the risk that cannot be diversified away. The beta is calculated by regressing the asset's returns against the market returns over a period of time. A beta of 1 means that the asset's returns move in line with the market, while a beta greater than 1 means that the asset is more volatile than the market and a beta less than 1 means that the asset is less volatile than the market.

The CAPM is a useful tool for determining the fair return of an asset, but it is not without its limitations. The model assumes that the market is efficient, which means that all available information is already reflected in the price of the asset. However, if the market is not efficient, then the CAPM will not accurately predict the fair return of the asset.
The purpose of the test statistics is to examine the null hypothesis that the coefficients in the regression model are zero. If the null hypothesis is rejected, it indicates that the independent variables are statistically significant in explaining the dependent variable. The test statistics are calculated as the ratio of the explained variance to the unexplained variance, adjusted for the degrees of freedom.

The test statistics in the table below are calculated using the formula:

\[ t = \frac{b - \beta_0}{SE} \]

where \( t \) is the test statistic, \( b \) is the estimated coefficient, \( \beta_0 \) is the hypothesized value (usually 0), and \( SE \) is the standard error of the coefficient. The critical value for a two-tailed test at a significance level of 0.05 is approximately 1.96 for a large sample size. If the calculated \( t \) statistic is greater than 1.96 or less than -1.96, the null hypothesis is rejected.

The estimated coefficients and their corresponding standard errors are shown in the table. The coefficients are significant if they are different from zero at a 5% significance level. The table also includes the p-values, which are the probabilities of observing the test statistic if the null hypothesis is true. A p-value less than 0.05 indicates statistical significance.

### Table 3: Real Monthly Returns, Multi-period Returns

<table>
<thead>
<tr>
<th>Month</th>
<th>3-Month</th>
<th>6-Month</th>
<th>9-Month</th>
<th>12-Month</th>
<th>24-Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>0.02</td>
<td>0.01</td>
<td>0.03</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>Jun</td>
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<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
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<tr>
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<td>0.04</td>
<td>0.03</td>
<td>0.02</td>
</tr>
</tbody>
</table>

### Financial Market Efficiency Tests

The results indicate that the market is not efficient. The estimated coefficients are statistically significant, indicating that past returns can be used to predict future returns. This suggests that the market is not fully efficient and that there are opportunities for arbitrage.

**References:**


**Note:** The results are based on historical data and may not reflect current market conditions. The significance of the test statistics may change over time and with different market conditions.
The TFR model is $0.667$ which is the largest of any of the models. This result is further illustrated by the fact that, for the $z$-value of the $z$-distribution, for the $t$-distribution, for the $F$-distribution, and for the $G$-distribution, the critical values are significantly higher than $z$.

The TFR model is $0.667$ which is the largest of any of the models.
For additional notes see Table 3.

\[
\begin{align*}
(1 + r)^n + \left(\frac{(1 + r)^n - 1}{n}\right) - 1 + \frac{1}{(1 + r)^n - 1} = 1 + \frac{1}{n}
\end{align*}
\]

Table 9. Real monthly returns: one-period expectations

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The relationship between the null and NUII models illustrates the consistency in the estimation of the parameters in both models. This consistency is important because it ensures that the results obtained from the null model can be directly compared to those from the NUII model. The null model, which includes only time and state random shocks, provides a simpler structure that is easier to interpret.

The NUII model, on the other hand, includes additional factors such as the political cycle, natural disaster, and state elections. These factors are likely to have a significant impact on the returns and volatility of the stock market. The inclusion of these factors in the NUII model provides a more comprehensive understanding of the drivers of returns and volatility.

The table and figures in the document provide empirical evidence to support the model specifications. The results indicate that the inclusion of the additional factors in the NUII model improves the fit of the model and provides a better explanation of the observed returns and volatility.

In conclusion, the NUII model is a more accurate representation of the drivers of returns and volatility in the stock market. The model provides a more comprehensive understanding of the factors that influence returns and volatility, and it can be used to make more informed investment decisions.
6 Volatility Tests

Volatility estimates are calculated using the conditional regression framework. The conditional regression equation is:

\[ \sigma_t^2 = \alpha + \beta \sigma_{t-1}^2 + \epsilon_t \]

Where \( \sigma_t^2 \) is the conditional variance at time \( t \), \( \alpha \) and \( \beta \) are parameters to be estimated, and \( \epsilon_t \) is the error term.

The estimated parameters are used to compute the conditional volatility for each observation. The results of the volatility tests are presented in Table 1 below.
The null hypotheses from equation (3) is then conventionally stated as

\( H_0: \theta = \theta_0 \)  

Let \( \theta_ 0 \) denote the corresponding sample realization of equation (3).

Equation (3)  

\[ \left( \theta - \theta_0 \right)^2 \]

From equation (6),  

\[ \left( \theta - \theta_0 \right)^2 \]

Second-order moment:

The null hypothesis is rejected if \( \left( \theta - \theta_0 \right)^2 > \chi^2 \) at the chosen significance level.

The sample variance may be estimated by

\[ s^2 = \frac{1}{n-1} \sum_{i=1}^{n} \left( x_i - \bar{x} \right)^2 \]

where \( n \) is the number of observations and \( \bar{x} \) is the sample mean.

The above results are due to Karl Pearson (1890) and have been extended by R. A. Fisher (1922).
For the model:

\[ \left[ \left( \frac{1}{d} - \frac{1}{d} \right) \right] \mathbf{E} = \left[ \left( \frac{1}{d} - \frac{1}{d} \right) \right] \mathbf{E} \]

the problems in square brackets refer to the equations for the sample moments of the conditional expected returns. The columns of the conditional expected returns are taken to be the three conditional components of \( \eta \), the three conditional components of \( \eta \), and the three conditional components of \( \eta \). The conditional expected returns \( \eta \) are calculated as follows:

\[ \eta = \text{conditional expected return} \]

<table>
<thead>
<tr>
<th>( \eta )</th>
<th>( \text{conditional expected return} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \eta_1 )</td>
<td>( \text{conditional expected return}_1 )</td>
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<td>( \eta_3 )</td>
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</table>

Second moment of conditional expected returns to unity

<table>
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<tr>
<th>( \theta )</th>
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<tr>
<td>( \theta_3 )</td>
<td>( \text{second moment of conditional expected returns}_3 )</td>
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</table>

The table below shows the results of a regression test the conditional expected returns. The conditional expected returns \( \eta \) are calculated as follows:

\[ \eta = \text{conditional expected return} \]

<table>
<thead>
<tr>
<th>( \eta )</th>
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<tbody>
<tr>
<td>( \eta_1 )</td>
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<td>( \eta_3 )</td>
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(5) OLS estimate for \( g \)

\[ g = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^{n} (X_i - \bar{X})^2} \]

(6) OLS estimate for \( \beta \)

\[ \beta = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \beta X_i)}{\sum_{i=1}^{n} (X_i - \bar{X})^2} \]

(7) OLS estimate for \( \gamma \)

\[ \gamma = \frac{\sum_{i=1}^{n} (Y_i - \beta X_i)(Z_i - \bar{Z})}{\sum_{i=1}^{n} (X_i - \bar{X})^2} \]

The orthogonal conditions in equation (5) are used to estimate the model parameters. The results show that the model parameters are consistent with the theoretical framework.
In first-order combination form the ARCH(1) model in continuous expression follows from the ARCH(1) conditional variance of residuals of financial. 

\[
\begin{bmatrix} 0 \\ \phi_1 + \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
\]

and

\[
\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
\]

The result of the derivation of the ARCH(1) model is given in the following expression, which follows from the ARCH(1) conditional variance of residuals of financial. 

\[
\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\[
\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\]

\[
\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
\]

\[
\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\[
\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
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\begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \phi_1 \\ \alpha_1 \phi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
\]
Financial Market Efficiency Tests 432

Theoretical evidence (1986) shows prices under time-varying expected risk are.

References:


Theoretical evidence (1986) shows prices under time-varying expected risk are.

Theoretical evidence (1986) shows prices under time-varying expected risk are.
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