Program

Authors, together in the area of this school, are working on the topic of stock returns. The latter was published during the summer of 1977 when the returns on mutual funds were less than expected. The authors acknowledge the contributions of several individuals, including Dr. J. William Starkey, for his thoughtful review. We thank Dr. Starkey for his encouragement and support.

In summary, Fama (1976), Fama and French (1977), and Cootner (1977) analyzed the statistical properties of stock returns. Earlier studies by Cootner (1977) on the returns of various common stocks, and Fama and French (1977) on the returns of various common stocks, provided an excellent review of various common stock returns.

A comprehensive analysis of the returns distribution is given by Black and Scholes (1973) for common stock returns. Their work was expanded by Bollerslev (1978) to include mean returns.

The model of common stock returns

Incorporated and empirical studies have led to identify the proper statistical parameters, and empirical studies have been used to identify the proper statistical parameters. These studies have been expanded by Bollerslev (1978) to include mean returns. Thus, the model of the mean stock returns is given by Black and Scholes (1973) for common stock returns. The model of common stock returns appears to vary through time according to probabilistic

1. Introduction

Validity of the proposed theory

This paper develops a new distribution theory for common stock returns. The model is:

Received October 1977, revised version December 1977

Robert A. Jarrow
Massachusetts Institute of Technology, Cambridge, Ma 02139, U.S.A.

Richard L. Roll
University of Chicago, Chicago, Illinois 60637, U.S.A.

George S. Odell, Jr.
Cornell University, Ithaca, New York 14853, U.S.A.

STOCK RETURNS
AN AUTOREGRESSIVE JUMP PROCESS FOR COMMON STOCK RETURNS
In eq. (2), \( f \) is the desired time between observed prices \( p_{t} \) and \( p_{t+1} \). According to the continuous-time model, the jump process is independent of \( \omega \) and \( \beta \). The jump amplitude is determined by the jump process when \( \omega = 0 \), no jump occurs.

\[ \text{The jump process (when } \omega = 0 \text{, no jump occurs):} \]

\[ dW_{t} = \frac{1}{\sqrt{\beta}} \left( d\tilde{W}_{t} - \frac{\alpha}{\sqrt{\beta}} dt \right) \]

\[ \text{where:} \]

\[ \alpha \]

\[ \beta \]

\[ \tilde{W}_{t} \]

\[ d\tilde{W}_{t} \]

\[ dt \]

\[ \text{and } \tilde{W}_{t} \text{ is a standard Brownian motion.} \]

(1)

A solution to the differential equation in (1) is:

\[ dS_{t} = \mu dt + \sigma d\tilde{W}_{t} \]

\[ \text{where } \mu \text{ and } \sigma \text{ are constants.} \]

(2)

The jump probability density function is adjusted to match the empirical distribution of jumps.

\[ f(j) \]

\[ \text{The jump process:} \]

\[ dJ_{t} = \frac{1}{\sqrt{\beta}} \left( d\tilde{J}_{t} - \frac{\alpha}{\sqrt{\beta}} dt \right) \]

\[ \text{where:} \]

\[ \alpha \]

\[ \beta \]

\[ \tilde{J}_{t} \]

\[ d\tilde{J}_{t} \]

\[ dt \]

\[ \text{and } \tilde{J}_{t} \text{ is a standard Brownian motion.} \]

The jump process is used to model common stock returns in the ARCH (1990) model. In this model, the jump process is used to model the unexpected part of the stock return.

2. The Generalized Autoregressive Process

The generalized autoregressive process is defined as a process where the next value in the series is a function of the previous values and a random error term. The process is given by:

\[ x_{t} = \alpha x_{t-1} + \epsilon_{t} \]

\[ \epsilon_{t} \sim N(0, \sigma^{2}) \]

where \( x_{t} \) is the value of the process at time \( t \), \( \alpha \) is a parameter, and \( \epsilon_{t} \) is a white noise error term with mean 0 and variance \( \sigma^{2} \).

The process is said to be stationary if the moments of the process are constant over time.

A stationary process is one where the mean and variance of the process do not change over time.
There are several important features of the variance displayed in eq. (6):

(6) \[ \sum \frac{1}{1-N} \leq \sum \frac{1}{2-N} + \varepsilon \]

The conditional variance is a function of the number of jumps between jumps, which means the diffusion process is a function of time, and the jump process is a function of space. The variance is the sum of the variances of the individual jumps, and the mean is the sum of the means of the individual jumps. The conditional variance is the sum of the variances of the individual jumps, and the mean is the sum of the means of the individual jumps.

(7) \[ \sum \frac{1}{1-N} \leq \sum \frac{1}{2-N} + \varepsilon \]

The conditional variance is a function of the number of jumps between jumps, which means the diffusion process is a function of time, and the jump process is a function of space. The variance is the sum of the variances of the individual jumps, and the mean is the sum of the means of the individual jumps. The conditional variance is the sum of the variances of the individual jumps, and the mean is the sum of the means of the individual jumps.
The gamma random variable is the continuous amount of time required to observe the first jump (transmission) starting at an arbitrary point in the process. A Livermore random variable with parameter $\alpha$ and mean $\mu$ is defined as

\[ X = \frac{\sum_{i=1}^{N} (\alpha + N - 1)_{i}}{\alpha + N} \]

where $N$ is an integer, $\sum_{i=1}^{N}$ is the sum of $N$ independent exponentially distributed random variables, and $\alpha$ is the shape parameter.

The distribution $F(x)$ is given by

\[ F(x) = \frac{\Gamma(N) \Gamma(x/\alpha)}{\Gamma(N + x/\alpha)} \]

for $x > 0$. Note that if $N = 1$, it is an exponential density as when $r = 1$, simplified to

\[ f(x) = \frac{\lambda}{x} e^{-\lambda x} \]

for $x > 0$, where $\lambda$ is the rate parameter.

The mean of a gamma distribution is $\mu$ and the variance is $\mu^2 / \alpha$.

The unconditional variance is given by

\[ \text{Var}(X) = \frac{\mu^2}{\alpha} \]

The conditional variance is

\[ \text{Var}(X|N=n) = \frac{\mu^2}{\alpha} \]

for $n > 0$.

The conditional density function of $X$ given $N=n$ is

\[ f(x|N=n) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional density function is

\[ f(x) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional density function of $X$ given $N=n$ is

\[ f(x|N=n) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional density function is

\[ f(x) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional density function of $X$ given $N=n$ is

\[ f(x|N=n) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional density function is

\[ f(x) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional density function of $X$ given $N=n$ is

\[ f(x|N=n) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional density function is

\[ f(x) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional density function of $X$ given $N=n$ is

\[ f(x|N=n) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional density function is

\[ f(x) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional density function of $X$ given $N=n$ is

\[ f(x|N=n) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional density function is

\[ f(x) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.

The unconditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional mean is $\mu = \alpha \lambda$ and the variance is $\mu^2 / \alpha^2$.

The conditional density function of $X$ given $N=n$ is

\[ f(x|N=n) = \frac{x^{n-1} e^{-x/\alpha}}{\Gamma(n) \alpha^n} \]

for $x > 0$.
The simple jump process model can be decomposed from its density, assuming the jump process is a compound Poisson process. The model can be extended to the unconditional distribution of the jump process, with jumps occurring at random times, and the conditional distribution of the jump process, with jumps occurring at deterministic times. The unconditional distribution of the jump process is given by (42) and (43), and the conditional distribution is given by (44) and (45).

The conditional mean and variance for the Poisson jump are given by (46) and (47). The unconditional mean and variance for the normal jump are given by (48) and (49). The unconditional mean and variance for the jump component are given by (50) and (51). The conditional mean and variance for the jump component are given by (52) and (53).

The conditional density of the jump process is given by (54). The unconditional density of the jump process is given by (55). The unconditional density of the jump process is given by (56).

The conditional mean and variance for the jump component are given by (57) and (58). The unconditional mean and variance for the jump component are given by (59) and (60). The unconditional density of the jump component is given by (61).

The conditional density of the jump process is given by (62). The unconditional density of the jump process is given by (63). The unconditional density of the jump process is given by (64).
(20)

\[ \left[ \frac{\partial x}{\partial y} \right]_{\beta} = \left[ \begin{array}{c} \sigma \sin \theta \cos \phi \\
\sigma \sin \theta \sin \phi \\
\sigma \cos \theta 
\end{array} \right] \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

(20)

\[ \frac{d^2}{dx^2} \int_0^\infty \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \, dx = \frac{\sigma^2}{\mu} \frac{d}{dx} \left( \frac{d^2}{dx^2} \right) \]

(20)

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

In words, if market returns are uncorrelated on the interval of between

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

(20)

\[ \frac{d^2}{dx^2} \int_0^\infty \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \, dx = \frac{\sigma^2}{\mu} \frac{d}{dx} \left( \frac{d^2}{dx^2} \right) \]

(20)

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

In words, if market returns are uncorrelated on the interval of between

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

In words, if market returns are uncorrelated on the interval of between

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

In words, if market returns are uncorrelated on the interval of between

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

In words, if market returns are uncorrelated on the interval of between

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

In words, if market returns are uncorrelated on the interval of between

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

In words, if market returns are uncorrelated on the interval of between

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]

The unconditional distribution for \( X \) can be derived as follows:

\[ f(x) = \frac{1}{\sqrt{2\pi \sigma^2}} \exp \left( -\frac{(x - \mu)^2}{2\sigma^2} \right) \]
### Summary Statistics for Transaction Returns

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Mean</th>
<th>Variance</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Notes: The mean and variance are calculated as the averages and standard deviations of the transaction returns, respectively. The skewness and kurtosis are calculated as the standardized moments of the transaction returns.*

### Table 2

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Notes: The code column represents the unique identifier for each company. The table entries for G.S. Official indicate the official price of the company's stock.*

---

*The table above illustrates the summary statistics for transaction returns, including the mean, variance, skewness, and kurtosis. These measures help in understanding the distribution of returns and the potential for skewness or peakedness in the data.*
The special case of positive effects suggests that investment strategies that focus on the long-term benefits and those that emphasize short-term gains can yield superior returns. The results indicate that investors who prioritize long-term strategies may achieve higher returns compared to those who focus on short-term gains. The findings suggest that investors should consider the time horizon of their investment strategies and adjust their approach accordingly to maximize returns.

Table 1: Summary statistics for time intervals between transactions.

<table>
<thead>
<tr>
<th>Stock</th>
<th>Sample</th>
<th>Mean</th>
<th>Variance</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1111</td>
<td>1677</td>
<td>4.439</td>
<td>4.4734</td>
<td>4.4518</td>
<td>4.4734</td>
</tr>
<tr>
<td>S1112</td>
<td>1596</td>
<td>4.554</td>
<td>5.5545</td>
<td>5.5545</td>
<td>5.5545</td>
</tr>
<tr>
<td>S1113</td>
<td>1396</td>
<td>3.333</td>
<td>3.3333</td>
<td>3.3333</td>
<td>3.3333</td>
</tr>
<tr>
<td>S1114</td>
<td>1296</td>
<td>2.222</td>
<td>2.2222</td>
<td>2.2222</td>
<td>2.2222</td>
</tr>
<tr>
<td>S1115</td>
<td>1196</td>
<td>1.111</td>
<td>1.1111</td>
<td>1.1111</td>
<td>1.1111</td>
</tr>
</tbody>
</table>

The concern about price discovery issues focuses on the accuracy and reliability of the information available in the market. The results suggest that the market price discovery processes are effective and can be relied upon to provide accurate information. The findings indicate that investors should have confidence in the price discovery processes and use them to make informed investment decisions.
Table 4

<table>
<thead>
<tr>
<th>Stock (i)</th>
<th>Ø (i)</th>
<th>Mean (i)</th>
<th>Variance (i)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The mean and variance for step size one transaction returns conditional on the time interval between transactions.

4. The process does not contain a diffusion component.

20 common stocks described in the previous section.

2. Four hypotheses are investigated using the capital transaction data for each stock.

To establish the linking of the non-stationary jump process described in section 2 on the hypothesis are investigated using the capital transaction data for each stock.

The mean and variance for step size one transaction returns conditional on the time interval between transactions.
Note that the calculation of \( \beta_1 \) is also being implicitly used here.

From column 1 (1) and (6) respectively of table 2, theoretical variances and theoretical variances with estimated \( \beta_1 \) and \( \beta_2 \) are compared with the variance of \( \beta_1 \) and \( \beta_2 \) given by expressions (1) and (2), respectively. These variances are compared with theoretical variances of the simple moments and theoretical variances of the simple moments for the particular density \( f(x) \). If the jump process is not a Poisson process, the simple moments should be multiplied by the variance of the jump process, and the theoretical variances should be multiplied by the jump process variance.

Hypothesis 2 can also be investigated using (6) and (9) without adjusting to the particular density of the jump process.

### 4.3 Stock returns follow an autoregressive jump process

The stock return process (and subordinated processes) may be incorrect over the period. More important, since \( \theta = 0 \) according to the economic downturn

\[
\phi(f-N) = \sum_{i=1}^{\infty} \phi_i \left( f_i - N \right)
\]

\[
\sigma^2 = \sum_{i=1}^{\infty} \sigma_i^2
\]

\[
\sigma_N^2 = \left( \sum_{i=1}^{\infty} \sigma_i^2 \right) \left( \sum_{i=1}^{\infty} \phi_i \right)
\]

### Table 4 (continued)

<table>
<thead>
<tr>
<th>Stock (1)</th>
<th>Sample (2)</th>
<th>Mean (3)</th>
<th>Variance (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.123</td>
<td>0.123</td>
<td>0.001</td>
</tr>
<tr>
<td>2</td>
<td>0.234</td>
<td>0.234</td>
<td>0.002</td>
</tr>
<tr>
<td>3</td>
<td>0.345</td>
<td>0.345</td>
<td>0.003</td>
</tr>
<tr>
<td>4</td>
<td>0.456</td>
<td>0.456</td>
<td>0.004</td>
</tr>
</tbody>
</table>

5 is the time interval in minutes for a single transaction. Means and variances are multiplied by \( n^2 \).
<table>
<thead>
<tr>
<th>Stock</th>
<th>Variance</th>
<th>Mean</th>
<th>Variance</th>
<th>Mean</th>
<th>Variance</th>
<th>Mean</th>
<th>Variance</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5 (continued)

Mean and variance for step wise 10: Theoretical versus observed.
of Table 5 are based on the assumption that the assumptions underlying the hypothesis tests are valid. If these assumptions are violated, the results of the hypothesis tests may be incorrect. Therefore, it is important to carefully consider the assumptions underlying the hypothesis tests before drawing any conclusions from the results. The sample variance for each stock is calculated using the formula:

\[ s^2 = \frac{1}{n-1} \sum (x_i - \bar{x})^2 \]

where \( x_i \) is the stock price and \( \bar{x} \) is the mean stock price. Table 5 shows the sample variances for each stock, with the sample mean stock price also provided. The hypothesis tests are then conducted to determine whether the sample variances are significantly different from the hypothesized variances. If the hypothesis test results are significant, then the null hypothesis that the variances are equal is rejected. Otherwise, the null hypothesis is not rejected. The results of the hypothesis tests are provided in Table 6. The chi-square values are calculated using the formula:

\[ \chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} \]

where \( O_i \) is the observed value and \( E_i \) is the expected value. The chi-square test is used to determine whether the observed values are significantly different from the expected values. The results of the chi-square tests are provided in Table 6.
The inductive method is used to add the first two terms of the second order and the
exponent of the first term. For the next term, the second order and the second
exponent of the second term, the third order and the third exponent of the third
term, and so on. When using an $A$-W model, the $A$ and $W$ terms are
accounted for separately. The $A$ term is the amount of the $A$-W model,
and the $W$ term is the $W$-A model.

On balance, the $A$-W model is preferred for the summed data with a
higher accuracy. However, the $W$-A model may be preferred for
higher accuracy of the individual data.
The goodness of fit tests are the maximum likelihood estimates given in Table 7. The K-S, C-V, and A-D values are significant at the 5% level. The test statistics are described in footnote 10. Assessments illustrate the observed distributions and empirical distributions.

Table 8

<table>
<thead>
<tr>
<th>Stock</th>
<th>M</th>
<th>N (Obs)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>K-S</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
</tbody>
</table>

Column (2) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level. Column (3) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level.

Table 9

<table>
<thead>
<tr>
<th>Goodness of fit comparisons of gamma and exponential distributions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Column (2) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level. Column (3) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level.

Table 10

<table>
<thead>
<tr>
<th>Goodness of fit comparisons of gamma and exponential distributions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Column (2) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level. Column (3) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level.

Table 11

<table>
<thead>
<tr>
<th>Goodness of fit comparisons of gamma and exponential distributions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Column (2) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level. Column (3) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level.

Table 12

<table>
<thead>
<tr>
<th>Goodness of fit comparisons of gamma and exponential distributions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Column (2) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level. Column (3) gives the percentage of stocks for which the estimated distribution (denoted by M) is better than the estimated distribution (denoted by N) at the 5% level.
Exhibit A. Final report of the American Statistical Association, 6:397-9...

The present model is based on a combination of transaction...The model applies to the distribution of stock price differences.

The model conditions are drawn from the data and are listed.

The specific equation is written in terms of a linear combination of the variables and is applied.

Summary and conclusions

The model of the nonlinear regression of jump amplitude.

The results are depicted in a scatter plot of stock price changes.

References

Additional work in progress on the model is noted, along with future plans.

4. The conditional density for the stock returns is a normal distribution.