Venture Capital Shares: An Investment Analysis

by

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ABSTRACT

An investors' objective is to earn a return from savings due to their deferred consumption, compensating the investor for the time, the expected rate of inflation and the uncertainty of the return. Arguably, the equity markets in general offered relative moderate returns over the past number of years. Venture capital investments on the contrary are perceived to offer super returns but also bear very high risk. Given the restricted ability of the equity market to produce super returns, the likelihood to include venture capital in an investment portfolio must be considered. Therefore, when considering supplementing a well diversified portfolio with venture capital equity, one should investigate whether this action potentially increases the portfolio's rate of return significantly, whereas the associated portfolio risk augments insignificantly.

At first this paper examines Portfolio theory under the Markowitz and Sharpe Models. It then moves on to Capital Market theory that extends Portfolio theory and develops a model for pricing all risky assets. Subsequently, scrutinizing investment risk, investment's rates of return and the risk return ratio associated with investments are done.

Upon completion of the literature study, an empirical study was done on the JSE Venture Capital securities to assess the validity of including venture capital in well diversified portfolios. This study has found venture capital securities to be characterised with low or no rates of return. Since there is no correlation between the rate of return of the security and the market return, the beta coefficient as a measure of market related risk for venture capital can not be used. Furthermore, the venture capital low or no rate of return phenomena causes high variability in the coefficient of variation. Consequently, using the coefficient of variation as criteria for comparing venture capital security risk/return relationships with other securities isn't suitable. The results also indicate that venture capital and small capitalisation securities yield similar results. Therefore, when portfolio compilation is done, small capitalisation securities can be exchanged for venture capital securities without increasing the risk or altering the risk/return relationship of the portfolio.

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CHAPTER 1

INTRODUCTION

1.1 Background

According to Sprecher (1975:3), once an economy passes beyond the subsistence level, the majority of transactions are facilitated by the use of financial assets. First it was the development of money as a medium of exchange, followed by credit and the formation of the banking system. These developments marked the beginning of a financial system. The financial system's major function is to facilitate economic growth, but becomes more complex as the economy grows, expanding into a wide range of institutions, markets and instruments. The economic growth is to a large extent dependant on the efficiency of the financial system in gathering and channelling savings into new tangible investments. Therefore, individuals' wealth can be held in the form of tangible assets, financial assets or a combination of both. Tangible assets, fundamental to economic well-being, normally take the form of land, equipment, knowledge etc. Financial assets represent claims against tangible assets and normally take the form of bonds, securities etc.

All financial assets are expected to produce cash flows, and the risk of an asset is judged in terms of the risk of its cash flows. The risk of an asset can be considered in two ways: (1) on a stand-alone basis, where the asset's cash flows are analysed independently or, (2) in a portfolio context, where the cash flows from a number of assets are combined and then the consolidated cash flows are analysed. There is an important difference between stand-alone and portfolio risk. An asset that has a great deal of risk if held in isolation may be much less risky if it is held as part of a larger portfolio. In a portfolio context, an asset is perceived to have firstly diversifiable risk. This risk can be diversified away. Diversifiable risk is thus of little concern to diversified investors. The second risk component is market risk, which reflects the risk caused by general stock market movements. This risk cannot be eliminated by diversification, hence does concern investors. To conclude, only market risk is relevant, diversifiable risk is irrelevant to rational investors because it can be diversified away. An asset with a high degree of relevant (market) risk must provide a relatively high expected return to attract investors (Brigham & Ehrhardt, 2002:200). From an investor's point of view, the fact that a particular share price goes up or down

is not very important, what is important is the rate of return of the portfolio and the portfolio's risk. Brigham and Ehrhardt (2002:212), states that the risk and return of an individual security should be analyzed in terms of how that security affects the risk and return of the portfolios in which it is held. Therefore, when considering supplementing a well diversified portfolio with venture capital equity, one should investigate whether this action potentially increases the portfolio's rate of return significantly, whereas the associated portfolio risk augments insignificantly. It is from this impression that the concept of including venture capital with the potential of above average – to super returns and associated higher risk in an investment structure is conceived.

From the above it can be concluded that the norm is for investors to prefer high returns on investments and to limit the risk taken. Given the "limited ability" of the equity market to produce super returns, the likelihood to include venture capital in an investment portfolio must be considered. However, it is also important to keep in mind that venture capital investments are perceived to be highly risky. The question is: when venture capital is judged on a comparable basis to the general equity market is it significantly riskier?

1.2 Research Statement

Investors are confronted with a choice between risk and return. The general rule is: the more risky the investment the higher the required return. It can be argued, that over the past number of years, the equity markets in general offered relative moderate returns. Venture capital investments on the contrary are perceived to offer super returns but also bear very high risk. It would therefore make sense to consider how venture capital investments can be utilised in a portfolio context to enhance investment returns without bearing too much risk.

1.3 Study Objective

1.3.1 Main Objective

To investigate and determine whether it is feasible to include venture capital in an investment portfolio.

1.3.2 Sub-objective

- To investigate and compare risk levels between selected shares listed on the venture capital and main board of the Johannesburg Securities Exchange (JSE).
- To investigate and compare the required rate of return (growth and dividend) between selected shares listed on the venture capital and main board of the JSE.
- To investigate and compare risk/return ratios of both JSE venture capital and main board listed shares as indicator of investment potential.

1.4 Research Design and Methodology

Research for this dissertation will firstly include a theoretical study of investment theory. Secondly, empirical research will be undertaken to investigate criteria that might assist in the selection of venture capital companies in investment portfolios.

Assessing empirically the risk-return profiles of the listed venture capital shares forms the basis of this investigation. Current venture capital equities listed under the JSE Venture Capital Section as well as equities currently in, and in the process of being transferred to the Alternative Exchange (AltX) will be assessed. Specifically, the performance of investments in venture capital companies will be compared with two benchmarks: (1) the FTSE JSE All Share Index (as the market indicator) and (2) selected JSE shares from the main board.

The analysis will focus on:

1. Risk
    - Stand-a-lone risk (σ_i); the risk an investor would face if he held only the one asset.
    - beta (b); which is relevant for securities held in well diversified portfolios and measures the security's volatility relative to the market.
2. Return

- Expected return ($\hat{k}$); for the purpose of this study, expected rate of return is the geometric average of the historical rates of return for the specified period.
- Required return (k_i); using the SML (Security Market Line) which is part of the CAPM (Capital Asset Pricing Model) to determine each security's required rate of return

3. Risk/Return relationship

- Coefficient of Variation (CV) in order to bring the company's expected return in relation to its risk. Defined as the company's stand-alone risk divided by the company's expected rate of return.
- Determining the Sharpe ratio for both JSE venture capital and main board listed shares as indicator of investment potential. The Sharpe ratio determines to what extent an investment out performs a risk free rate of return and then adjusts the figure with the risk of the investment.

The Wilcoxon signed rank test, a non-parametric test will be used to determine whether a meaningful statistical difference exists between the

- risk associated with venture capital securities and selected securities listed on the JSE main board
- rate of return of the venture capital shares and selected securities listed on the JSE main board
- risk/return relationships of the venture capital shares and selected securities listed on the JSE main board

4. Portfolio selection

- Correlation coefficient (r)

  The correlation coefficient will be used to determine how venture capital correlates to the market, satisfying one of the "when to invest in venture capital" factors. Therefore, if venture capital securities have a substantial negative correlation (< -0.5) to the

market (k_m), investment during bear market conditions would be potentially feasible. The All Share Index will be used as the market return variable (k_m).

- Coefficient of Determination (R^2)

  The Coefficient of Determination reveals how much of the equity's movement can be attributed to movement in the market. When little can be ascribed to market movement, other factors have to be responsible for the equity's movement.

1.5 Limitations

Certain limitations to this study exist:

- Survivorship bias: A high percentage of companies that initially list on the venture capital boards fail, therefore the companies that do appear in this analysis are bias towards successful venture capital investments.

- Lack of trading activity: Analysed venture capital companies were further reduced on grounds of inactivity. Trading inactivity was evidenced both by an absence of prices for months and by consecutive months for which no price change was recorded. Most of the inactivity can be attributed to venture capital companies having low or no dividend rates of return and low or no capital rates of return. These low or no rates of return contribute to low demand and illiquidity. Some of the inactivity can be contributed to the AltX. First, the speculation of an alternative index being listed for venture and development capital securities caused even lower than normal demand for these securities. Secondly, the actual listing of the AltX, with securities subsequently being either transferred or going through a re-evaluation process again caused lower than normal demand.

- Lack of information: In order to give a statistical correct beta (b), at least 60 data points or 60 months data is required. Obviously this is not possible with all of the venture capital shares. Also, the small

capitalization sample only accounted for 9.1% (4/44) of the total sample size, which skews the statistical data analysis towards the better represented samples.

CHAPTER 2

LITERATURE STUDY

2.1 Concept

All business models function within spheres determined by their micro- and macro environments that are dependent on people, technology, systems and networks that are supported by financial-, human resource- and information management platforms. Nel (2003:5) agrees that the financial domain is subdivided into three main categories namely (1) internal reporting (cost management according to Smit (2002)), (2) external reporting (accounting according to Pretorius (2001)) and (3) wealth creation.

Wealth creation is a process of financial management activities that operates in the well known three phases, input, transformation and output. The input phase consists of investment, financing and dividend decisions as well as working cost management. The transformation phase includes the production factors' processes men, material, money, machines and information that generate the output and the associated risk in achieving the required investor return. Bodie et al. (1996:11) divides the created wealth in real and financial assets, real assets being the land, buildings, machines and knowledge that generates income and financial assets being securities and bonds claiming the income from these real assets. Nel (2003:4) maintains that when correctly managed, this wealth creation process will generate wealth in the form of a value component (share price growth) and a cash component (dividend payout). According to Reilly and Brown (2003:5), this wealth creation process links directly with the investors' objective to earn a return (the investors' required rate of return) from savings due to their deferred consumption, compensating them for the time, the expected rate of inflation and the uncertainty of the return. Sprecher (1975:12) expands this objective into one of deriving an optimised portfolio of securities that attempts to maximise the investor's expected return subject to certain risk constraints. Sharpe (1966:119) concurs when explaining that the theory of portfolio analysis is normative; it describes efficient techniques for selecting portfolios on the basis of predictions about the performance of individual securities, using two key elements namely expected return and associated risk. Two individuals, Harry Markowitz and

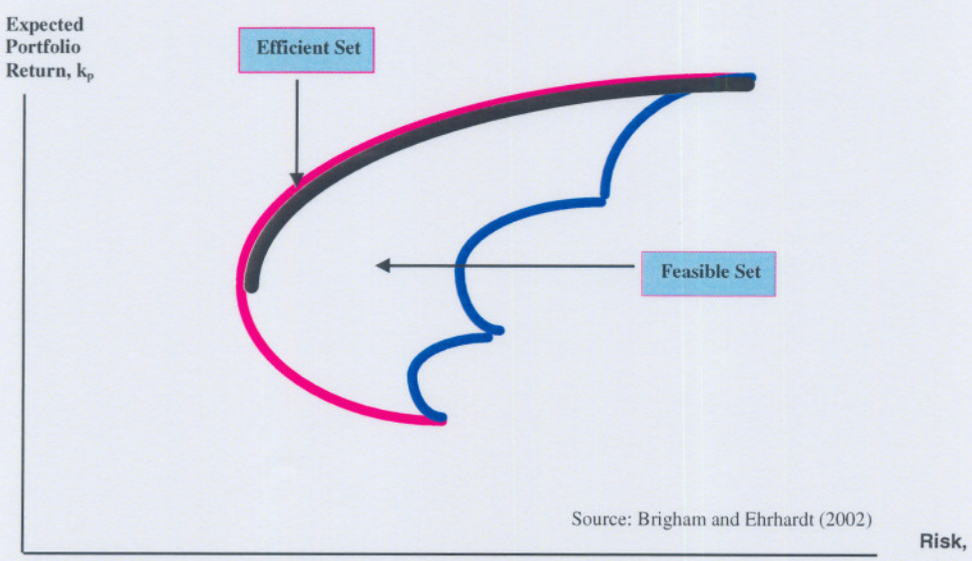
William Sharpe, contributed significantly towards understanding and creating portfolio theory and analysis.

2.2 Portfolio Theory

According to Sharpe (1970:1), portfolio theory is concerned with decisions involving outcomes that cannot be predicted with complete certainty, but acknowledges uncertainty and interrelationships among outcomes.

2.2.1 The Markowitz Model

Markowitz (1991:6) assumes that investors like a high rate of return and want this return to be dependable, stable and not subject to uncertainty. In short, investors dislike risk. This assumption is reinforced and linked with portfolio theory by Williamson (1970:98) who explains that any investor will seek out a portfolio that provides the maximum rate of return for a given level of risk and the minimum level of risk for a given rate of return. Since investors may weight risk and return differently, Markowitz makes no attempt to specify the exact preferences of every individual. The Model simply attempts to find a set of portfolios that provides the maximum rate of return for every possible level of risk and the minimum level of risk for every rate of return. This set of portfolios is referred to as the efficient set.



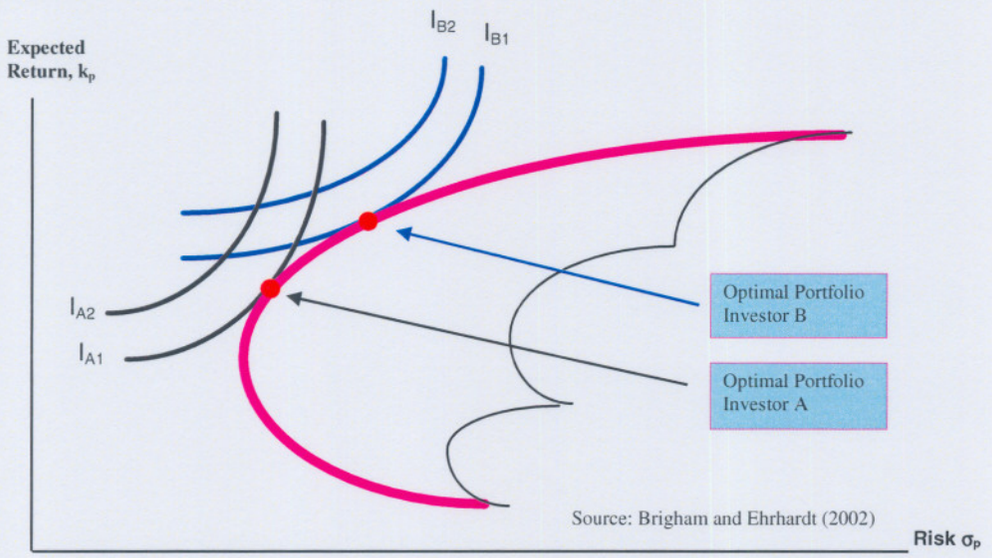
Source: Brigham and Ehrhardt (2002)

Graph 1: Feasible and Efficient Portfolios

The feasible set, as explained by Alexander et al (1993:161) represents the set of all portfolios that could be formed from a group of N securities. An efficient portfolio is one that offers:

- the most return for a given amount of risk, or
- the least risk for a given amount of return.

The collection of efficient portfolios is called the efficient set or efficient frontier. The efficient set is represented by the upper left-hand boundary of the feasible set. Refer to graph 1.



Graph 2: Optimal Portfolio

Indifference curves reflect an investor's attitude towards risk as reflected in his or her risk/return trade-off function. These curves differ among investors because of investors' differences in risk aversion. In graph 2 above, investor I_{B1} is less risk averse than investor I_{A1}, since investor I_{A1} expects a higher return than investor I_{B1} for the same increase in risk. An investor's optimal portfolio is defined by the tangency point between the efficient set and the investor's indifference curve

It is left to the investor to select from this efficient set the single portfolio (optimal portfolio) which best serves the investor's needs. Since the Markowitz model assumes that investors dislike risk and akin to high rates of return, venture capital securities might be the tool that alters the efficient set's boundaries to the liking of investors. Venture capital securities are perceived to have above-average to super returns at risk levels normally to high for most investors. The risk can be balanced through correctly

correlating and weighting the venture capital portion of the portfolio to ensure the portfolio is still well balanced, but able to respond correctly in both the up and down cycle of the venture capital market. It can be argued that combined in well diversified portfolios, venture capital securities could change the efficient set's boundaries to such an extent that it would increase the expected rate of return for a given level of risk. This would allow investors to find a portfolio that best fits their indifference curves.

2.2.2 The Sharpe Model

Williamson (1970:111) states that Markowitz himself suggested that it might be possible to use the relationship between each security's rate of return and the rate of return on some market index, as a substitute for the full co-variance matrix. Sharpe pursued this approach to develop the single index-model. The Sharpe model, also known as the Market model, not only asks less data but also differs in the kind of data required for every security. The Markowitz model solicits for a forecast of the rate of return on each security while the Sharpe model requests a conditional forecast. Alexander et al. (1993:842) describes it as a simple linear model that expresses the relationship between the return on a security and the return on a market index. The Sharpe model demands a characteristic line. This line is a specification, not of how well a specific security will do, but on how the performance of the security relates to the performance of the market.

The Sharpe model: $r_i = \alpha_i + \beta_i r_I + \varepsilon_i$

Where: r_i = return on security i for some given period,

r_I = return on market index I for the same period,

α_i = intercept term,

β_i = slope term, and

ε_i = random error term.

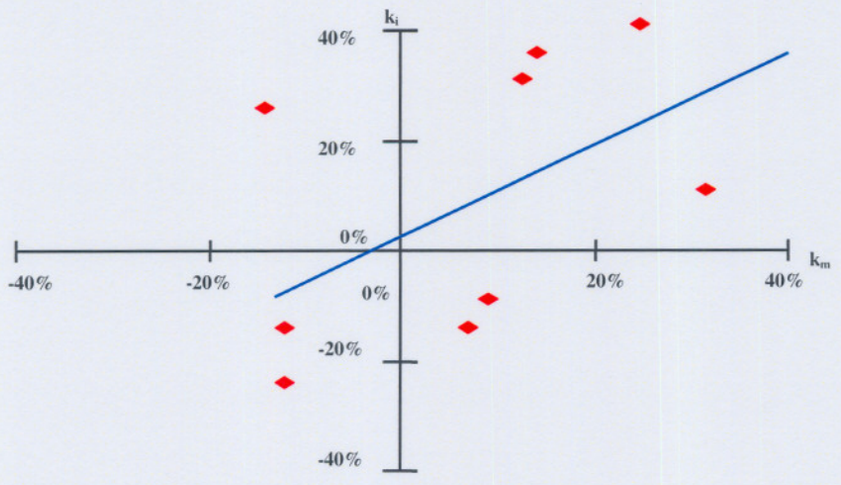
The Sharpe model would therefore be able to indicate how venture capital equities relate to the market. This performance information would in-turn enable investors to structure portfolios accordingly, providing an opportunity to validate venture capital security inclusion in well diversified portfolios.

2.3 Capital Market Theory

Capital market theory extends portfolio theory and develops a model for pricing all risky assets. The major factor, according to Reilly and Brown (2003:240), that allowed portfolio theory to develop into capital market theory, is the concept of a risk-free asset. A risk-free asset can be defined as an asset with no variance in the rate of return it would provide the risk-free rate of return (RFR). The rates of return of risk-free assets will have no correlation with the rates of return of other risky assets. This no correlation assumption allows for a generalized theory of capital asset pricing under conditions of uncertainty from the Markowitz portfolio theory to be derived. The final product, the Capital Asset Pricing Model (CAPM), will allow the determination of the required rate of return for any risky asset. The CAPM model implies, according to Alexander et al. (1993:217) that the expected return of an asset will be related to a measure of risk for that asset known as the beta coefficient.

2.3.1 Beta (b)

Alexander et al. (1993:833) defines the beta coefficient as a relative measure of the sensitivity of an asset's return to changes in the return of the market portfolio. The diagram below illustrates the concept of beta. The regression line measures the relative volatility of a share's returns (k_i) against market returns (k_m). The slope of the regression line is defined as the share's beta coefficient (b). The beta of a portfolio is a weighted average of the betas of the individual securities in the portfolio.



Source: Brigham and Ehrhardt (2002)

Graph 3: Calculating Beta (b)

Brigham and Ehrhardt (2002:279) indicate that this slope is found by regressing historical returns on the share versus historical returns on the market. Analysts typically use five years' of monthly returns to establish the regression line. Sixty points are used to establish enough data points along the time series to determine any trends and exclude highly random data points.

The regression line data is also used to find the correlation coefficient and the coefficient of determination.

2.3.2 Correlation Coefficient (r)

Brigham and Ehrhardt (2002:213) indicate the tendency of two variables to move together is called correlation. The correlation coefficient (r) measures this tendency and is calculated using the formula below.

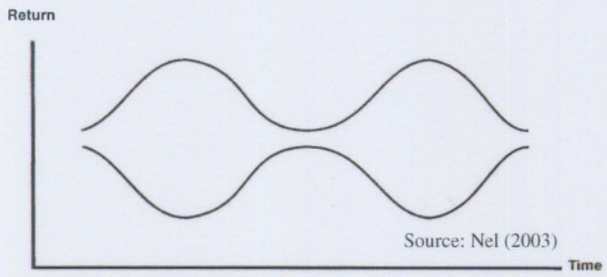
$$r = \frac{\sum xy - \left(\sum x \sum y\right)/n}{\sqrt{\sum x^2 - \left(\sum x\right)^2/n}\sqrt{\sum y^2 - \left(\sum y\right)^2/n}}$$

The correlation coefficient (r) can range from +1.0 (perfect positive correlation), denoting that the two variables move up and down in perfect synchronization, to -1.0

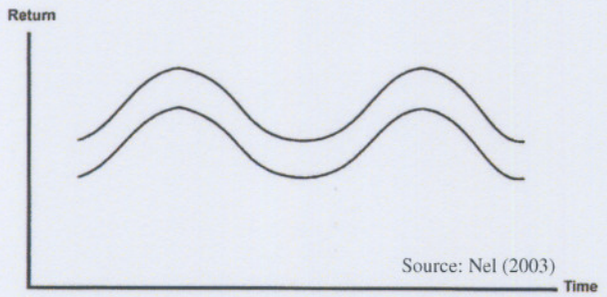
(perfect negative correlation), denoting that the variables always move in exactly opposite directions. Refer to graphs 4 and 5 below. Interpreting correlation coefficient values between the two extreme values, 1 and -1, is done using Cohen's (1977:75-108) guidelines:

- 0.5 or < -0.5 high effect
- 0.3 or < -0.3 medium effect
- 0.1 or < -0.1 small effect

A correlation coefficient of zero indicates that the two variables are not related to each other and that changes in the one variable are independent of changes in the other. Thus, diversification does nothing to reduce the risk if the portfolio consists of perfectly positively correlated shares.



Graph 4: The Flow of Returns of a Perfectly Negative Correlated (r=-1) Investments



Graph 5: The Flow of Returns of Perfectly Positive Correlated (r=1) Investments

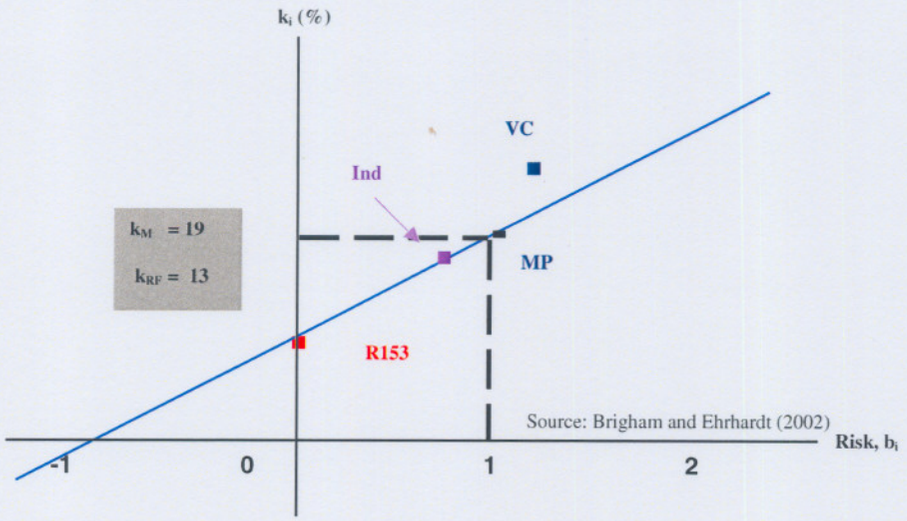
2.3.3 Coefficient of Determination (R^2)

The coefficient of determination is simply the square of the correlation coefficient. It is explained at the hand of the example of $R^2 = 0.6$. A coefficient of determination of 0.6 implies that 60% of the securities movement can be attributed to movement within the market. Low coefficient of determination values are indicative of securities that are influenced to a greater extend by factors directly influencing the bottom line of that specific company, rather than general market conditions. These securities tend to fall within the venture capital domain.

The Capital Asset Pricing Model provides a tool to evaluate both single securities and combined securities or so called portfolios. Therefore, venture capital equities can be assessed as individual securities and as part of a portfolio, were the portfolio with and without venture capital can be appraised.

2.3.4 Security Market Line (SML)

Alexander et al. (1993:847) indicate that the SML is derived from the CAPM and is a linear relationship between the required return of a security and the risk level of that specific security, as measured by the security's beta (or, the security's covariance with the market portfolio). Beta and not stand-alone risk is used, because beta reflects risk after taking diversification benefits into account.



Graph 6: SML and Examples of Investment Alternatives

The SML in the above graph indicates the SML for the market portfolio (MP) which has a beta of one. The y-axis cut-off is the 13% return (average for the past 10 years) of the R153 bond that represents the risk-free rate of return. Move the SML so that the line pivots on the 13% y-axis cut-off and the top point of the line is fixed on the point denoted as "VC". It can therefore be argued that the line obtained can be viewed as a typical SML for venture capital equity. The indicated point "VC" also point out that venture capital securities require a higher rate of return due to their inherent higher risk (b). The venture capital SML furthermore draws attention to the reality that for any beta (b), the required rate of return would be higher for a venture capital security than for any other investment alternative.

The SML is therefore used to calculate the required rate of return for individual shares. The return required for any security i, is equal to the risk-free rate plus the market risk premium times the security's beta:

$$k_i = k_{RF} + (RP_m)b_i$$

k_i = required rate of return for security i

k_{RF} = risk free rate

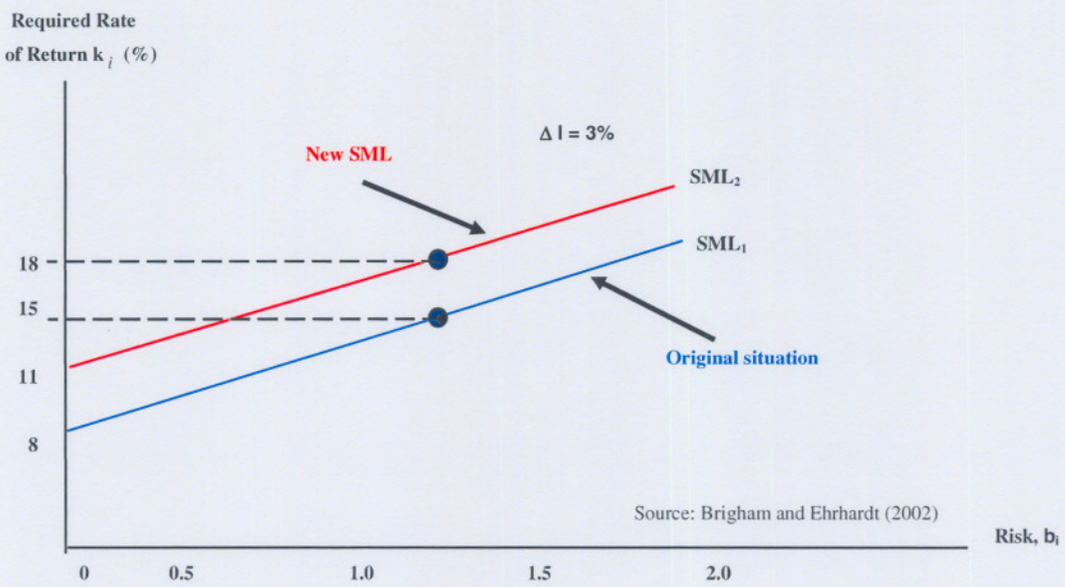
$RP_m = (k_m - k_{RF})$ = market risk premium = return on market – risk-free rate

Brigham and Ehrhardt 2002:237 states that for a share to be in equilibrium the shares' expected and required rate of return should be equal, but a number of things can happen that causes the required rate of return to deviate from the expected return: (1) the risk-free rate can change because of changes in either real rates or anticipated inflation, (2) a shares beta can change, and (3) investors' aversion to risk can change. Inflation has a direct impact on all levels of risk and moves the SML vertical and parallel in relation to the original SML on the required rate of return axes. In graph 7 below, a change of 3% in the inflation rate has occurred. The SML equation changes due to the inflation premium being added.

$$k_i = k_{RF} + I_p + (RP_m)b_i$$

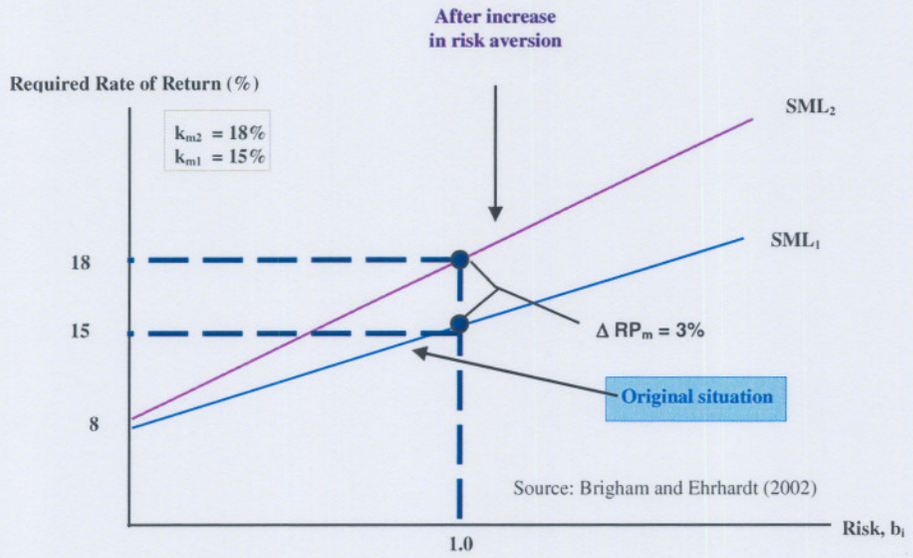
I_p = Inflation premium

The inflation premium caused the required rate of return to increase with 3%, from 15% to 18% for the same beta of 1.25. Therefore, inflation increases all securities' required rate of return, irrespective of their risk aversion.



Graph 7: Impact of Inflation Change on SML

Changes in the market risk premium (RP_m) will change the slope of the SML, changing the risk/required return ratio. In graph 8 below, the market risk premium rises with 3%, causing k_m to rise from k_{m1}=15% to k_{m2}=18%. The returns on other risky assets also rise, and the effect of this shift in risk aversion is more articulated on riskier equities. For example, the required return on a security with $b_i = 0.25$ increases by only 1.75 percentage points, from 8 to 9.75 percent, whereas that on a security with $b_i = 1.25$ increases by 2.5 percentage points, from 18 to 20.5 percent. From literature in general, it seems that developing economies react more severely than relative stable developed economies to changes within the macro- and micro environment. It can therefore be speculated that developing economies in general have a more volatile market risk premium. Due to the mentioned volatility and other environmental factors, developing nations' market risk premiums are higher than those found with the more established developed nations. Consequently, it can be argued that investing in venture capital securities in developing nations would require a higher rate of return than in developed economies.



Graph 8: Impact of Risk Aversion Change

2.3.5 Capital Market Line (CML)

The Capital Market Line (CML) is all linear combinations of the risk-free asset and portfolio M, refer to graph 9. Portfolio M is an efficient portfolio, a well diversified portfolio. Hence, all the unsystematic risk from portfolio M has been diversified and all that remains is market risk. Therefore, unlike individual securities, the risk of an efficient portfolio is measured by its standard deviation (σ_p). Portfolios below the CML, which defines the new efficiency set, are inferior.

$$CML: \hat{k}_p = k_{RF} + \left(\frac{\hat{k}_M - k_{RF}}{\sigma_M} \right) \sigma_p$$

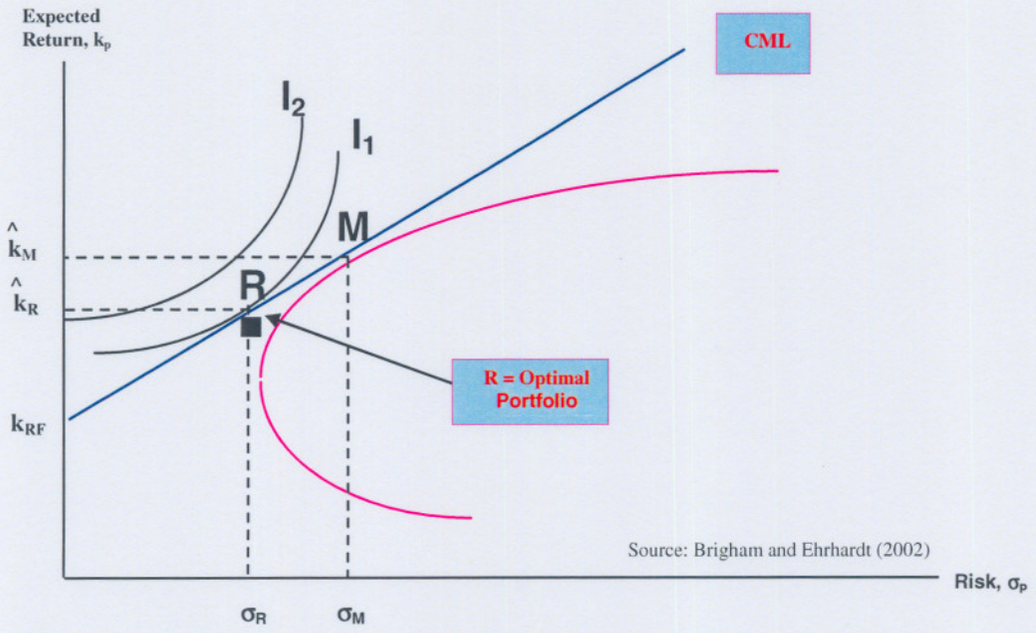
$\hat{k}_p$: The expected rate of return on an efficient portfolio

k_{RF}: Riskless rate

$\hat{k}_M$: The expected return on the market portfolio of risky securities

σ_p: Portfolio standard deviation

σ_M: Standard deviation of returns on the market portfolio



Graph 9: Optimal Portfolio

According to portfolio theory the optimal portfolio for any investor can be found at the point of tangency between the CML and the investor's indifference curve. When venture capital is included in investors' portfolios, investors' indifference curves can adjust to such a degree that it would increase the expected rate of return for a given risk. It is here, where investors' indifference curves meet the CML that venture capital could add value within the selected portfolio. In the discussion of the Markowitz Model, this study proposed that portfolios which include venture capital can alter the efficient set's boundaries to such an extent that it would increase the expected rate of return for a given level of risk. The mentioned proposition can be explained with the CML equation. Venture capital inclusion in the market portfolio potentially increases the market portfolio's expected rate of return. The mentioned increase might lead to proportionally increasing the numerator in relation to the denominator in the slope term of the CML equation. When the portfolio's standard deviation for a specific return also increases due to the inclusion of venture capital, the expected rate of return on an efficient portfolio raises.

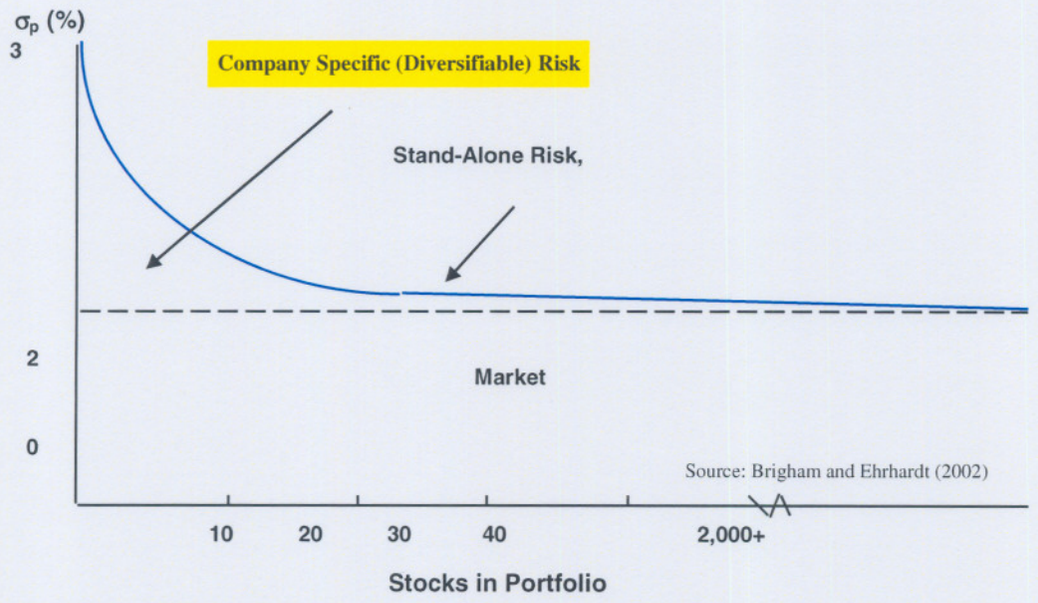
2.4 Risk

Nel (2003:7) indicates that both the internal and external environments create risk for businesses. Internal environment refers to production factors and external factors to political, regulatory and technological factors. Brigham and Ehrhardt (2002) explain investment risk as the probability of earning a return less than that expected. Therefore, the greater the chances of an investment return far below the expected return, the greater the risk. The risk of an asset's cash flow, according to Brigham and Ehrhardt (2002:237), can be considered on a stand-alone basis or in a portfolio context, where the investment is combined with other assets and its risk is reduced through diversification.

2.4.1 Stand-alone Risk

Brigham and Ehrhardt (2002:202) define stand-alone risk as the risk an investor would face if only one asset was held.

Stand-alone risk = Market risk + Diversifiable risk



Graph 10: Stand-alone Risk

According to communication by Nel (2003) market risk is that part of a security's stand-alone risk that cannot be eliminated through diversification. The market risk of

the share therefore contributes to the overall risk of a portfolio. The market risk of a share is measured by the share's beta coefficient. Beta as previously explained measures the volatility of the share's return relative to the return of the market. Firm-specific, or diversifiable, risk is that part of a security's stand-alone risk that can be eliminated through diversification.

2.4.2 Portfolio Risk

Nel (2003:100) defines a portfolio as an investment in a combination of income-generating assets with the purpose of earning a satisfactory return for a given level of risk. Risk in portfolio context is measured by σ_p. According to Brigham and Ehrhardt 2002:213 cognisance should be taken and warn that the risk of a portfolio, σ_p, is generally not equal to the weighted average of the standard deviations of the individual assets in the portfolio. The portfolio's risk will be smaller than the weighted average of the assets' standard deviations. Portfolio risk, according to Metrick (2001:5), depends on how much a specific asset class tends to change the volatility of the portfolio.

2.4.3 Portfolio Selection Criteria

Evans (2004:14) established that wealthy investors use quantitative and qualitative risk metrics to measure risk. The most popular measures are Standard Deviation (48%), Peer Comparison (43%), Sharpe Ratio (38%), Beta (34%) and other categories (27%). Every investor has a different level of risk aversion. These investors perceive their risk aversion to be high 33% (5/15), medium 13% (2/15) and low 53% (8/15). It is clear that more than half of these wealthy investors perceive investment as a low risk action. Consequently, these investors use methods to offset bad against good outcomes and in the process maintain a relative low exposure to risk. According to Reid *et al* (1997:37) the general perception, 71% (10/14), amongst the investors are to avoid single technology involvements. In this context the computer software industry, gambling and property development and building were regarded as too risky. Another perceived method according to Reid *et* al (1997:38), although not well known, to ensure low risk exposure is the number of investees investing in the same portfolio. The investors indicated the average portfolio to have 28 investees, the model size had 10 to 15 and the size range was from 1 to 200. Reid *et al* (1997:38) upholds a widely

used rule of portfolio composition to hold no more than 10% of the portfolio in any one company.

2.4.4 Venture Capital Risk Profile

Metrick (2001:5) argues to justify an investment with a beta of 1; it should have the same expected return as the whole stock market. Investments with betas higher or lower should therefore have expected returns higher or lower than the market, respectively. It has previously been indicated that it is difficult to measure the beta of a venture capital investment. John Cochrane (sited by Metrick, 2001:3) tried to solve this problem by focusing on the value of venture-backed companies at the time of the initial public offering, of acquisition, or when business stops. Results from Cochrane's research suggest that venture investments have a beta close to 1. The latter indicates that venture capital investments bear the same amount of risk as an investment in a market portfolio. This is a rather unexpected finding since the perception is that venture capital investments generate high returns and are subject to high levels of risk. From a risk point of view this evidence supports inclusion of venture capital in investment portfolios. However, another study of venture capital portfolios by Venture Economics reported, according to Bhide (2001:1), that about 7% of venture capital investments accounted for more than 60% of the portfolio's profits, while a third of the investments resulted in partial or total loss. This study emphasizes the volatility of venture capital. Subsequently, the allocation of investments to venture capital should depend on the investor's risk-reward trade-off.

2.5 Rate of Return

In order to evaluate investment performance, a criterion applicable to all financial results has to be used as a measuring instrument. Brigham and Ehrhardt (2002) affirm this measuring instrument to be investment rate of return. Rates of return can be expressed in monetary or percentage terms.

2.5.1 Expected Rate of Return

Before an investor invests in a security, the expected return on the security or portfolio of securities is compared to the expected returns on other investment instruments. The expected rate of return is determined from historical data.

$$\text{Expected return} = \hat{k} = \sum k_i P_i$$

k_i = rate of return obtained from historical data, assuming this figure is an accurate indication of the security's rate of return, and thus of the security's expected rate of return

P_i = probability of achieving the rate of return

$$\text{Expected portfolio return} = \hat{k}_p = \sum_{i=1}^{n} w_i \hat{k}_i \qquad (\hat{k}_p \text{ is a weighted average})$$

w_i = security's weight within the portfolio

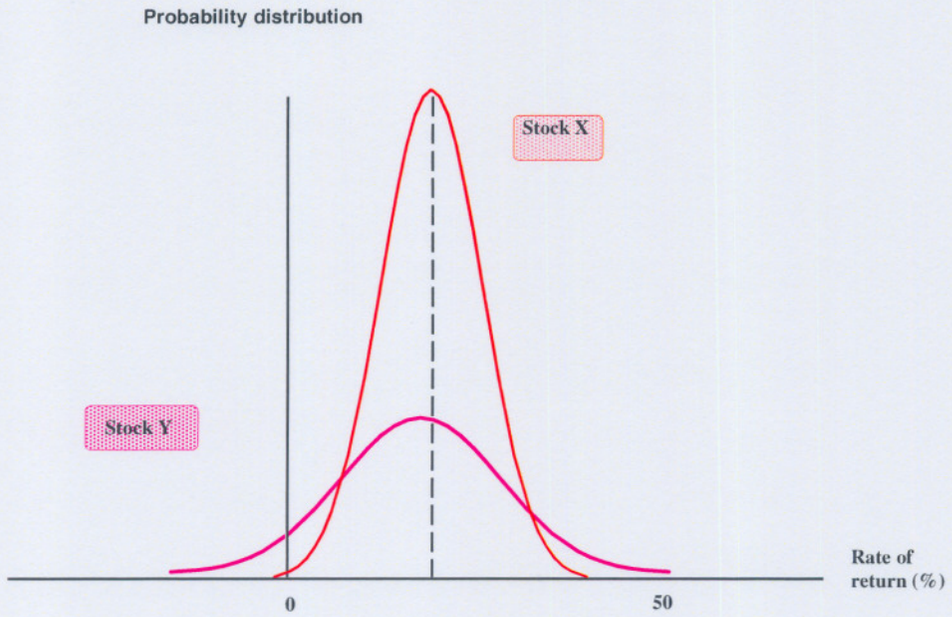
$\hat{k}_i$ = security's expected return

It is important to understand that each expected rate of return has an associated risk. Applying basic statistics to the rates of return will yield the related risk in achieving the specific rate of return for each security. The standard deviation is this basic statistic.

$$\text{Standard Deviation} = \sigma = \sqrt{\sum_{i=1}^{n} (k_i - \hat{k})^2 P_i}$$

The standard deviation provides an idea of how far above or below the expected return the actual value is likely to be.

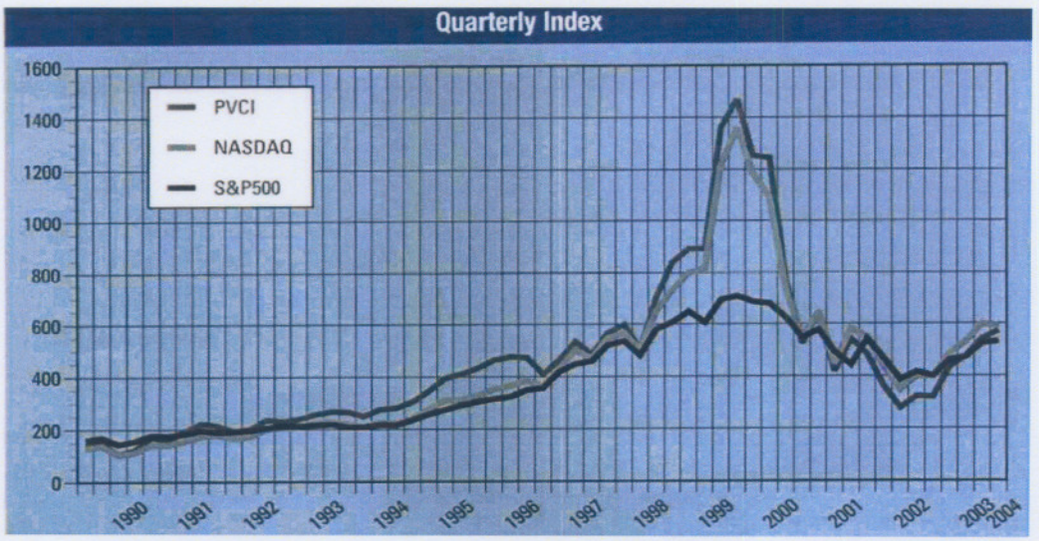
The smaller the standard deviation of returns (σ), the tighter the probability distribution of expected future returns, the lower the risk of a given investment (Brigham and Ehrhardt 2002:205).



Graph 11: Continuous Probability Distribution Source: Brigham and Ehrhardt (2002)

2.5.2 Venture Capital Return

The Thomson Venture Economics Post-Venture Capital Index (PVCI) is a market-valued index that measures the performance of U.S. public stocks of companies that have received venture capital or buyout financing (Anon., 2004:57).



Graph 12: PVCI **Source:** Thomson Venture Economics (2004)

The initial index of 100 points in 1986 has grown to its current 550 points (2004). It had an average return of 8.7% per annum over the past 10 years compared to the S&P's 9.9% and the NASDAQ's and DOW's 11.2%. Metrick (2001:5) also considered venture capital when evaluating one dollar invested either in venture capital or in the Nasdaq Composite Index from January 1981 to September 2000. This comparison indicates that one dollar would have grown to $18.15 if invested in the Nasdaq Composite Index and $68.37 if invested in the "average" venture capital fund, implying annualized returns of 15.9% and 24% respectively. These figures indicate that although the venture capital index under performs against other indexes, venture capital funds do outperform the average market. These venture capital funds consist of structured portfolios where venture capital securities that improve the portfolios risk/return relationship has been included.

PUBLIC MARKET INDEX COMPARISON					
INDEX	**INDEX Value**	**1 DAY % rtn**	**YTD % rtn**	**1 Yr % rtn**	**3 Yr % rtn**
PVCI	549.25	1.4	1.2	30.1	-5.0
S&P	1132.01	0.6	1.8	17.5	-3.4
NASD	1995.6	1.3	-0.4	25.0	-1.8
DOW	10380.4	0.4	-0.7	17.3	-1.7

Public Market Index Comparison as of 6/15/04

PVCI stands for Post Venture Capital Index. Onetime VC-backed companies remain on the PVCI for 10 years after going public, after which they are dropped. They are also dropped if acquired, merged or delisted.

Table 1: U.S. Public Market Index Comparison **Source:** Thomson Venture Economics (2004)

The above table indicates the most recent Public Market Index Comparison. Looking at the percentage returns, it is clear that the venture capital market yield has outperformed all the other indexes in the short term, but under performed all other indexes over the medium term. A well balanced portfolio that include venture capital might give an investor access to this above average short-term return, while the less risky securities in the portfolio protect the portfolio's return over the medium term. It could be argued that if a venture capital portfolio is actively managed, the return over the long term should yield a higher net return.

The table below illustrates the PVCI industry breakdown. The PVCI's current market capitalization is $511 billion, 42.2% attributed to the 152 companies in the computer software and services industry, 12.5% to the 95 communication companies and 7.1% to the 76 companies in the Medical/Health industry.

INDUSTRY BREAKDOWN					
INDUSTRY	**# OF COMPANIES INDEXED**	**MARKET VALUE ($M) 4/30/04**	**MARKET VALUE ($M) 5/31/04**	**DIFFERENCE ($M)**	**PERCENT GAIN/LOSS**
Computer Software and Services	152	$186,736.00	$207,993.0	$21,257.0	11.4
Communications	95	$55,084.4	$58,579.7	$3,495.3	6.3
Semiconductors and other Electronics	53	$29,408.5	$31,858.1	$2,449.6	8.3
Computer Hardware	22	$15,427.7	$16,245.2	$817.5	5.3
Manufacturing	5	$12,561.5	$13,063.7	$502.2	4
Finance, Insurance, Real Estate	23	$23,201.0	$23,672.8	$471.8	2
Industrial Products	17	$12,570.0	$12,969.9	$399.9	3.2
Energy	13	$9,117.6	$9,358.5	$240.9	2.6
Other	2	$3,425.4	$3,526.9	$101.5	3
Agriculture, Forestry, Fishing, Mining	1	$1,659.9	$1,746.8	$86.9	5.2
Construction	1	$56.0	$51.0	$(5.0)	-8.9
Utilities	1	$836.6	$825.0	$(11.6)	-1.4
Business Services	9	$10,520.9	$10,195.0	$(325.9)	-3.1
Transportation	7	$8,533.8	$8,139.4	$(394.4)	-4.6
Consumer Related	44	$26,834.5	$26,253.6	$(580.9)	-2.2
Medical/Health	76	$34,416.6	$33,707.1	$(709.5)	-2.1
Biotechnology	62	$25,607.5	$24,560.1	$(1,047.4)	-4.1
Total	**583**	**$455,997.9**	**$482,745.8**	**$26,747.9**	**5.9**

Table 2: PVCI Industry Breakdown **Source:** Thomson Venture Economics (2004)

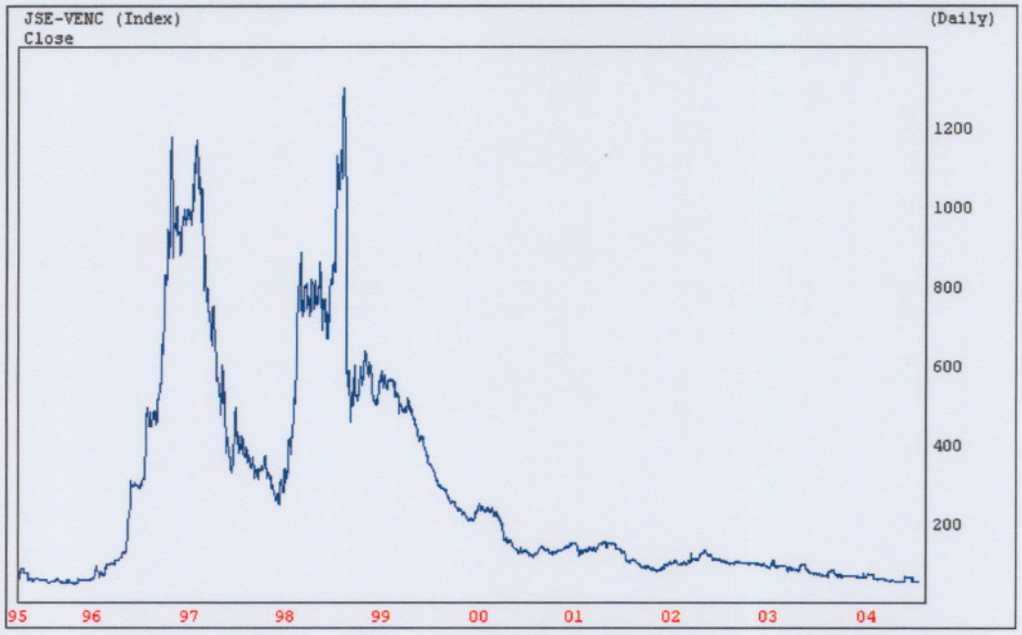
Since its inception, 6 companies have been removed from the index. Table 3 below indicates the 6 companies as well as the reason for the each delisting. It is clear that all 6 companies are still doing business and therefore investments in these companies are still active.

COMPANIES TAKEN OFF PVCI			
TICKER	**NAME**	**FIRST INDEX DATE**	**NOTES**
WUS	Vivus Inc.	4/6/94	Deleted due to age
MTIC	MTI Technology Corp.	4/6/94	Deleted due to age
ACCL	Accelrys Inc.	12/5/95	Name changed to Accelrys Inc.
MLWL	Mail-Well Inc.	9/21/95	Changed name to Cenveo
DTHK	DigitalThink Inc.	2/24/00	Acquired by Convergys Corp.
NPTT	NPTest Holding Corp.	12/11/03	

Table 3: Companies Taken Off the PVCI **Source:** Thomson Venture Economics (2004)

The PVCI listed 19 new companies in July 2004 alone. Martin and Petty (1983:401) suggest that these new firm creations and the increasing rate of new firm creations serves as sufficient proof that investors believe that venture capital companies offer an attractive risk-return opportunity. However, Rotch, Huntsman and Hoban (as quoted by Martin and Petty, 1983:402) cautioned investment in venture capital securities due to the risk involved. Evidence of the risks involved in venture capital investing were cited to be the lengthy holding periods required for venture capital investments to produce super returns and the small percentage of profitable venture capital investments available.

Closer to home, Muller (2004) affirmed the creation of the JSE Venture Capital Index (VCI) in March 95. It under performed the Overall Index substantially during the 7 years to end Sept 2002. This compares favorably with the data observed from the US PVCI, which also under performed to all the other indexes over the medium term. It could be argued that the same investment guidelines hold true for portfolio selection in South Africa as previously suggested for US market investors. However, the VCI was oscillating just below 110 points in 2002 before it started its slide to its current below 60 points position. This does not reflect the US venture capital turn-around indicated in table 1. It might be that the South African venture capital market lags the US venture capital market and that a turnaround in the South African venture capital market is on the horizon.



Graph 13: JSE Venture Capital Index **Source:** Muller (2004)

Well-known shares such as Rareco plummeted rapidly during the period (2002) and shares such as TRADEK, VIKING, GILBOA and CCI were deleted from this index. The JSE announced (24/5/04) that it intends to close its Venture Capital and Development Capital Markets ("VCM and DCM"). As a result, the companies ("the affected companies") listed on the VCM and DCM which have been unable to transfer to the main board or which have not successfully applied for a listing on the Alternative Exchange ("AltX") may face the possibility of suspension and ultimately, delisting of their securities from the JSE. AltX is the JSE's new market for small to medium and growing companies that wish to list on the JSE and is regulated in terms of section 21 of the JSE Listings Requirements.

Meyer (2003) explains that the AltX will not be a new stock exchange as such, but a division of the JSE modelled loosely on the Alternative Investment Market in London. AltX will target black economic empowerment and junior mining companies. The Department of Trade and Industry is involved in the AltX initiative because it dovetails with the government's efforts to support small- and medium-sized companies and promote black economic empowerment. The project will replace the ineffective venture capital and development capital markets. AltX will have lower listing and annual fees and less stringent listing requirements than the JSE. Companies

with pre-tax profits of R8 million or less and a minimum capital of R2 million can apply for an AltX listing. Other important requirements for an AltX listing are that: all directors must attend an induction programme; the company must have a designated adviser and a qualified financial director; there must be at least 100 public shareholders; and company announcements must be published on the Stock Exchange News Service and the AltX website.

2.6 Risk Return Ratio

2.6.1 Coefficient of Variation (CV)

Brigham and Ehrhardt (2002) indicate that the Coefficient of Variation (CV) is an alternative measure to assess stand-alone risk. CV measures a company's expected return in relation to its risk.

$$\text{Coefficient of Variation} = CV = \frac{\sigma}{\hat{k}}$$

σ = stand-alone risk of company

$\hat{k}$ = expected return of company

The coefficient of variation is used to compare the risk return relationship of venture capital securities to that of other JSE main board listed companies. A standard deviation equal to zero would signal no risk in achieving the expected rate of return. However, for the purpose of this study a coefficient of variation equal to 1 was defined as the risk indicator benchmark. Hence, the security's CV's will be evaluated against this benchmark.

2.6.2 Sharpe Ratio

The Sharpe Ratio, according to Lo (2002:36) is the excess expected return of an investment in relation to its return volatility or standard deviation. The Sharpe ratio is calculated as follows:

$$\text{Sharpe Ratio} = \frac{\text{Risk Premium}\left(\text{Share Rate of Return} - \text{Market Rate of Return}\right)}{\text{Standard Deviation of the return on the investment}}$$

Levitan (2004:9) further explains the Sharpe Ratio as a statistic that determines to what extent an investment out performs a risk-free rate of return. The ratio then adjusts the figure with the risk of the investment. The risk measurement must be the standard deviation of the return on the investment. In practise, the Sharpe ratio for the market will be subtracted from the Sharpe ratio of the security investment.

$$SR = SR_i - SR_m$$

The Sharpe ratio obtained, brings the company's risk in relation to the market.

In order to determine the security's Sharpe ratio (SR_i), the risk-free rate for investment would be subtracted from the expected return of the security investment. The risk measure used will be the stand-alone risk (standard deviation) for that specific security.

$$SR_i = \frac{k_i - k_{RF}}{\sigma_i}$$

The market's Sharpe ratio will be calculated by subtracting the risk-free rate for investment from the market's expected return. The risk measure used will be the stand-alone risk (standard deviation) for the market.

$$SR_m = \frac{k_m - k_{RF}}{\sigma_m}$$

In a South African environment, the R153 government bond will be used as the risk-free rate for investment and the FTSE JSE All Share Index for the expected return of the market.

Bringing this ratio in context with other ratios mentioned within, Reisman and Zohar (2004:38) reports that the S&P 500 index had a Sharpe ratio of 0.27 over the last 50 years. This ratio implies that the S&P 500 index out performed risk-free investments with 27%.

2.6.3 Security Market Line (SML)

The third method used in this paper to obtain risk return relationships is the SML or CAPM approach. As previously illustrated the SML gives a linear relationship between the required rate of return and risk of a security. Risk in the SML equation is

expressed as the security's beta coefficient (or, the security's covariance with the market portfolio).

In terms of this study the following three methods will be used to express the risk return relationship:

- CV – bringing a company's expected return in relation to its own risk (company's standard deviation).
- Sharpe ratio – bringing the company's excess expected return in relation to the market
- Security Market Line – bringing the company's expected return in relation to its own risk (company's beta).

2.7 Closure

A challenge that continues to face the private equity industry is to "convince pension fund trustees that private equity represents a suitable asset class for long-term sustainable growth" (KPMG & SAVCA, 2001). Goodman (as quoted by Fellers, 2001:1) said the risk profile of a small, new partnership investing in early-stage companies is too high for most institutions. Individuals, he said, filter their investments differently, deciding intuitively without running risk analysis on spreadsheets. These individuals promote according to Pienaar (1985:16), five basic evaluation characteristics (1) market attractiveness, (2) product differentiation, (3) managerial capabilities, (4) resistance to environmental threats and (5) cash-out potential. According to Ryan (2001:18), the ratio of venture capital and private equity industry as a percentage of GDP in South Africa is 4.2%. This figure is comparatively higher than those of countries with mature private equity markets. The ratio is 2.3% in the United Kingdom, 1.3% in the Netherlands and 1.2% in Sweden. The figure for the U.S.A. is 4.9%, which is close to the 4.2% figure for South Africa. However, Pension and Endowment funds made up only 28% of the sources of third party funds in the South African private equity market in 2000, compared to a figure of 47% in the United States (KPMG & SAVCA, 2001). Phipps (2001:2) argues that the main reason why local pension fund trustees do not invest in private equity is the belief or perception that the exceeded returns are not in line with the associated higher risk. Therefore, improving perceptions with supporting studies on venture capital

investments as a fundamental part of any investment portfolio will go some way in convincing pension fund trustees to invest in this asset class.

CHAPTER 3

EMPIRICAL STUDY

3.1 Description of Research Sample

Forty-four FTSE JSE listed companies were used in this analysis, consisting of nineteen venture capital, fourteen large capitalization, seven medium capitalization and four small capitalization companies. The nineteen venture capital companies included five AltX listed companies. These AltX companies were included because: (1) the AltX companies represent a significant portion of listed venture capital companies and (2) the AltX companies were listed under the venture capital index on the FTSE JSE main board at least until October 2003 before the transferring process from the FTSE JSE to the AltX started.

3.2 Analysis

All data was compiled from the McGregor BFA database, using Microstation as the interface tool. Calculations were done on a weekly basis, compounded monthly (four weekly). Week 28, 1995 is the earliest data point available on the FTSE JSE Index, and was thus used as the base to work all other data sets from.

In most cases, at least 5 years (60 points) were used. Due to unbundling, new listings and other reasons, some equities could not yield 60 points. These equities were included in the calculations; they are however clearly indicated.

Equity return calculations were done without taking dividends into account, since the data calculations were done on a weekly basis, compounded monthly and dividend payouts register semi-annually or annually.

Please refer to Appendix B for all factors used in the company specific calculations. Appendix B also graphically illustrates each company's trading history and historical rates of return.

3.3 Results

The results are given in monthly and not annual format, since most of the data obtained from McGregor BFA was already in this format. The risk-free rate of return (R153) and the market risk premium (FTSE JSE Index) was calculated using 109 data points from week 28, 1995 to week 28, 2004. The geometric average for both the R153 and the FTSE JSE Index was then obtained. The R153 and the FTSE JSE Index results were converted to monthly figures by simply dividing with 12.

3.3.1 Ratio's

As indicated earlier, one of the objectives of this study is to investigate and compare risk/return ratios of both JSE venture capital and main board listed shares as indicator of investment potential. The Coefficient of Variation and the Sharpe ratio pertaining to each investigated company is shown in Appendix A.

3.3.2 Venture Capital's Correlation to the Market

The correlation coefficient (r) will be used to determine how venture capital correlates to the market. Using Cohen's guidelines for interpretation of a correlation coefficient, venture capital equities have a small (< 0.3) correlation with the market. All the investigated company's correlation coefficients are displayed in Appendix A.

3.3.3 Statistical Data Analysis and Discussion

The Statistics Consultation Service from the North-West University used the UNIVARIATE-procedure from the SAS programme (SAS Institute, Inc, 1999) to do the statistical analysis.

The data obtained from BFA McGregor and the resulting analysed data clearly indicated volatility in certain categories and therefore the median was used instead of the mean. The median of beta, the coefficient of determination and all the other factors of venture capital was deducted from all the non-venture capital data before any analysis was done. This was done because the venture capital data is a complete data set, where as all the other grouped data sets are test samples and the venture capital data was thus used to compare all other data with.

The Shapiro-Wilk test for normality indicated that there are both non-normal distributions (p-value < 0.05) and normal distributions (p-value > 0.05) present.

Therefore, one could use parametric tests like the Student-t test for data that has a normal distribution and non-parametric tests similar to the Wilcoxon signed rank test for data that has a non-normal distribution. It was however decided that for the purpose of this study and to ensure consistency, that all data will be assumed to have non-normal distribution. Hence, all data was analysed using the Wilcoxon signed rank test.

3.3.3.1 Risk Analysis

Tables 4-7 indicates summarized results produced from the risk data analysis.

Does a difference exist between (significant on a 5% level of significance)		Wilcoxon signed rank test (p-value)	Answer
1. the risk (σ_i - stand-alone risk) associated with	Venture Capital and Main Board listed equities	p = 0.0001	Yes
	Venture Capital and Top 40 equities	p = 0.0002	Yes
	Venture Capital and Mid Cap equities	p = 0.3750	No
	Venture and Small Cap equities	p = 0.1250	No
2. the risk (b – beta) associated with	Venture Capital and Main Board listed equities	p = 0.0001	Yes
	Venture Capital and Top 40 equities	p = 0.0007	Yes
	Venture Capital and Mid Cap equities	p = 0.2969	No
	Venture and Small Cap equities	p = 0.2500	No

Table 4: Summary of Analysed Risk Data

The results indicate that for both stand-alone risk and the beta coefficient, only a significant difference exists between venture capital and those equities that reside within the Top 40 Index.

Does a difference exist between (significant on a 5% level of significance)		Wilcoxon signed rank test (p-value)	Answer
3. the expected rate of return of	Venture Capital and Main Board listed equities	p = 0.0001	Yes
	Venture Capital and Top 40 equities	p = 0.0002	Yes
	Venture Capital and Mid Cap equities	p = 0.0156	Yes
	Venture and Small Cap equities	p = 0.1250	No
4. the required rate of return (k_i) of	Venture Capital and Main Board listed equities	p = 0.0001	Yes
	Venture Capital and Top 40 equities	p = 0.0005	Yes
	Venture Capital and Mid Cap equities	p = 0.2500	No
	Venture and Small Cap equities	p = 0.2500	No

Table 5: Summary of Analysed Rate of Return Data

There is no significant difference between the expected return of venture capital and small cap equities. The required rate of return calculated using the SML from the CAPM yields only a significant difference between venture capital and top 40 equities.

Does a difference exist between (significant on a 5% level of significance)		Wilcoxon signed rank test (p-value)	Answer
5. the risk/return relationship (CV) of	Venture Capital and Main Board listed equities	p = 0.0708	No
	Venture Capital and Top 40 equities	p = 0.1677	No
	Venture Capital and Mid Cap equities	p = 0.8125	No
	Venture and Small Cap equities	p = 0.625	No
6. the risk/return	Venture Capital and	p = 0.0001	Yes

relationship (Sharpe ratio) of	Main Board listed equities		
	Venture Capital and Top 40 equities	p = 0.0046	Yes
	Venture Capital and Mid Cap equities	p = 0.0156	Yes
	Venture and Small Cap equities	p = 0.3750	No

Table 6: Summary of Analysed Risk/Return Relationship Data

The two measures used to evaluate the risk/return relationship provided two totally different sets of results. This might be attributed to the high variability found within the CV data. When the expected rate of return of equities is brought in relation with their stand-alone risk, there is no significant difference between venture capital and any main board equity. However, when the company's risk is brought in relation to the market, the Sharpe ratio's of only venture capital and small cap equities have no significant difference.

Does a difference exist between (significant on a 5% level of significance)		Wilcoxon signed rank test (p-value)	Answer
7. the coefficient of determination of	Venture Capital and Main Board listed equities	p = 0.0001	Yes
	Venture Capital and Top 40 equities	p = 0.0002	Yes
	Venture Capital and Mid Cap equities	p = 0.0313	Yes
	Venture and Small Cap equities	p = 0.1250	No

Table 7: Summary of Analysed Coefficient of Determination Data

A significant difference exists between the coefficient of determination of venture capital and that of top 40 and medium cap equities.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Conclusions were made from the information collected on a JSE representative population sample (44), taken all venture capital equities (complete data set) into account. The fact that portfolio composition is done, in most situations, without including venture capital based on the general theory that the risk/return relationship is more unattractive than any other JSE main board grouping was proven to be inaccurate. It was found that:

1. As a single equity therefore based on stand-alone risk as measured by standard deviation, there are no significant differences in the risk levels between medium cap, small cap and venture capital equities. The top 40 stand-alone difference in medians (-0.238) indicates that the top 40 equities have a significant lower stand-alone risk than the venture capital equities. The actual returns of the top 40 securities would therefore be closer to the expected returns of the top 40 securities than the actual returns of venture capital securities would be to the expected returns of the venture capital securities.

2. There is no significant difference between the beta coefficients of venture capital, medium cap and small cap equities. Since the beta of a portfolio is a weighted average of the betas of the individual securities in the portfolio, venture capital equities included in a well diversified market portfolio would exhibit the same influence on the portfolio's beta as any other medium- or small cap equity of the same portfolio weight. The top 40 beta difference in medians (0.434) denotes that the top 40 equities have a significant higher beta coefficient than the venture capital equities, indicating that it is less risky to invest in venture capital equities than in the top 40 equities. According to investment and portfolio theory the latter makes no sense. Investigation revealed that data was used that did not meet the efficient theory criteria in that negative and very low correlation coefficient values were not removed from the sample data. Possible explanations for these low correlated results are that firstly venture capital companies have by virtue of their

entrepreneurial status no or very little surplus cash. This results in no or very small dividends being paid that consequently lead to low or no dividend yields. Secondly, lack of trading activity attributable to low demand and illiquidity most probably contribute to low capital returns. Low or no dividend yields plus low or no capital returns ensures low or no total rates of return. The latter positions the venture capital equity regression line on or close to the horizontal market return (k_m) line, the x-axis. Refer to graph 3. A single transaction can move the regression line in any direction. Thus, no correlation between the rate of return of the security and the market return signifies that one can't use the beta coefficient as a measure of market related risk for venture capital.

3. There is no significant difference between the expected rate of return of venture capital and small cap equities. The expected rate of return difference in medians of both the top 40 (0.035) and medium cap (0.031) equities denote that venture capital equities have a significant lower expected rate of return than the top 40 and medium cap equities.

4. There is no significant difference between the required rate return of venture capital, medium cap and small cap equities. However, the required rate of return difference in medians (0.006) for top 40 equities implies that the required rate of return for venture capital and top 40 equities does significantly diverge. Therefore, without looking at risk/return calculations and taking the above risk results into account, it is clear that venture capital and small cap equities have a similar risk/return profile.

5. There is no significant difference between the CV's of main board and venture capital equities. Once again, as explained in 2 above, the low or no rate of return characterised by venture capital in principle, but also by one or two other main board equities, explains the high variability throughout the sample range in these values.

6. The Sharpe ratio's for top 40 and medium cap equities differ significantly from venture capital Sharpe ratios. Conversely, the Sharpe ratio difference in medians for top 40 (0.106) and medium cap (0.08) equities point towards a significant higher Sharpe ratio than that obtained for venture capital and consequently better investment opportunity.

7. No significant difference exists between the coefficient of determination of venture capital and that of small capitalization equities. Using this information and looking at the coefficient of determination results for venture capital in the data analysis summary (see Appendix A), it is derived that <10% of venture capital equity movement can be attributed to movement in the market. More than ninety percent of the time other factors cause venture capital equities to respond.

In conclusion, low or no rates of return create unanticipated constraints. Since there is no correlation between the rate of return of the security and the market return, the beta coefficient as a measure of market related risk for venture capital can't be used. In addition, the low or no rate of return characteristic of venture capital causes high variability in the coefficient of variation. Consequently, using the coefficient of variation as criteria for comparing venture capital security risk/return relationships with other securities isn't suitable.

The results also indicate that venture capital and small capitalization securities yield similar results. Therefore, when portfolio compilation is done, small capitalization securities can be exchanged for venture capital securities without increasing the risk or altering the risk/return relationship of the portfolio.

4.2 Recommendations for Further Research

Future research might target both exploratory and confirmatory paths. Exploratory paths might include a repeat of this study with a larger number of small capitalization securities included in the analysed data. A repeat study could also include comparing venture capital to a combined medium and small capitalization security selection.

As previously indicated, the beta coefficient isn't suitable to measure market related risk for venture capital. Therefore, further exploratory research should attempt to find another method to measure market related risk for venture capital. Auxiliary criteria for comparing venture capital security risk/return relationships with other securities should also be investigated since high variability in the coefficient of variation seems inevitable.

An additional exploratory aim might be to extend the research to include other forms of investment alternatives such as property and bonds.

The confirmatory research could have the same bearing as each of the exploratory studies indicated above. Each confirmatory study would probable advocate different objectives, but combined results would more accurately indicate the viability of including venture capital in well diversified portfolios.

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Appendices

Appendix A

Summarized Analysis Results Pertaining to Each Company

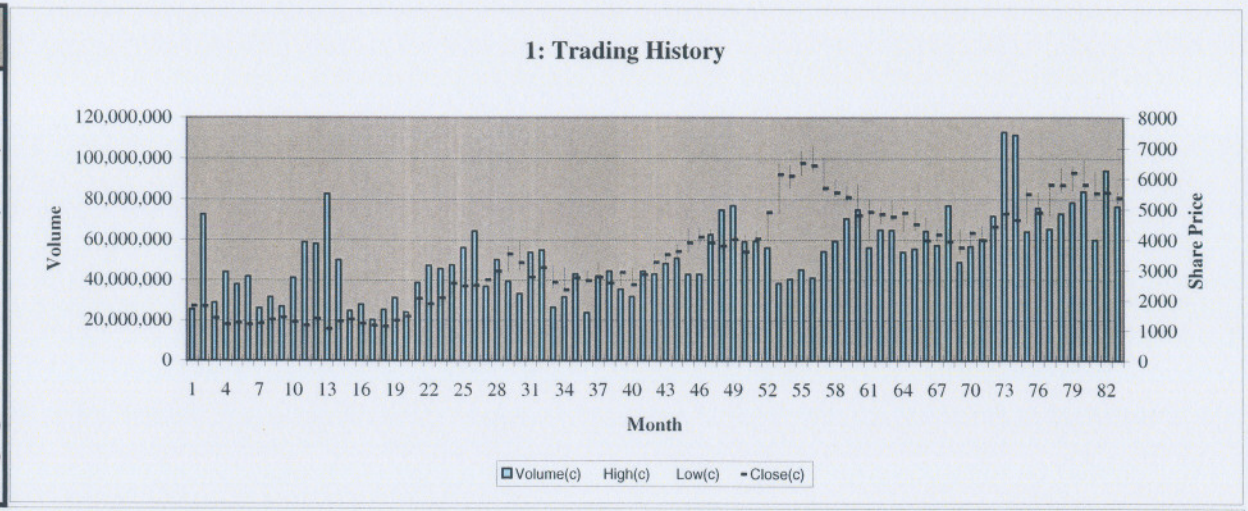
Analysis Results								
Company	Stand-alone Risk	Beta	Expected Return	Correlation Coefficient	Coefficient of Determination	Coefficient of Variation	Sharpe Ratio	Required Rate of Return
1	0.104	1.119	0.013	0.698	0.487	7.900	0.101	0.016
2	0.089	0.834	0.012	0.557	0.310	7.516	0.081	0.015
3	0.076	0.842	0.004	0.656	0.431	19.237	-0.021	0.015
4	0.118	1.180	0.009	0.593	0.352	12.664	0.057	0.017
5	0.106	0.964	0.016	0.543	0.295	6.587	0.119	0.016
6	0.077	0.807	-0.001	0.531	0.282	-58.591	-0.113	0.014
7	0.045	0.314	0.007	0.322	0.104	6.855	0.090	0.010
8	0.064	0.605	0.003	0.475	0.225	18.799	-0.068	0.013
9	0.090	1.046	0.005	0.692	0.479	16.816	0.009	0.016
11	0.148	1.170	0.008	0.471	0.222	18.238	0.052	0.017
12	0.117	0.921	0.015	0.468	0.219	7.961	0.103	0.016
13	0.095	0.921	-0.002	0.543	0.333	-45.282	-0.066	0.016
14	0.120	0.908	0.007	0.474	0.224	18.232	0.047	0.015
15	5.689	-2.485	-0.001	-0.026	0.001	-8,796.884	0.069	-0.001
16	0.082	0.658	0.004	0.481	0.231	20.843	-0.016	0.014
17	0.448	1.148	0.024	0.152	0.023	19.007	0.099	0.017
18	0.171	1.542	0.003	0.539	0.290	53.344	0.026	0.019
19	0.101	0.764	0.000	0.449	0.201	204.715	-0.032	0.015
20	0.093	0.674	0.000	0.472	0.223	-196.855	-0.043	0.014
21	0.208	2.028	0.013	0.581	0.337	16.475	0.079	0.021
22	0.056	0.221	0.018	0.189	0.036	3.152	0.199	0.010
23	0.126	1.034	-0.011	0.413	0.170	-11.009	-0.137	0.015
24	0.180	1.470	-0.007	0.487	0.237	-26.850	-0.027	0.018
25	0.166	1.153	0.006	0.453	0.205	26.918	0.049	0.016
26	0.449	0.897	-0.005	0.101	0.010	-95.494	-0.001	0.014
27	0.206	0.755	-0.056	0.230	0.053	-3.653	-0.246	0.014
28	0.269	1.236	-0.021	0.288	0.083	-12.790	-0.039	0.016
29	0.278	-0.516	-0.022	-0.093	0.009	-12.635	-0.083	0.007
30	0.341	1.478	-0.070	0.209	0.044	-4.874	-0.186	0.017
31	0.469	0.007	-0.020	0.001		-23.992	-0.031	0.010
32	0.269	0.622	-0.112	0.092	0.008	-3.660	-0.232	0.008
33	0.284	-0.391	-0.078	-0.086	0.007	-3.660	-0.232	0.008
34	0.396	0.108	-0.028	0.014	0.050	-14.221	-0.063	0.010
35	0.442	1.341	-0.039	0.181	0.033	-11.480	-0.041	0.018
36	0.333	-0.150	-0.032	-0.023	0.001	-10.505	-0.093	0.009
37	0.265	-0.342	-0.004	-0.077	0.006	-71.479	0.016	0.009
38	0.162	0.559	-0.021	0.216	0.047	-7.749	-0.115	0.013
39	0.652	-0.141	-0.061	-0.014	0.000	-10.631	-0.032	0.010
40	0.293	0.487	-0.027	0.108	0.012	-10.724	-0.054	0.013
41	2.339	-2.604	-0.029	-0.070	0.005	-80.846	0.061	-0.003
42	0.160	-0.316	-0.002	-0.085	0.007	-75.037	0.224	0.007
43	0.356	1.574	-0.052	0.277	0.077	-6.897	-0.096	0.018
44	0.480	0.712	-0.017	0.088	0.008	-28.358	0.013	0.015



Appendix B

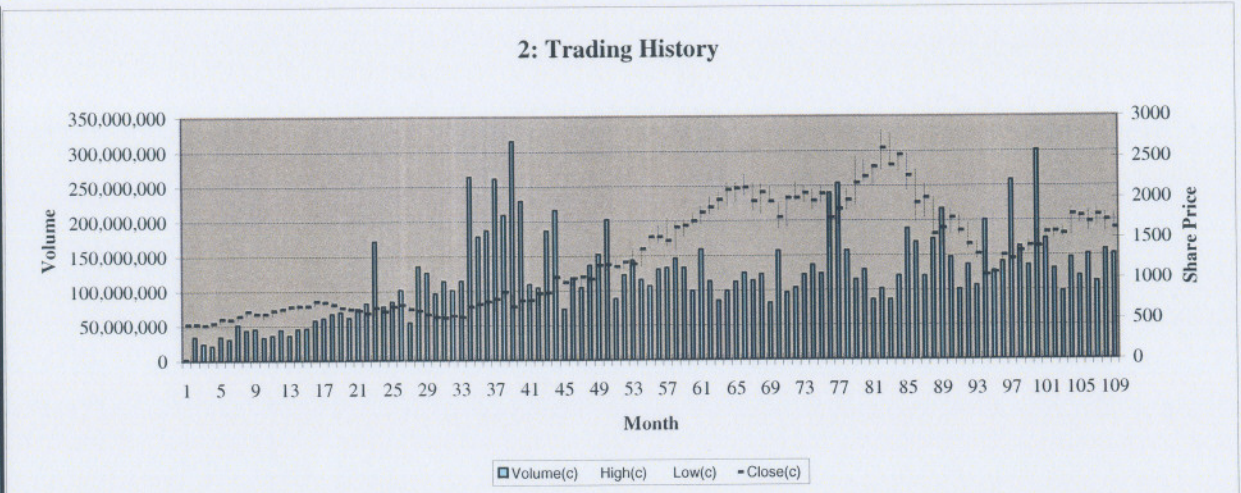
Company Specific Analysis

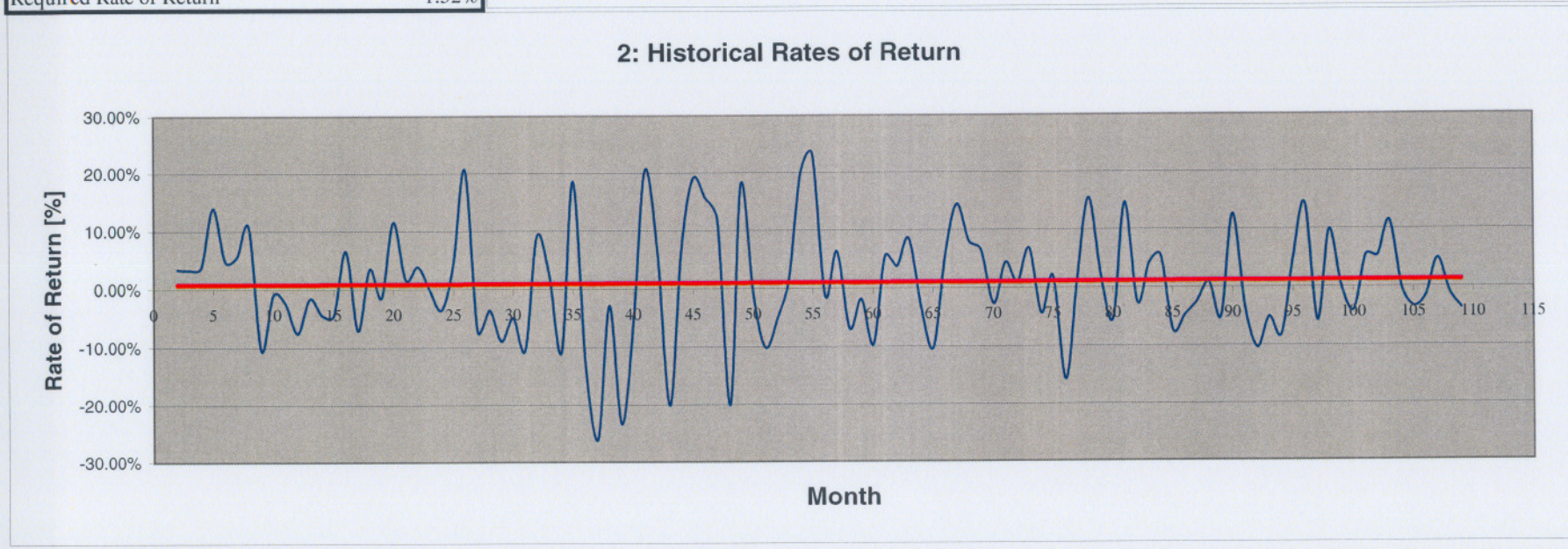
Company 1: Summary Calculation period: Week 28, 1997 to Week 28, 2004	
Historical Return	
Geometric Average	1.32%
Standard Deviation	0.1044
Market Standard Deviation	0.0651
Beta	1.1194
Risk Free Rate of Return	1.05%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.56%
Correlation Coefficient	0.6981
Coefficient of Determination	0.487
Coefficient of Variation	7.90
Sharpe Ratio	0.10
Required Rate of Return	1.61%



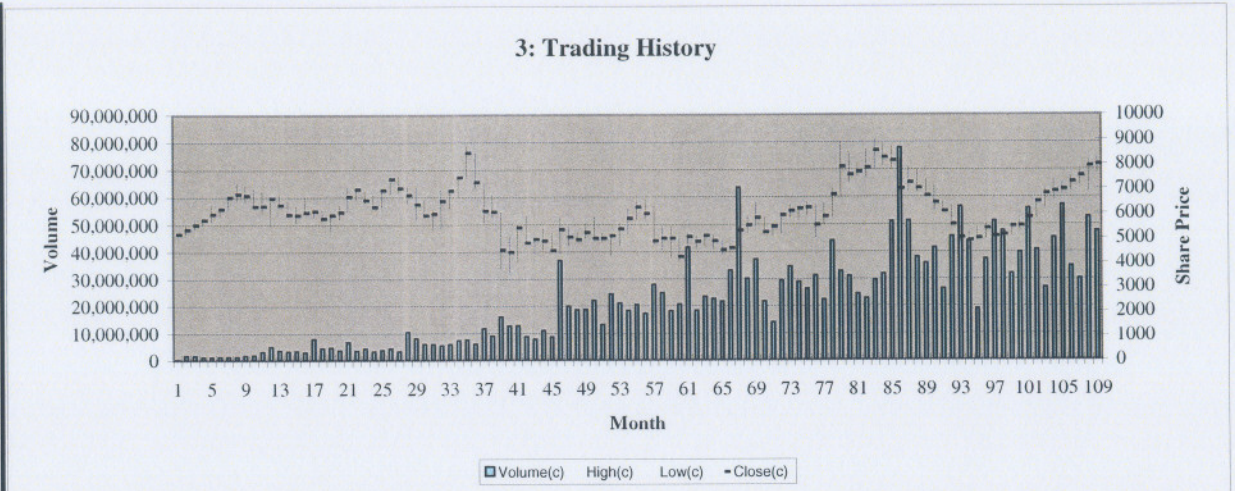


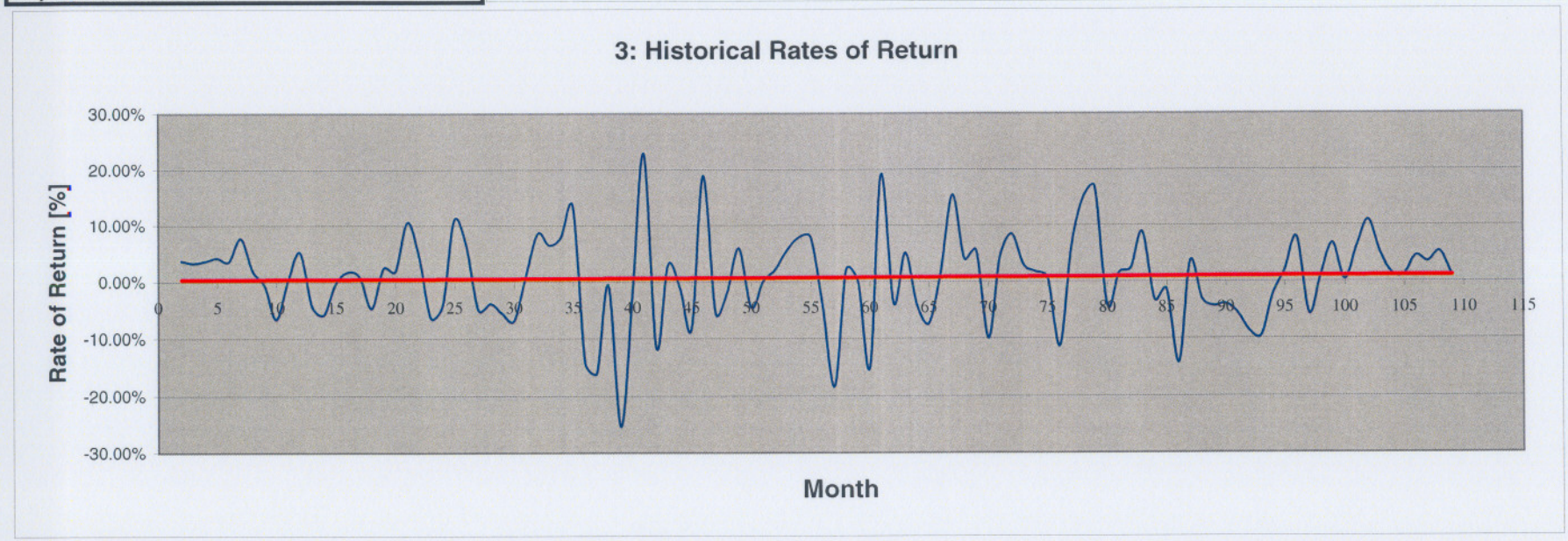
Company 2: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	1.19%
Standard Deviation	0.0892
Market Standard Deviation	0.0595
Beta	0.8343
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.5569
Coefficient of Determination	0.310
Coefficient of Variation	7.52
Sharpe Ratio	0.08
Required Rate of Return	1.52%



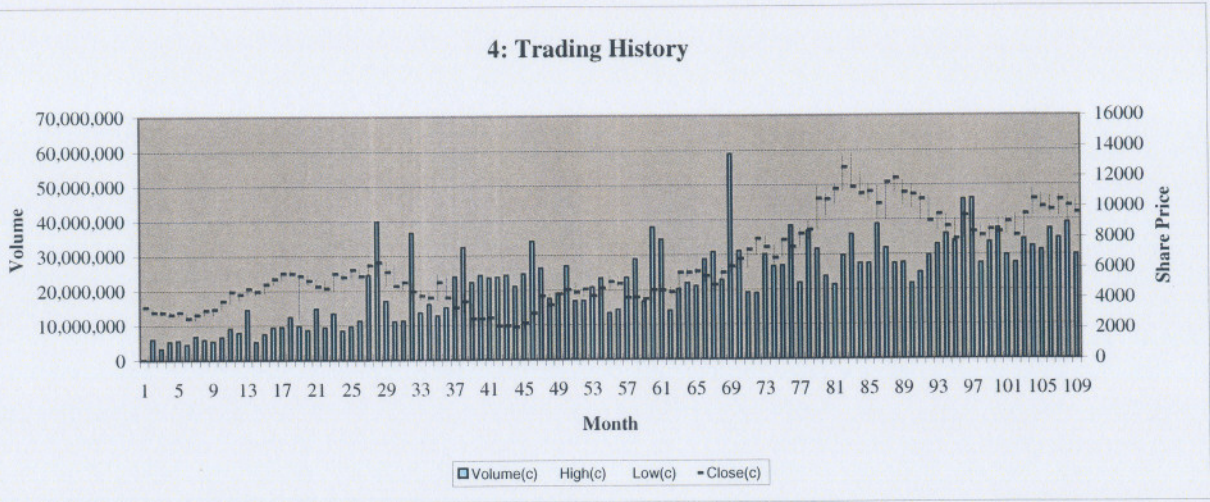


Company 3: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	0.40%
Standard Deviation	0.0764
Market Standard Deviation	0.0595
Beta	0.842
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.6562
Coefficient of Determination	0.431
Coefficient of Variation	19.24
Sharpe Ratio	-0.02
Required Rate of Return	1.52%



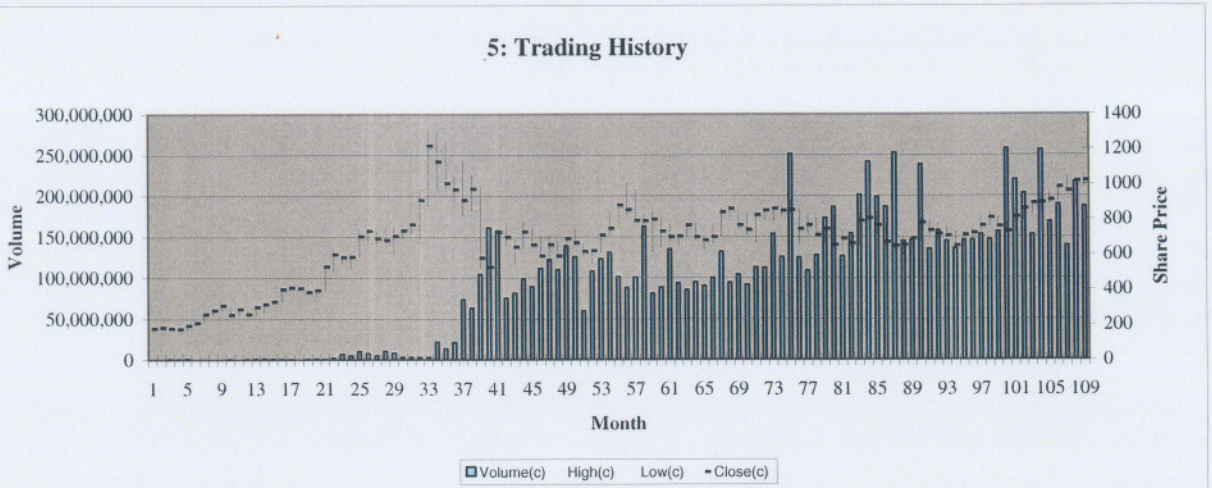


Company 4: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	0.93%
Standard Deviation	0.1184
Market Standard Deviation	0.0595
Beta	1.1801
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.5934
Coefficient of Determination	0.352
Coefficient of Variation	12.66
Sharpe Ratio	0.06
Required Rate of Return	1.69%



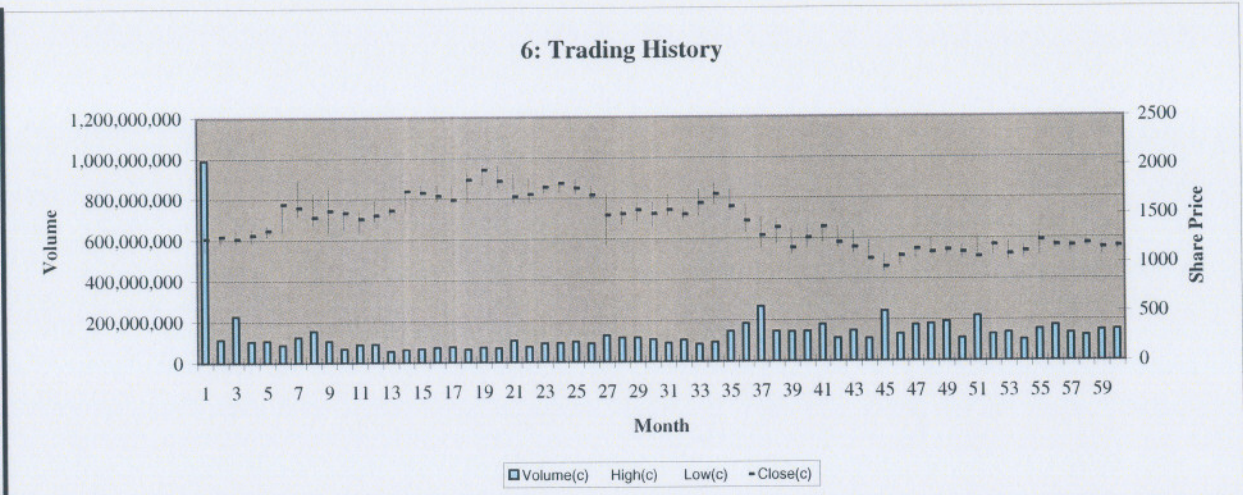


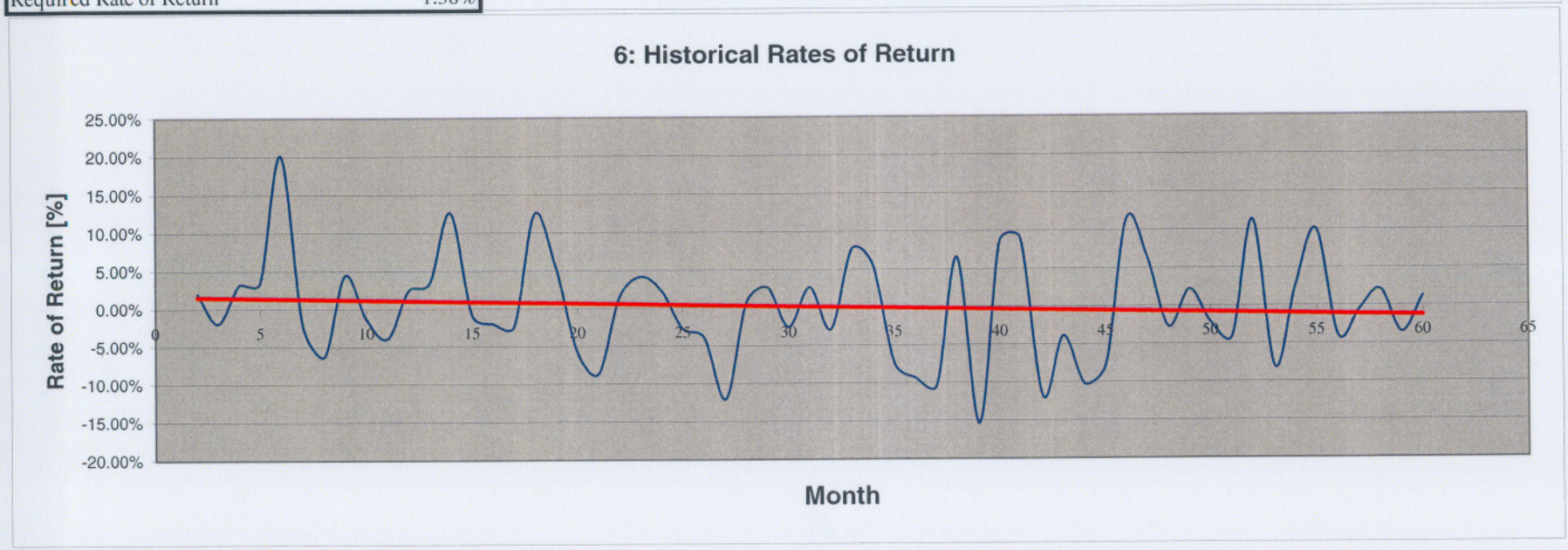
Company 5: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	1.60%
Standard Deviation	0.1056
Market Standard Deviation	0.0595
Beta	0.9635
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.5434
Coefficient of Determination	0.295
Coefficient of Variation	6.59
Sharpe Ratio	0.12
Required Rate of Return	1.58%



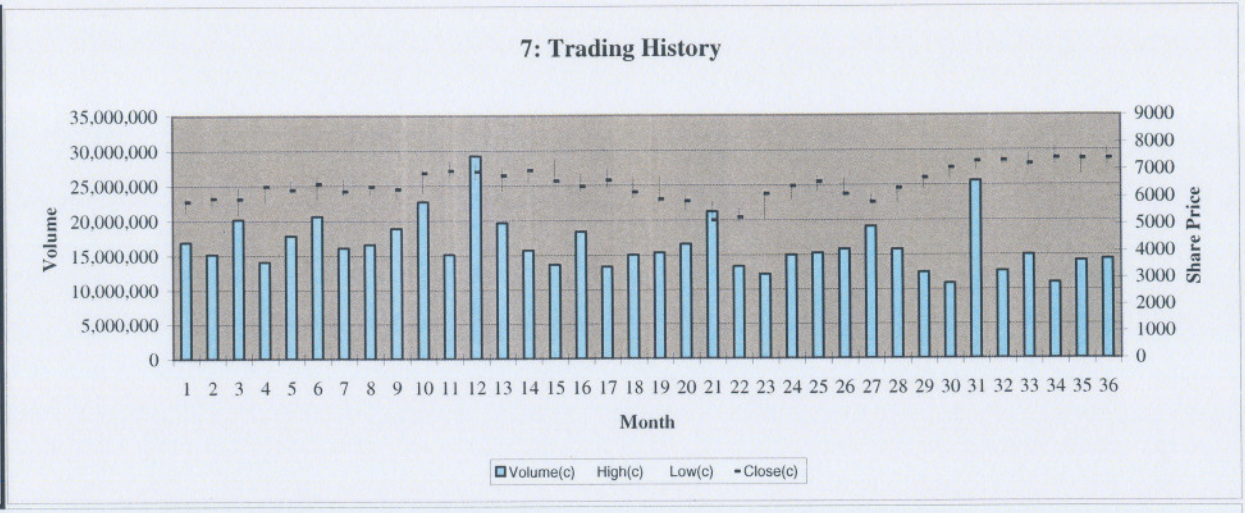


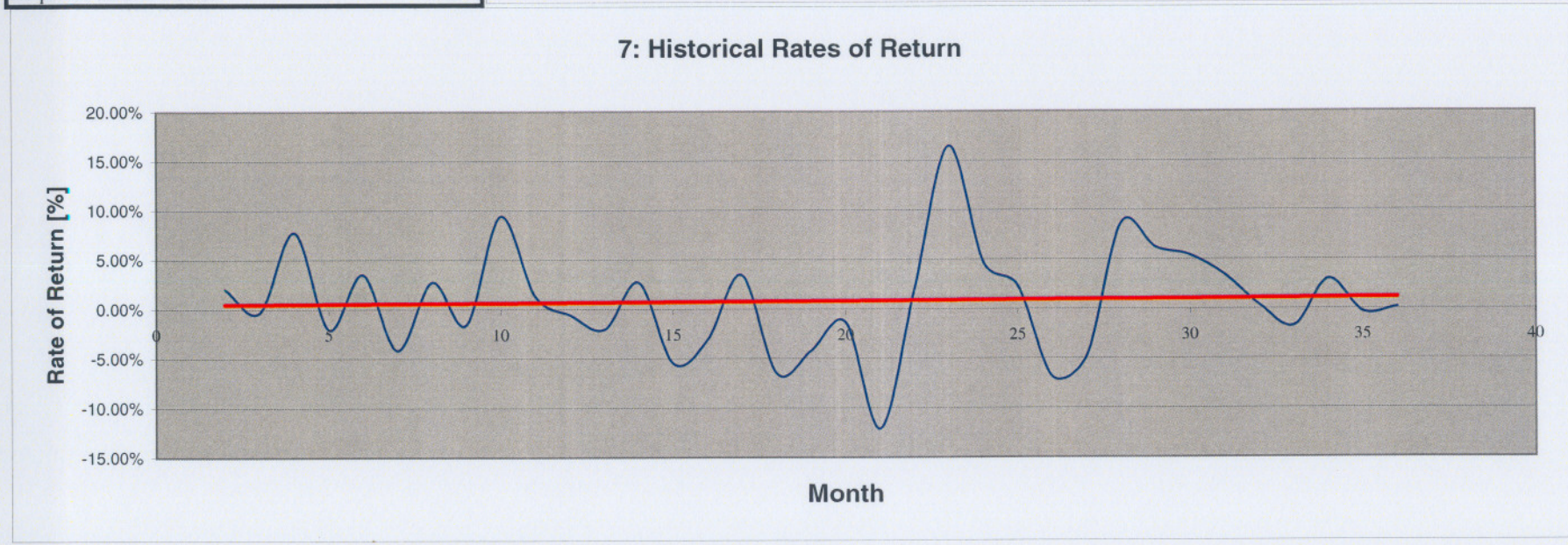
Company 6: Summary Calculation period: Week 32, 1999 to Week 28, 2004	
Historical Return	
Geometric Average	-0.13%
Standard Deviation	0.0765
Market Standard Deviation	0.0503
Beta	0.8068
Risk Free Rate of Return	0.98%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.82%
Correlation Coefficient	0.5311
Coefficient of Determination	0.282
Coefficient of Variation	-58.59
Sharpe Ratio	-0.11
Required Rate of Return	1.38%



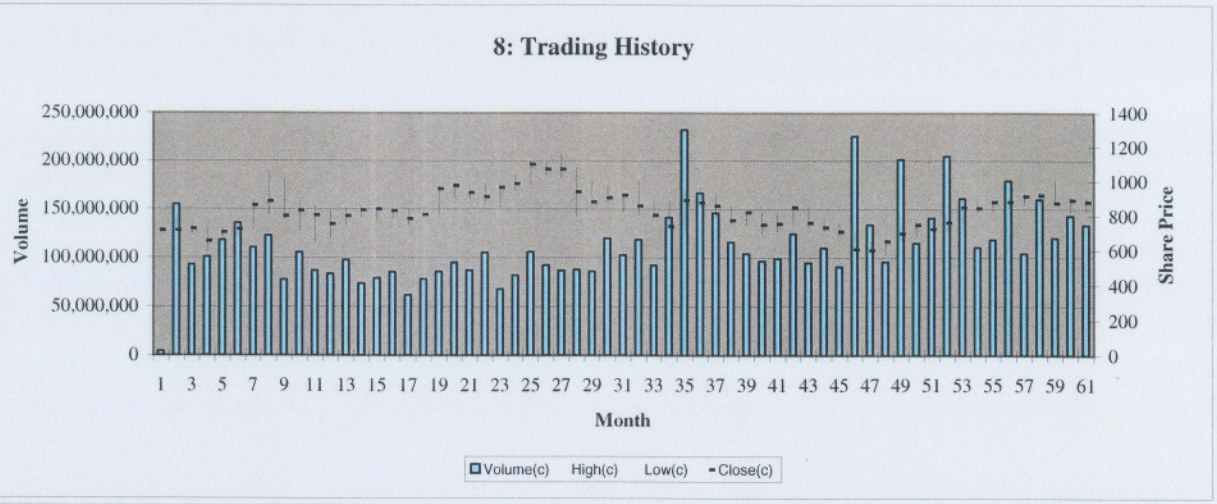


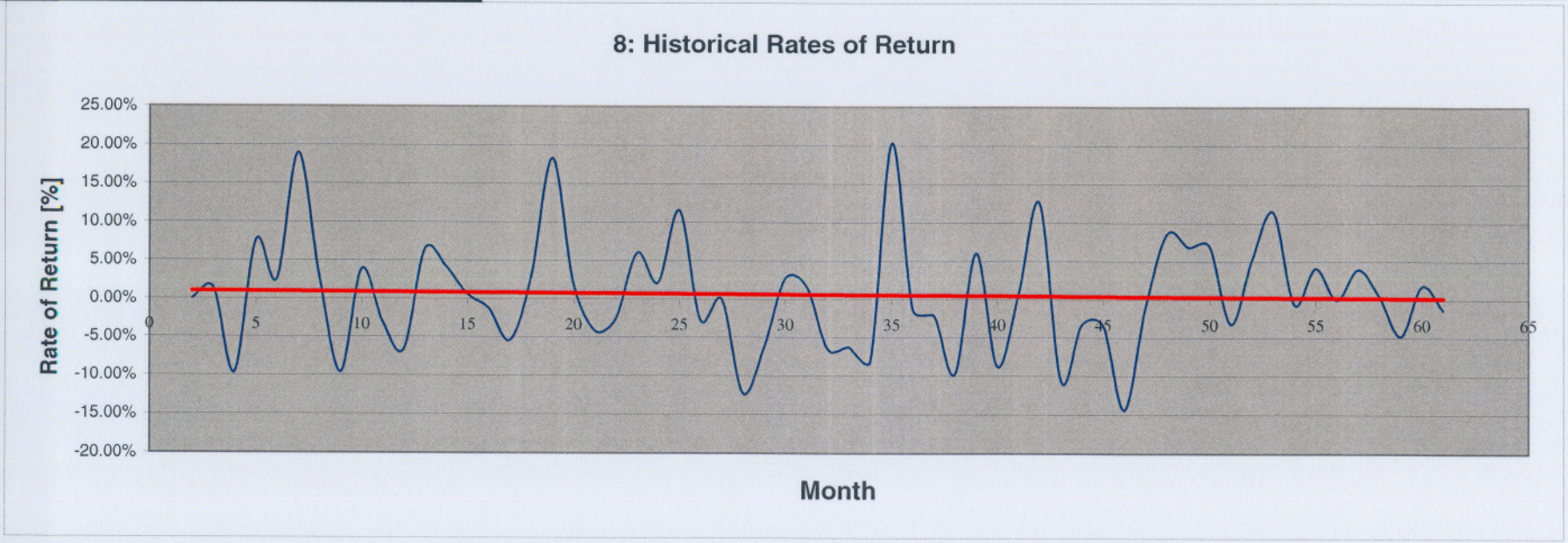
Company 7: Summary Calculation period: Week 28, 2001 to Week 28, 2004	
Historical Return	
Geometric Average	0.66%
Standard Deviation	0.0449
Market Standard Deviation	0.046
Beta	0.3138
Risk Free Rate of Return	0.87%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.23%
Correlation Coefficient	0.322
Coefficient of Determination	0.104
Coefficient of Variation	6.85
Sharpe Ratio	0.09
Required Rate of Return	1.03%



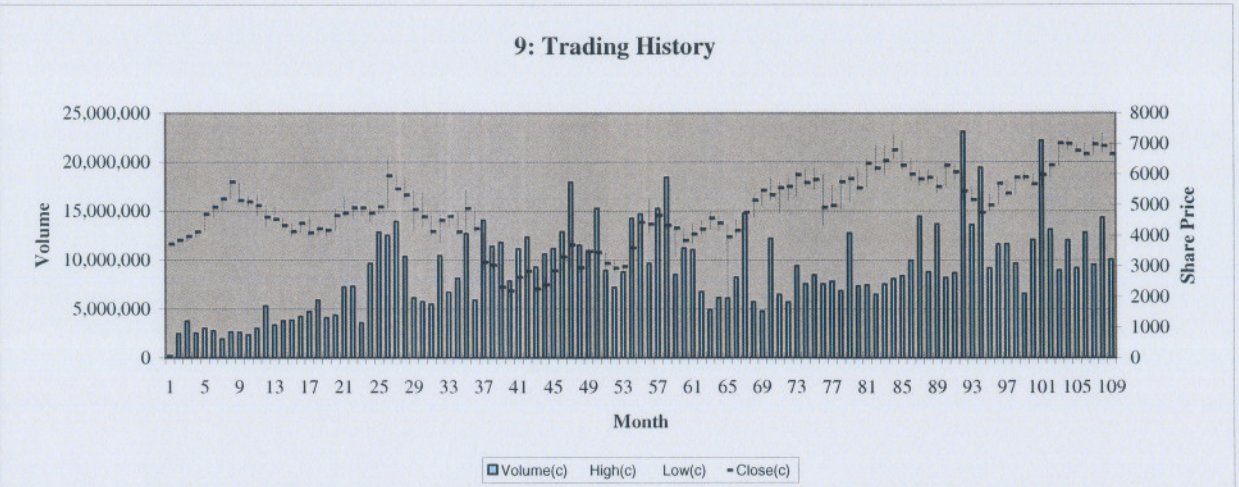


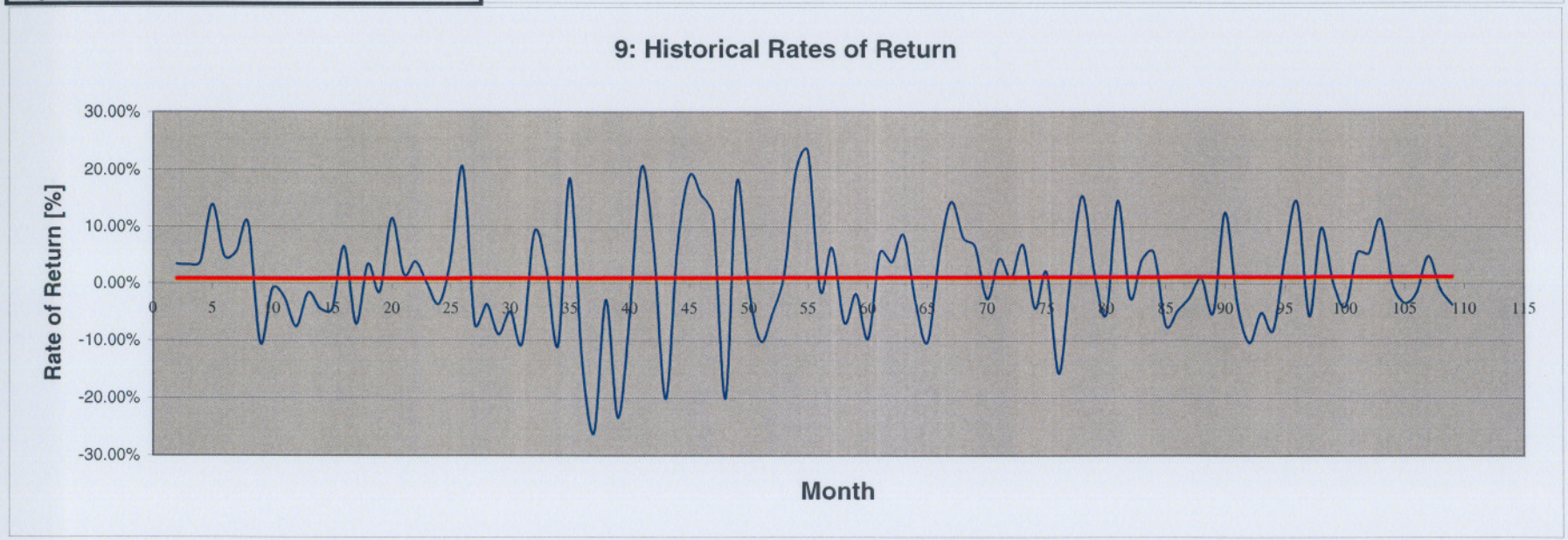
Company 8: Summary Calculation period: Week 28, 1999 to Week 28, 2004	
Historical Return	
Geometric Average	0.34%
Standard Deviation	0.0641
Market Standard Deviation	0.0503
Beta	0.6049
Risk Free Rate of Return	0.98%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.82%
Correlation Coefficient	0.4748
Coefficient of Determination	0.225
Coefficient of Variation	18.80
Sharpe Ratio	-0.07
Required Rate of Return	1.28%



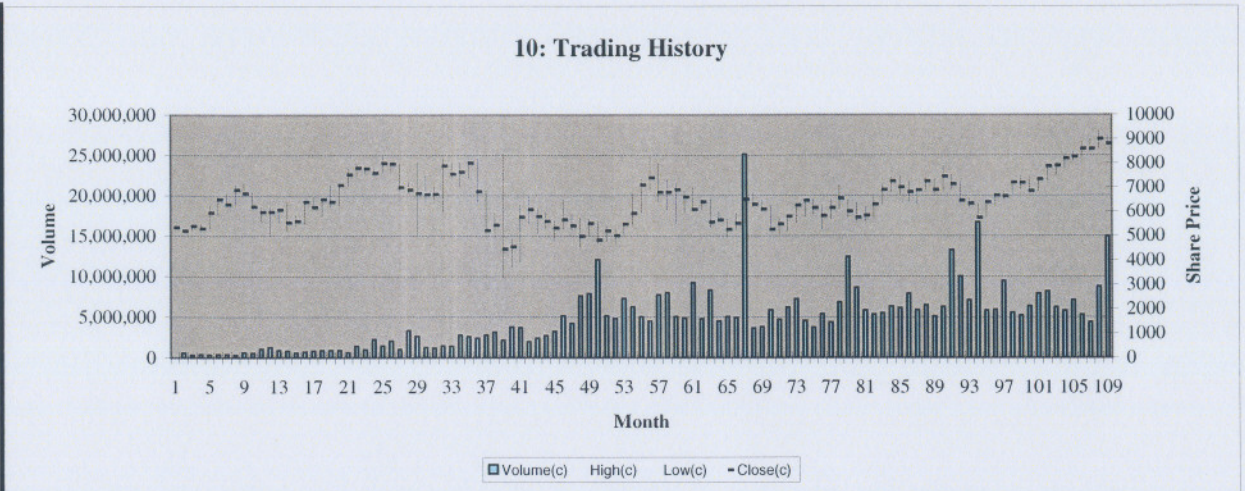


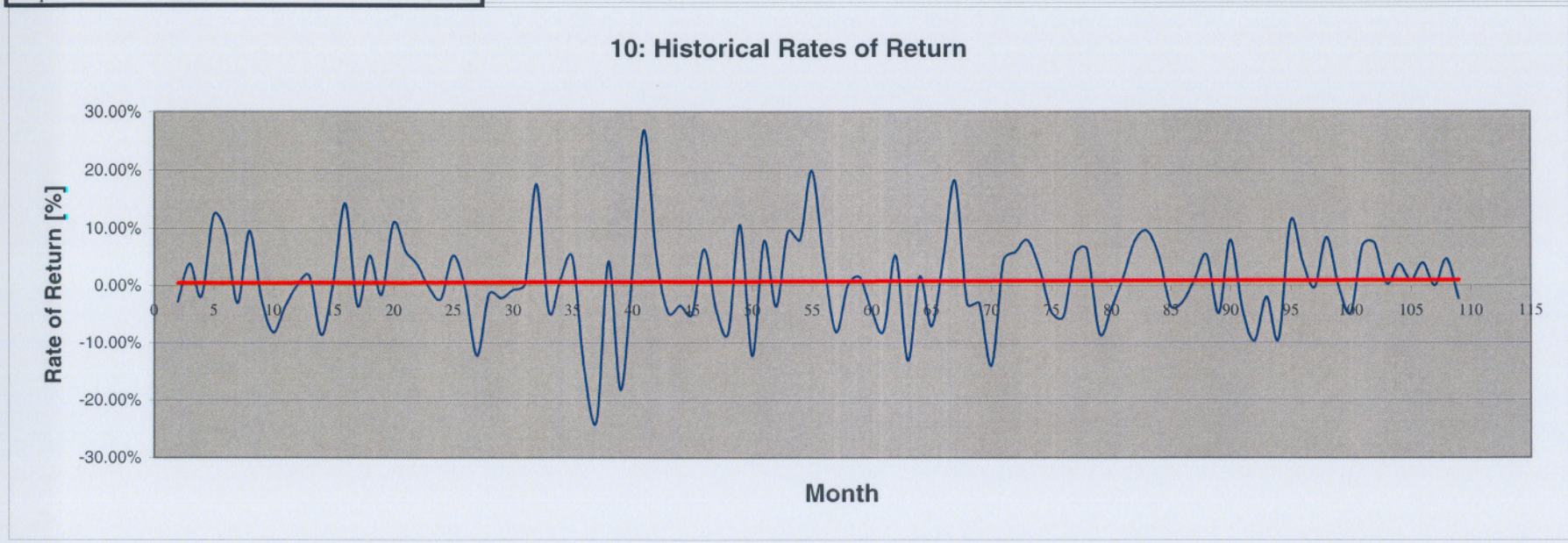
Company 9: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	0.54%
Standard Deviation	0.09
Market Standard Deviation	0.0595
Beta	1.0464
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.6923
Coefficient of Determination	0.479
Coefficient of Variation	16.82
Sharpe Ratio	0.01
Required Rate of Return	1.62%



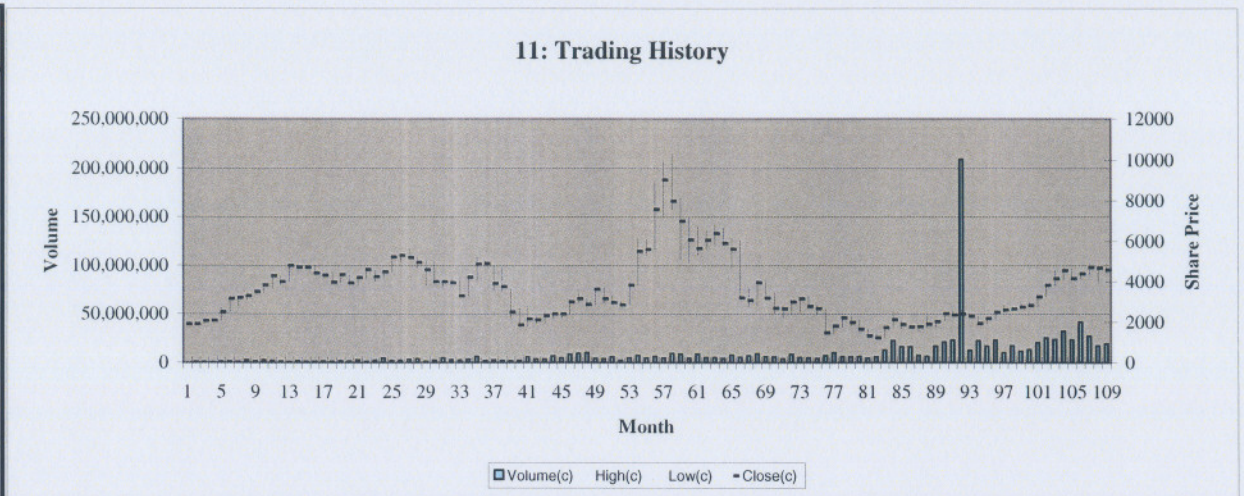


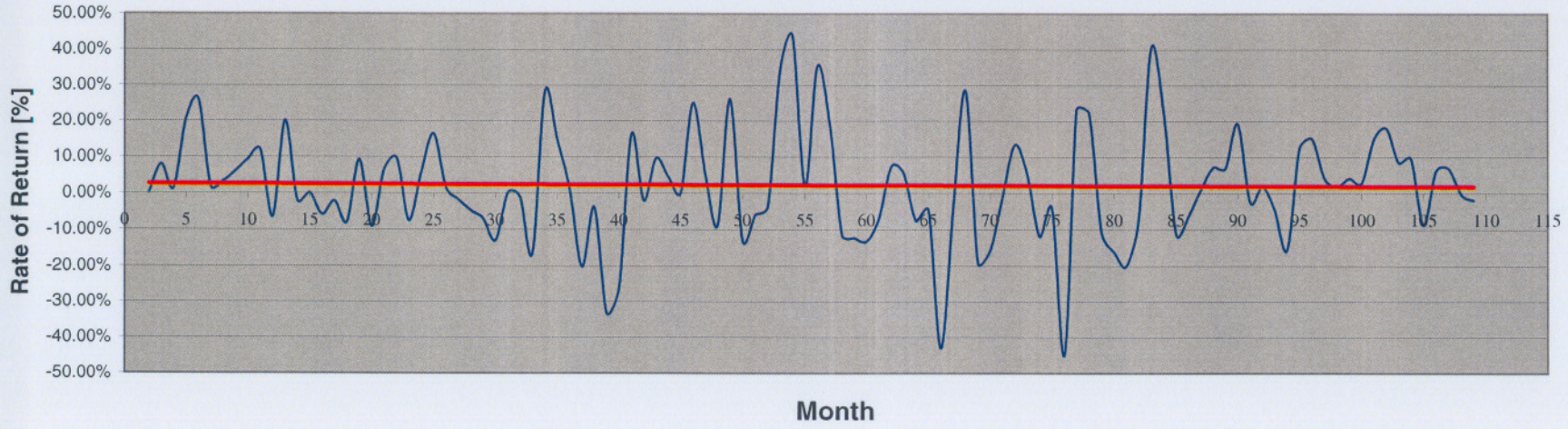
Company 10: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	0.46%
Standard Deviation	0.074
Market Standard Deviation	0.0595
Beta	0.5358
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.4314
Coefficient of Determination	0.186
Coefficient of Variation	16.17
Sharpe Ratio	-0.02
Required Rate of Return	1.37%



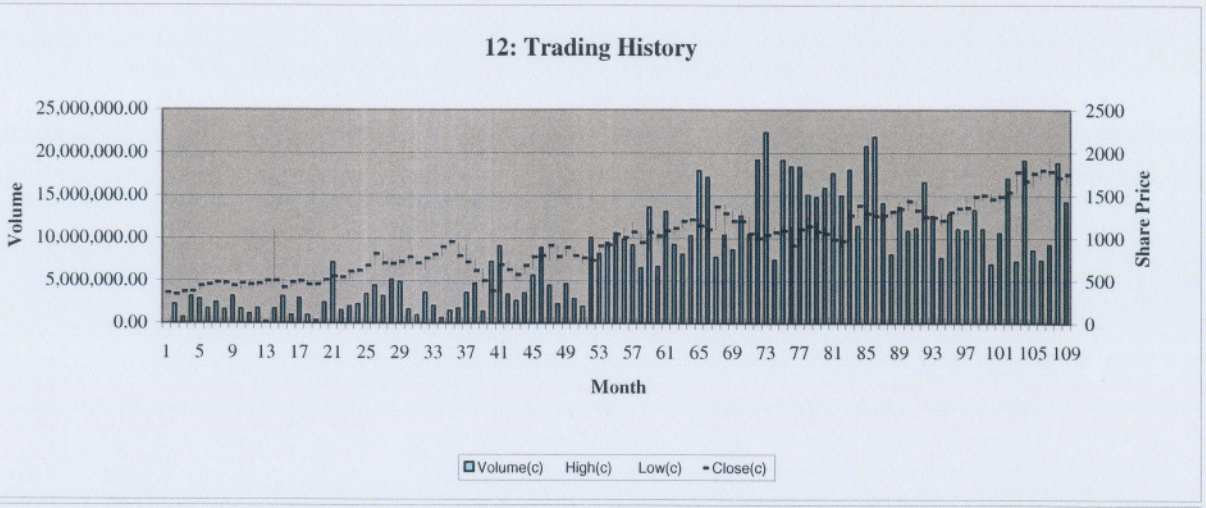


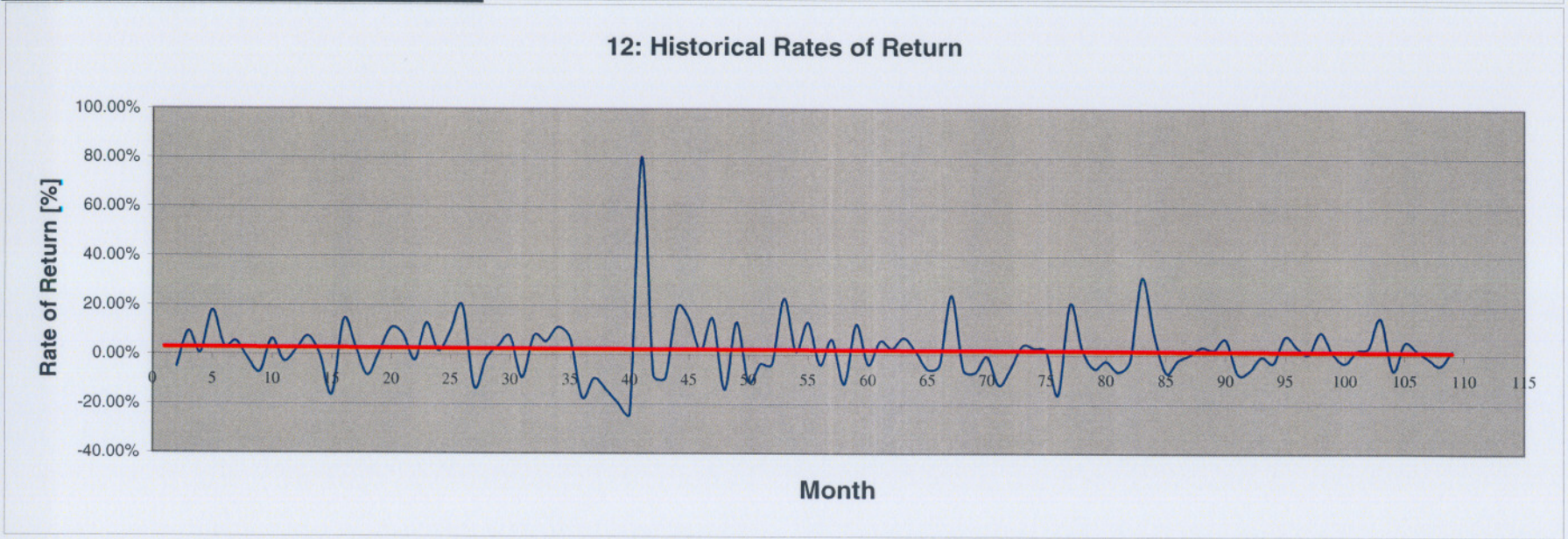
Company 11: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	0.81%
Standard Deviation	0.148
Market Standard Deviation	0.0595
Beta	1.1698
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.4706
Coefficient of Determination	0.222
Coefficient of Variation	18.24
Sharpe Ratio	0.05
Required Rate of Return	1.69%



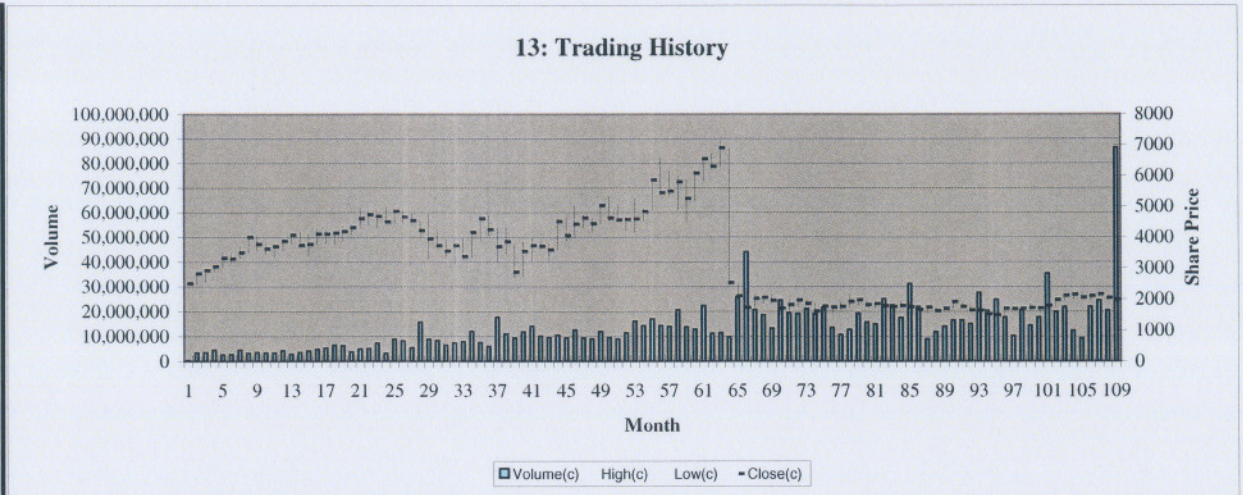


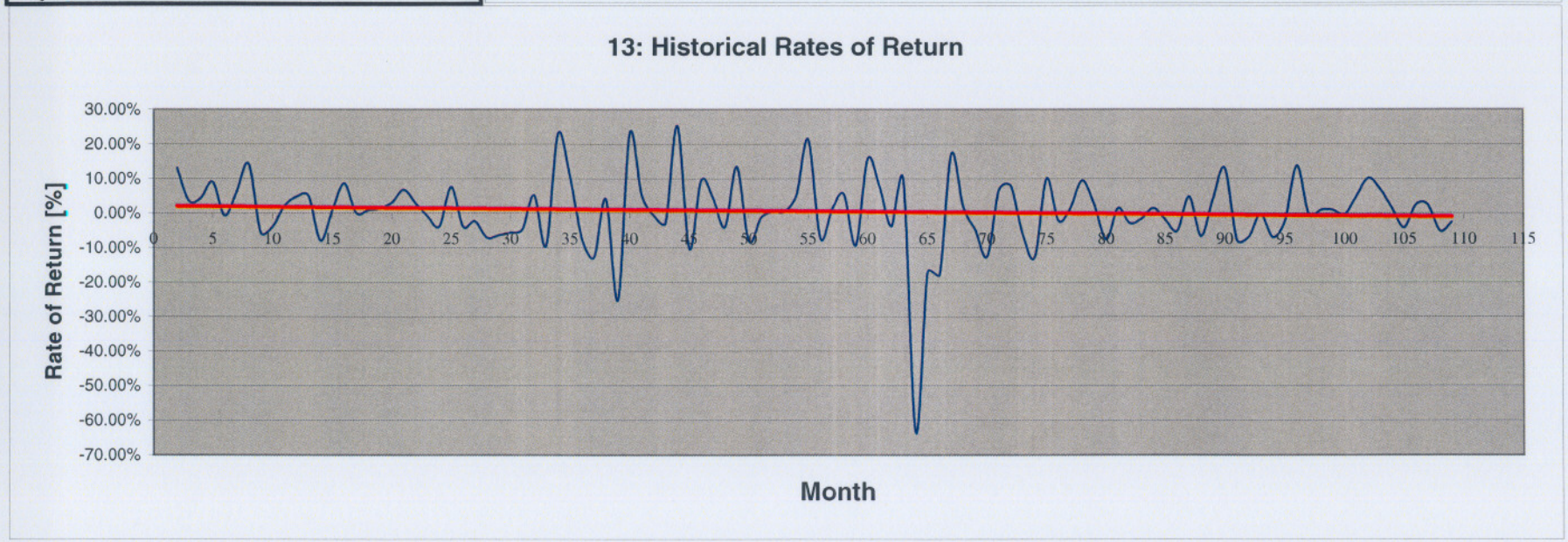
Company 12: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	1.47%
Standard Deviation	0.117
Market Standard Deviation	0.0595
Beta	0.9205
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.4684
Coefficient of Determination	0.219
Coefficient of Variation	7.96
Sharpe Ratio	0.10
Required Rate of Return	1.56%



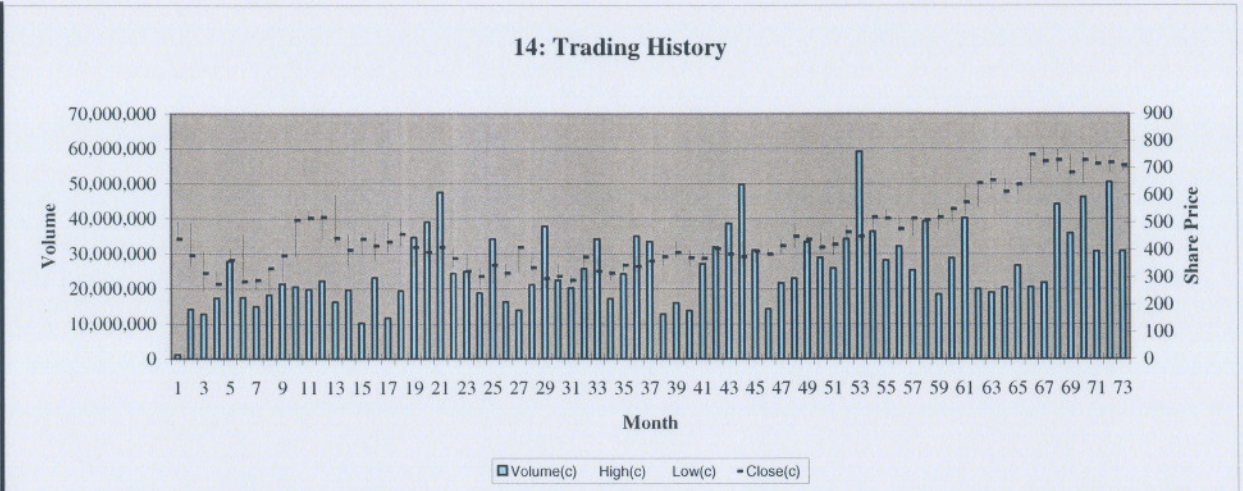


Company 13: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	-0.21%
Standard Deviation	0.0951
Market Standard Deviation	0.0595
Beta	0.9205
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.5434
Coefficient of Determination	0.333
Coefficient of Variation	-45.28
Sharpe Ratio	-0.07
Required Rate of Return	1.56%



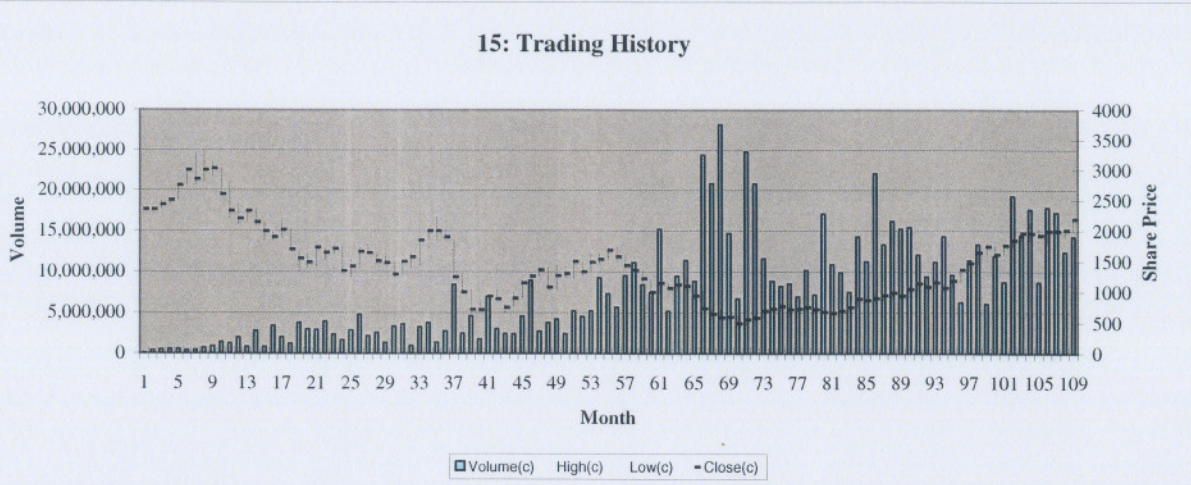


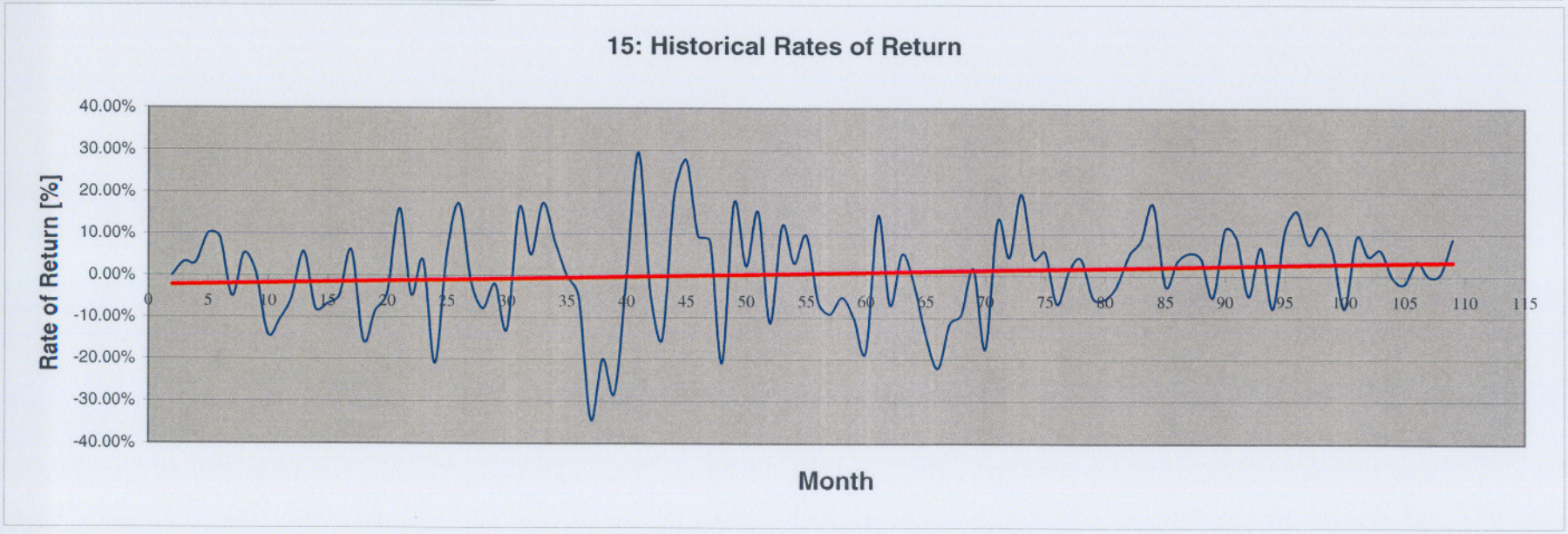
Company 14: Summary Calculation period: Week 28, 1998 to Week 28, 2004	
Historical Return	
Geometric Average	0.66%
Standard Deviation	0.1199
Market Standard Deviation	0.0625
Beta	0.9077
Risk Free Rate of Return	1.03%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.55%
Correlation Coefficient	0.4736
Coefficient of Determination	0.224
Coefficient of Variation	18.23
Sharpe Ratio	0.05
Required Rate of Return	1.49%



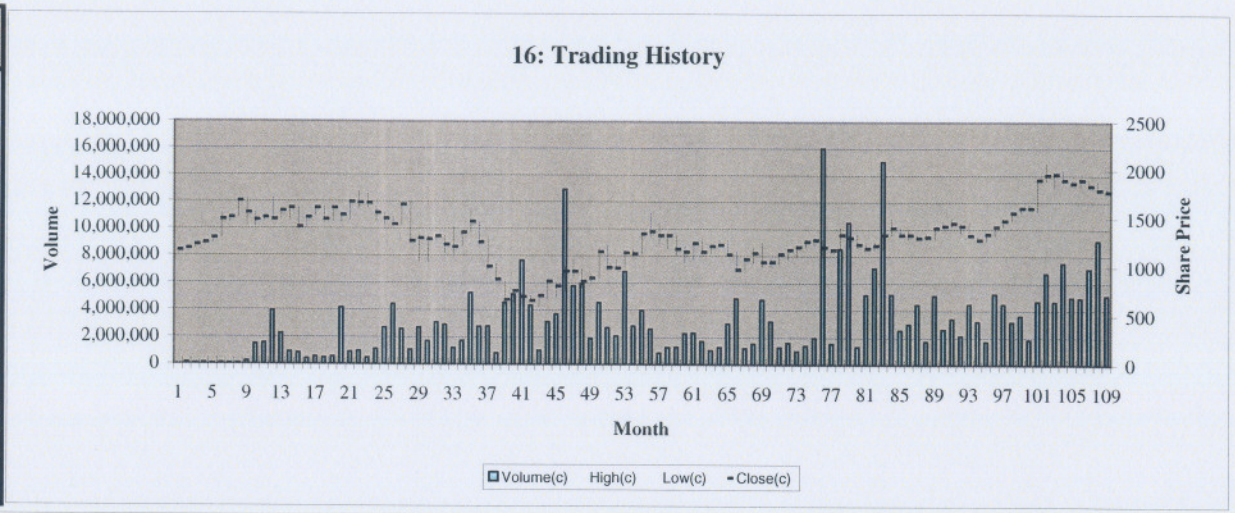


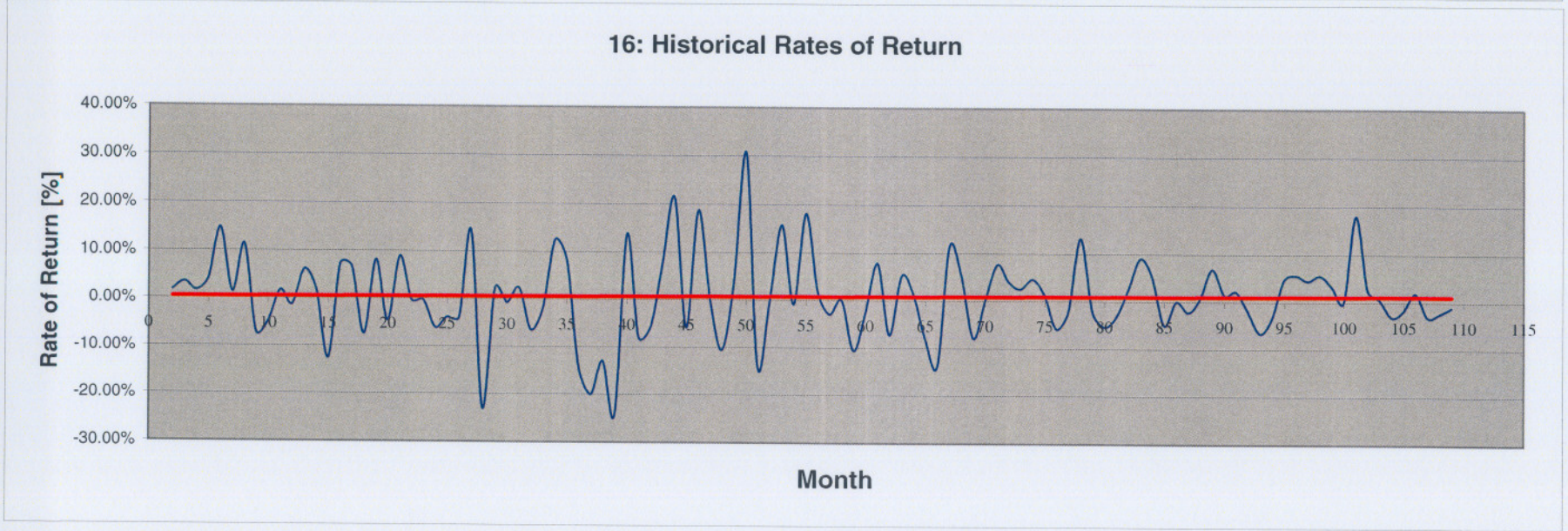
Company 15: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	-0.06%
Standard Deviation	5.689
Market Standard Deviation	0.0595
Beta	-2.4851
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	-0.026
Coefficient of Determination	0.001
Coefficient of Variation	-8796.88
Sharpe Ratio	0.07
Required Rate of Return	-0.14%



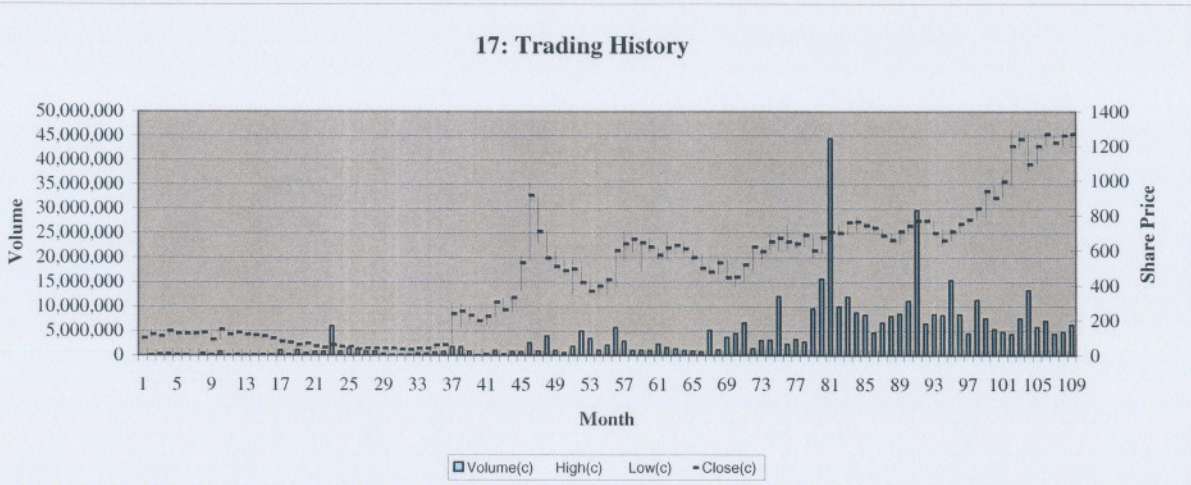


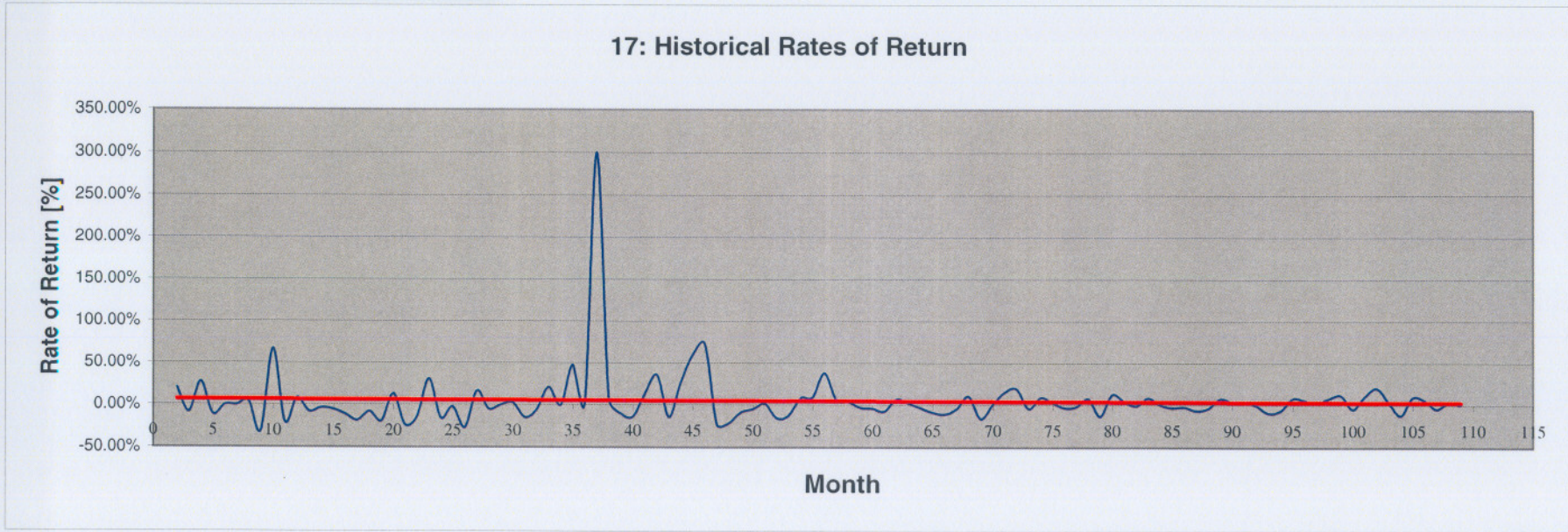
Company 16: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	0.39%
Standard Deviation	0.0815
Market Standard Deviation	0.0595
Beta	0.6579
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.4808
Coefficient of Determination	0.231
Coefficient of Variation	20.84
Sharpe Ratio	-0.02
Required Rate of Return	1.43%



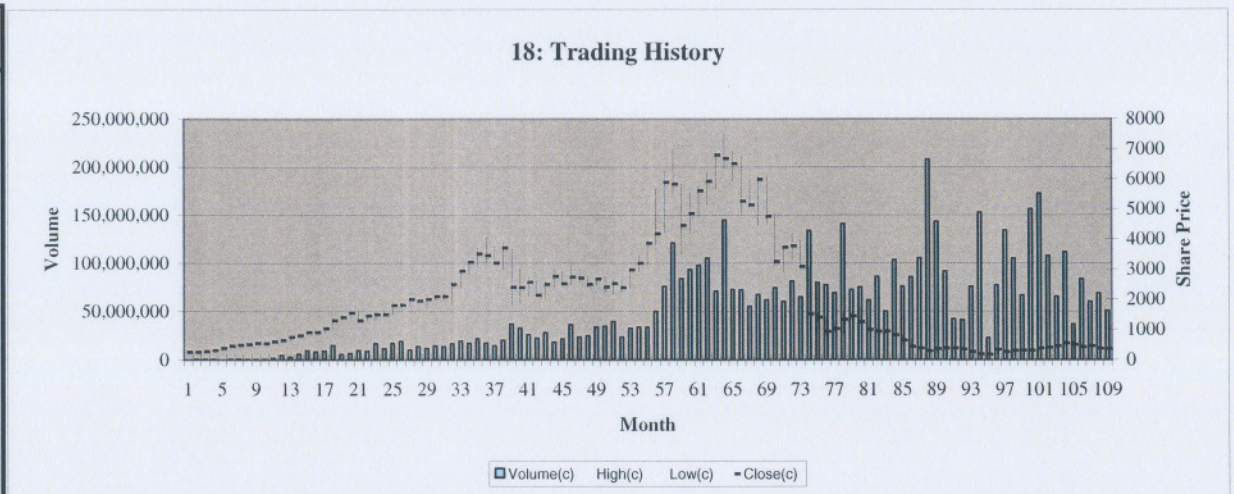


Company 17: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	2.36%
Standard Deviation	0.4484
Market Standard Deviation	0.0595
Beta	1.1479
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.1524
Coefficient of Determination	0.023
Coefficient of Variation	19.01
Sharpe Ratio	0.10
Required Rate of Return	1.67%



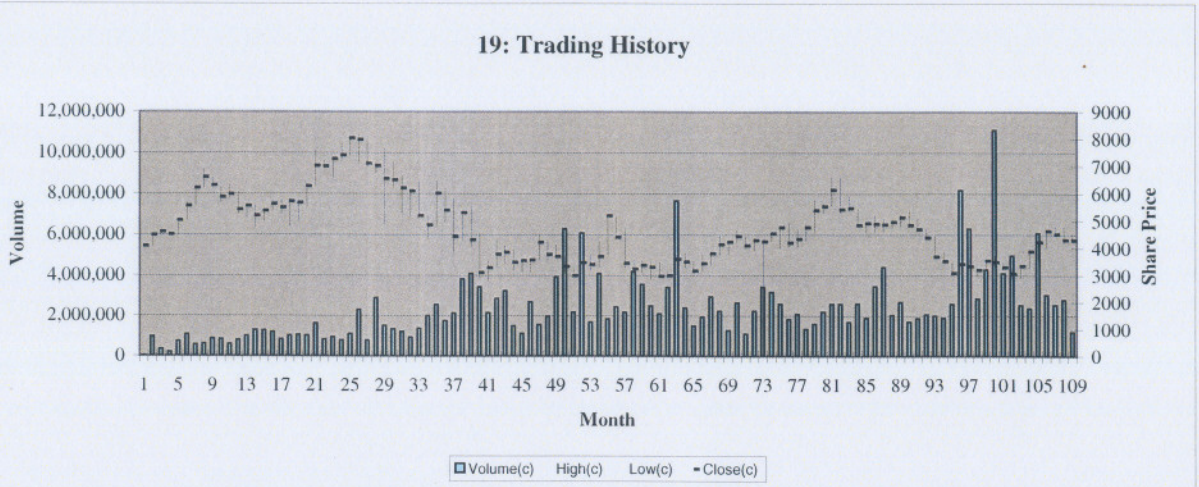


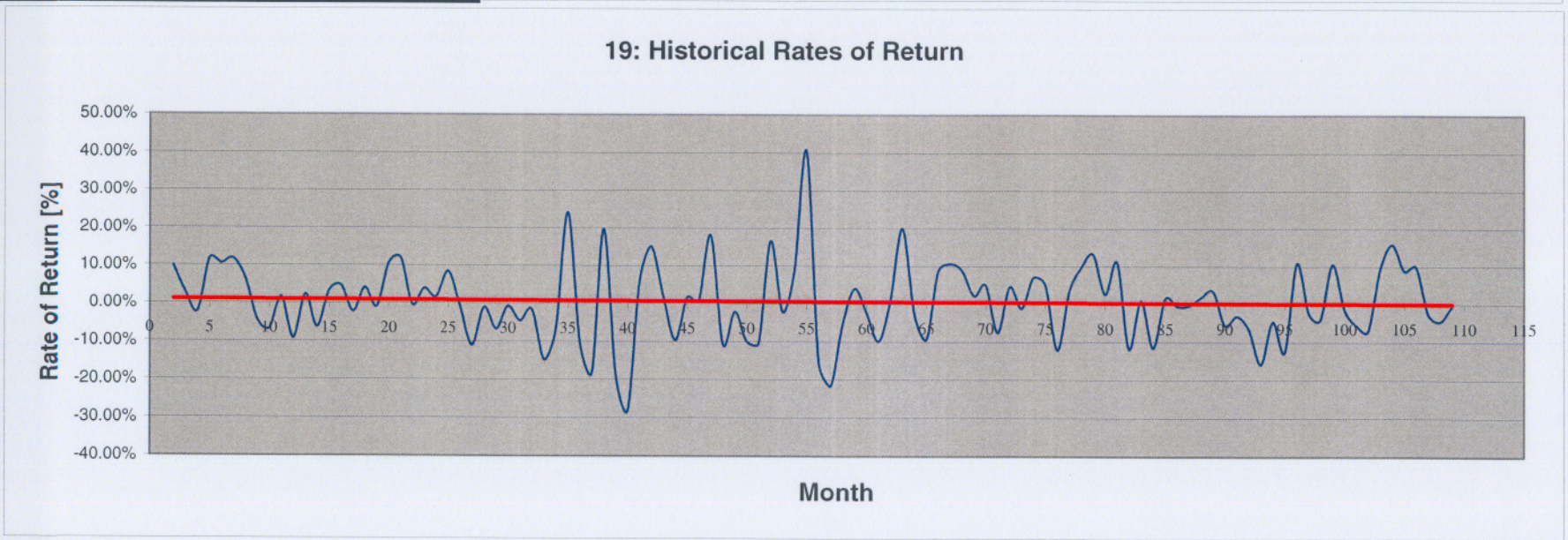
Company 18: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	0.32%
Standard Deviation	0.1705
Market Standard Deviation	0.0595
Beta	1.542
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.5385
Coefficient of Determination	0.290
Coefficient of Variation	53.34
Sharpe Ratio	0.03
Required Rate of Return	1.87%



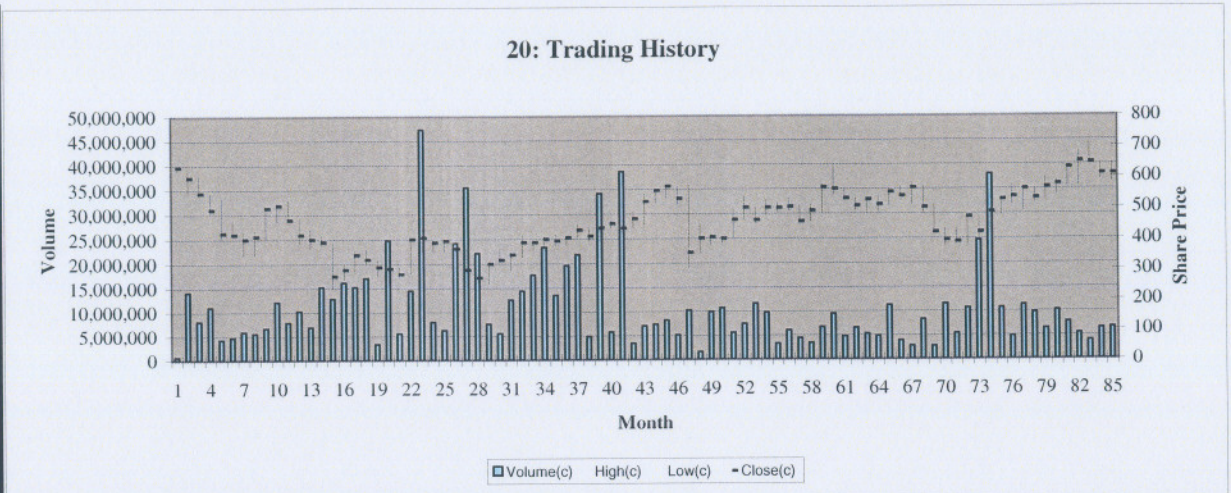


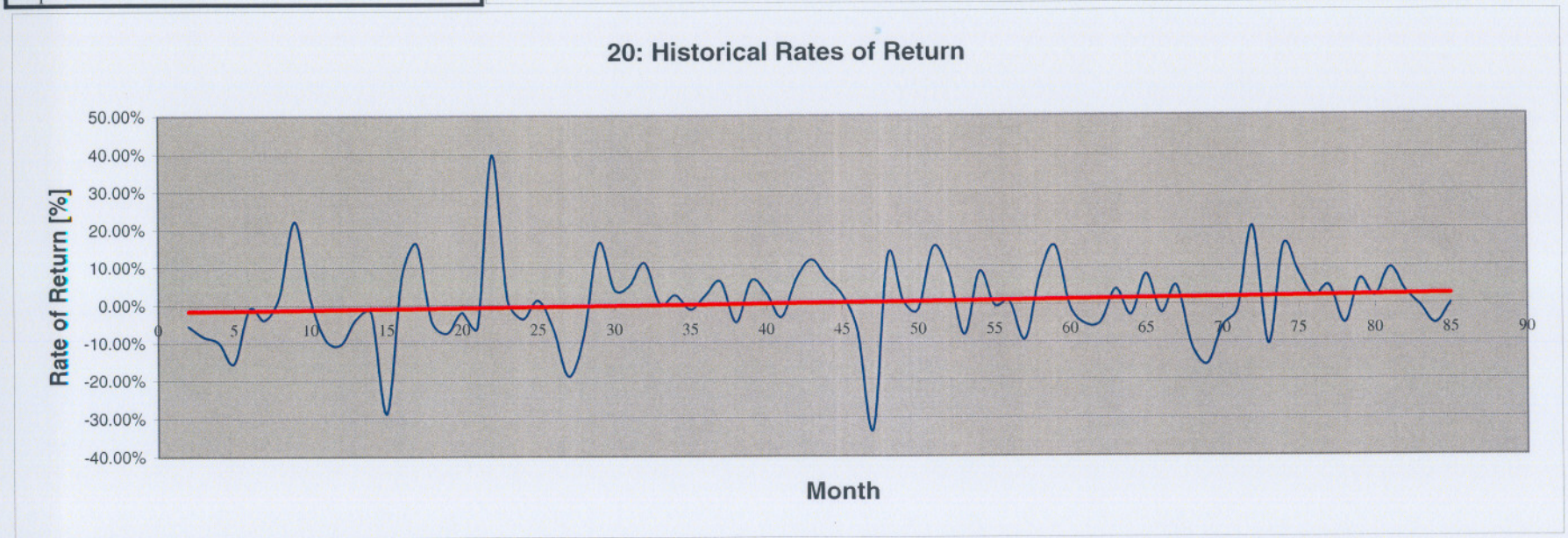
Company 19: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	0.05%
Standard Deviation	0.1014
Market Standard Deviation	0.0595
Beta	0.764
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.4488
Coefficient of Determination	0.201
Coefficient of Variation	204.72
Sharpe Ratio	-0.03
Required Rate of Return	1.48%



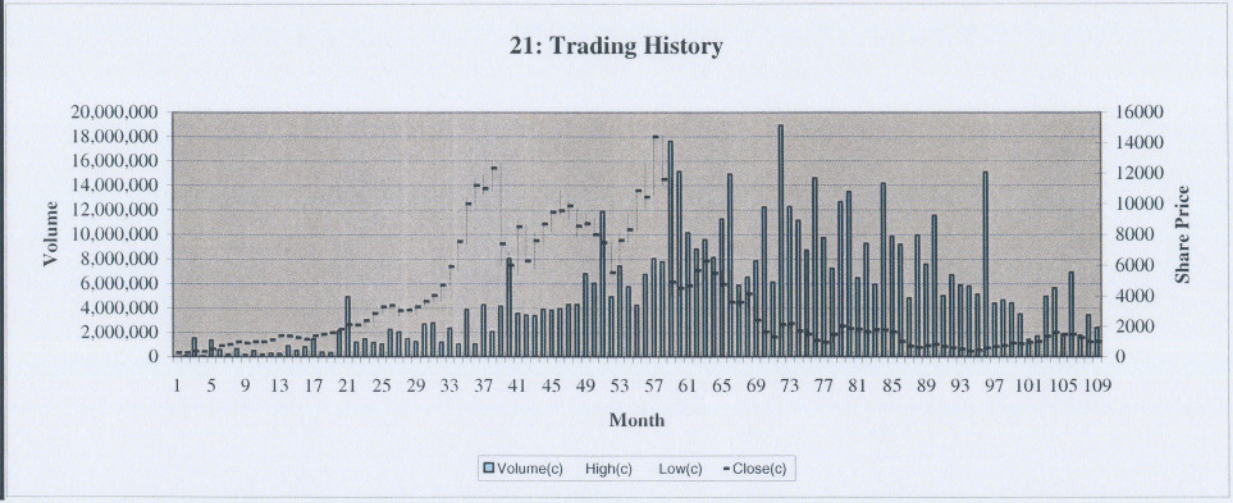


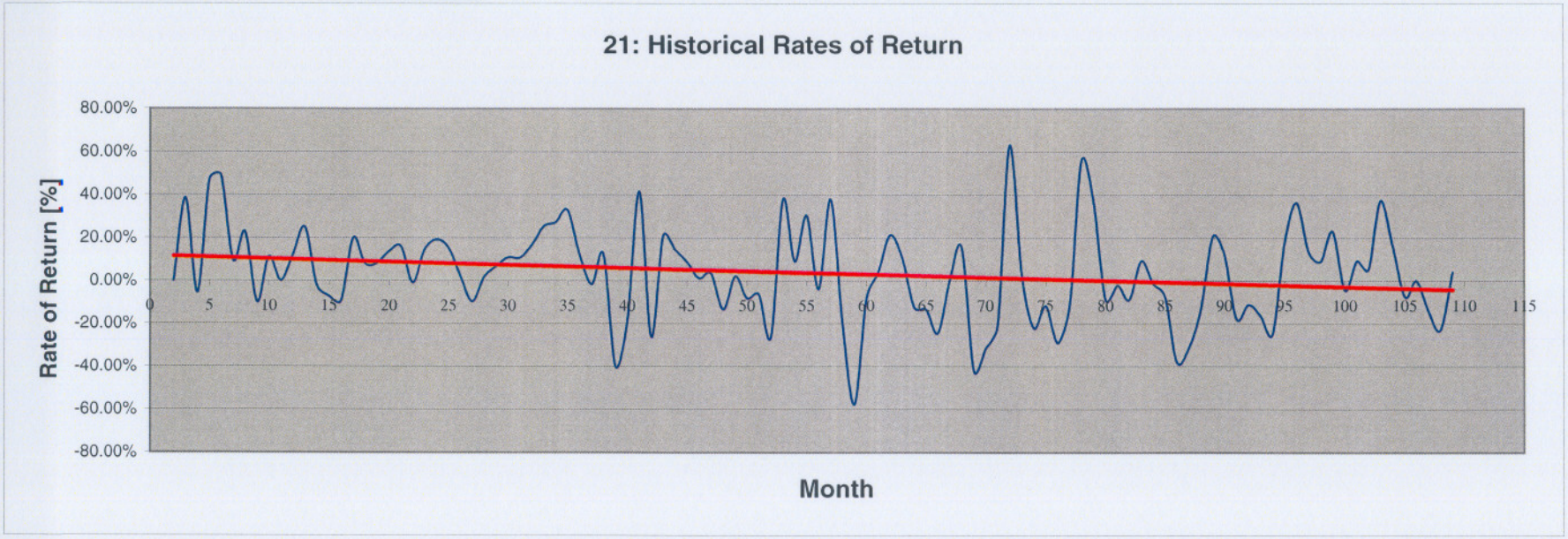
Company 20: Summary Calculation period: Week 28, 1997 to Week 28, 2004	
Historical Return	
Geometric Average	-0.05%
Standard Deviation	0.093
Market Standard Deviation	0.0651
Beta	0.6744
Risk Free Rate of Return	1.05%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.56%
Correlation Coefficient	0.4721
Coefficient of Determination	0.223
Coefficient of Variation	-196.85
Sharpe Ratio	-0.04
Required Rate of Return	1.39%



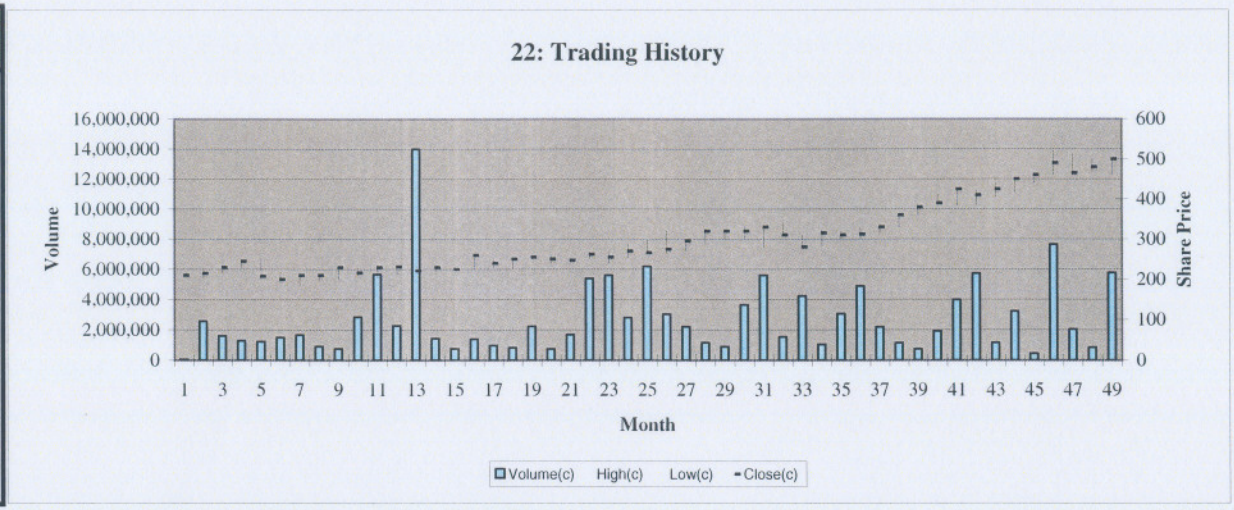


Company 21: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	1.26%
Standard Deviation	0.2079
Market Standard Deviation	0.0595
Beta	2.0276
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.5808
Coefficient of Determination	0.337
Coefficient of Variation	16.48
Sharpe Ratio	0.08
Required Rate of Return	2.11%



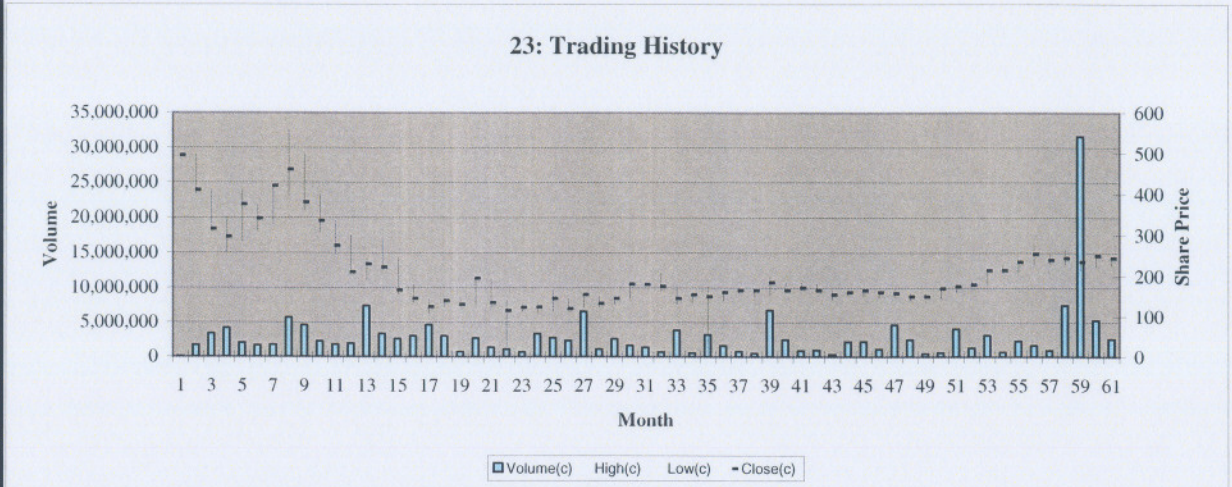


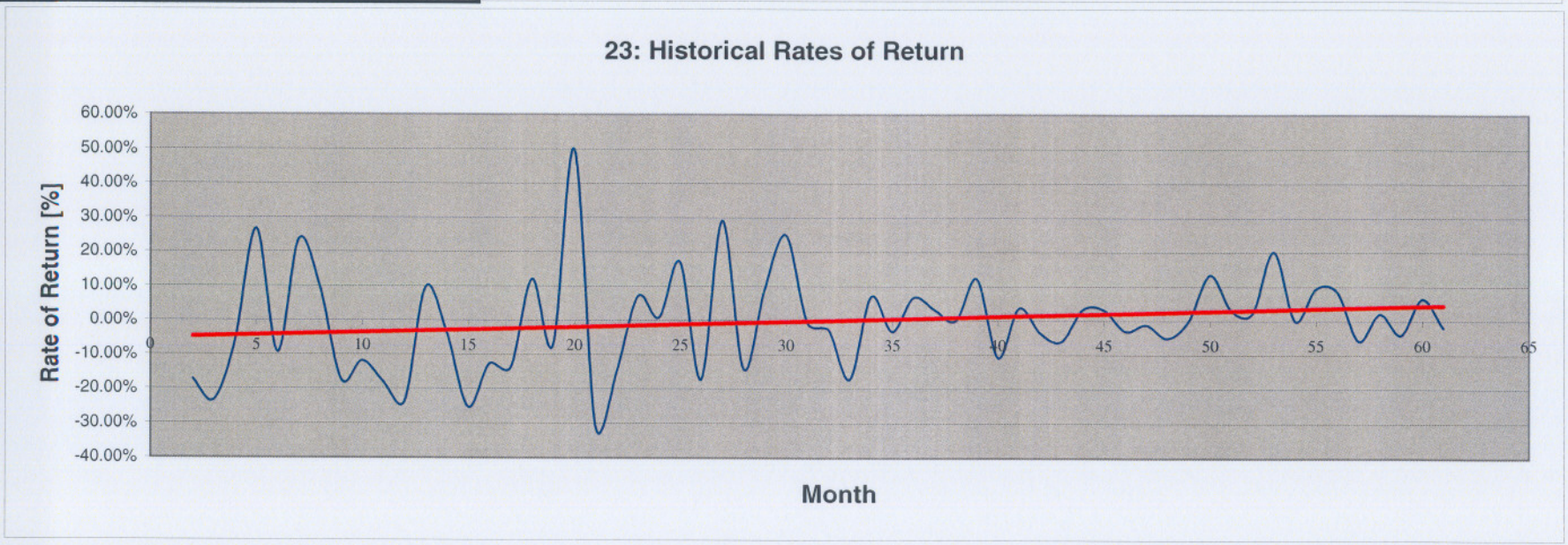
Company 22: Summary Calculation period: Week 28, 2000 to Week 28, 2004	
Historical Return	
Geometric Average	1.79%
Standard Deviation	0.0563
Market Standard Deviation	0.0481
Beta	0.2206
Risk Free Rate of Return	0.92%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.70%
Correlation Coefficient	0.1885
Coefficient of Determination	0.036
Coefficient of Variation	3.15
Sharpe Ratio	0.20
Required Rate of Return	1.03%



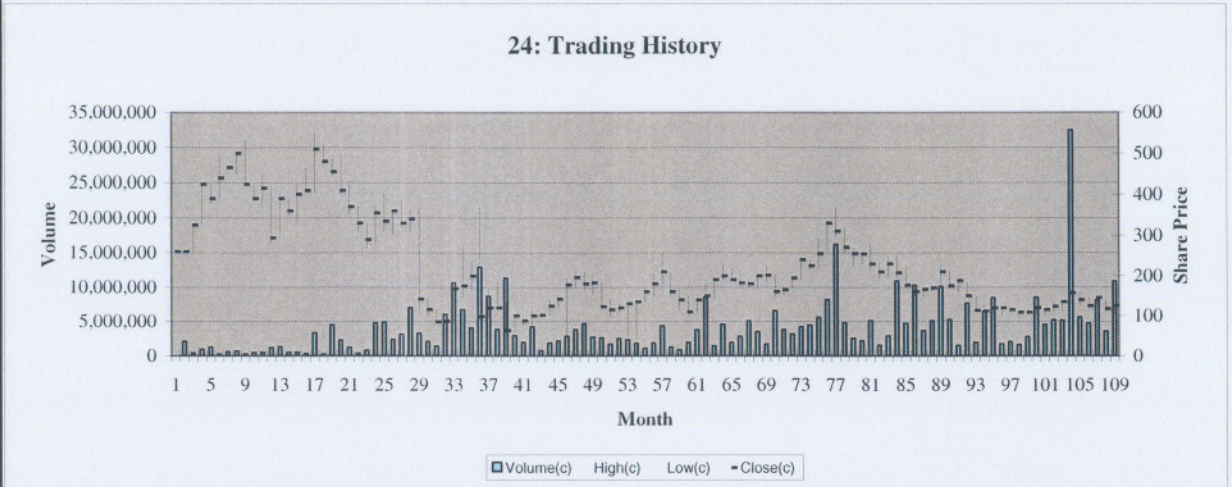


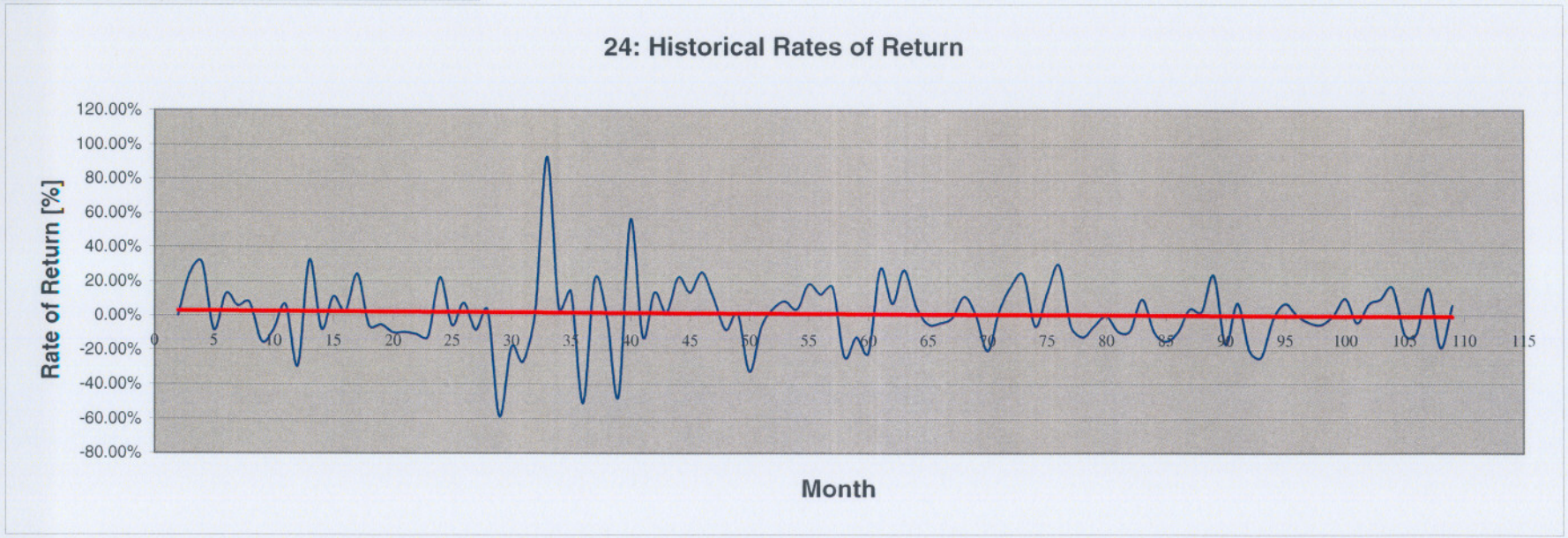
Company 23: Summary Calculation period: Week 28, 1999 to Week 28, 2004	
Historical Return	
Geometric Average	-1.15%
Standard Deviation	0.1262
Market Standard Deviation	0.0503
Beta	1.0344
Risk Free Rate of Return	0.98%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.82%
Correlation Coefficient	0.4125
Coefficient of Determination	0.170
Coefficient of Variation	-11.01
Sharpe Ratio	-0.14
Required Rate of Return	1.50%



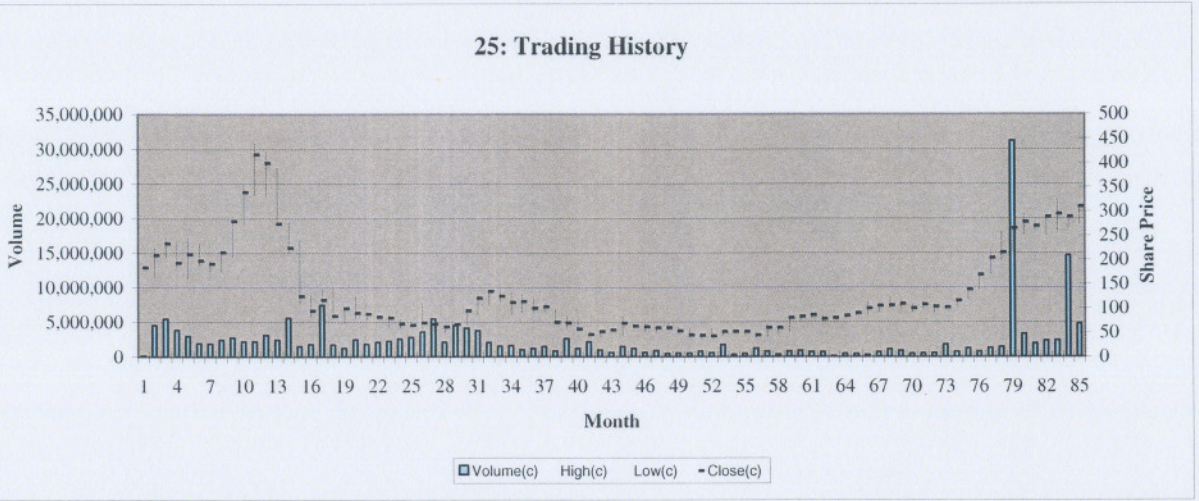


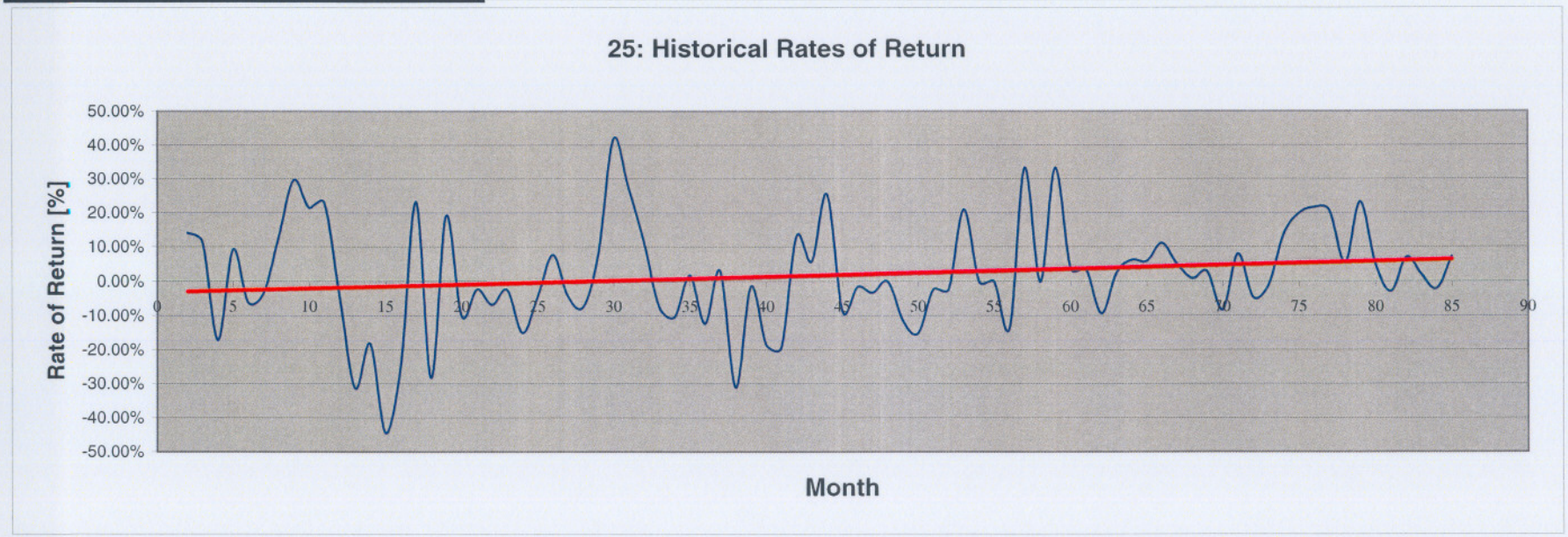
Company 24: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	-0.67%
Standard Deviation	0.1798
Market Standard Deviation	0.0595
Beta	1.4701
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.4869
Coefficient of Determination	0.237
Coefficient of Variation	-26.85
Sharpe Ratio	-0.03
Required Rate of Return	1.84%



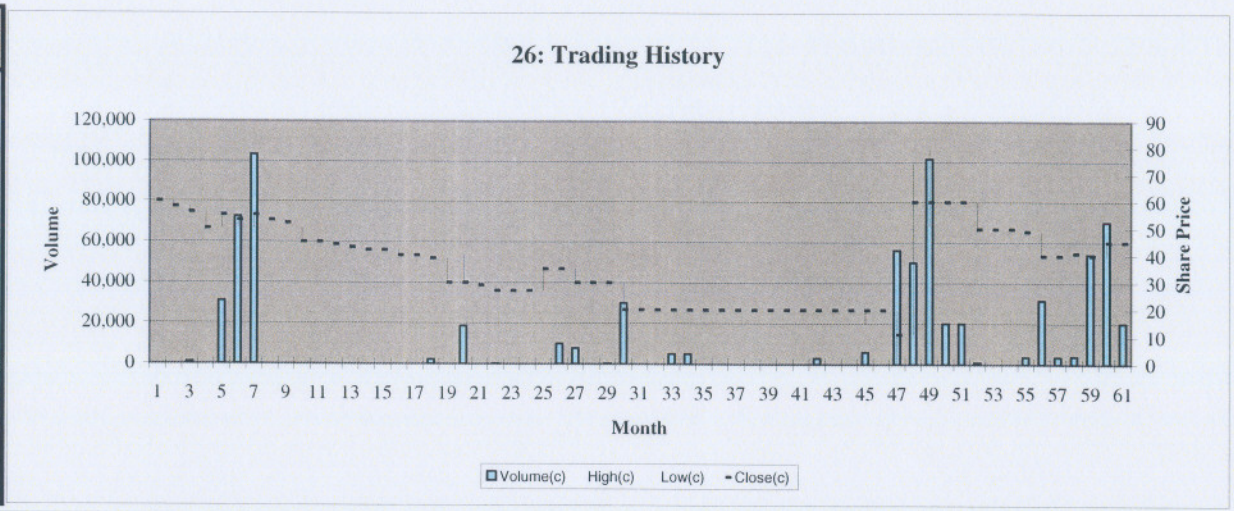


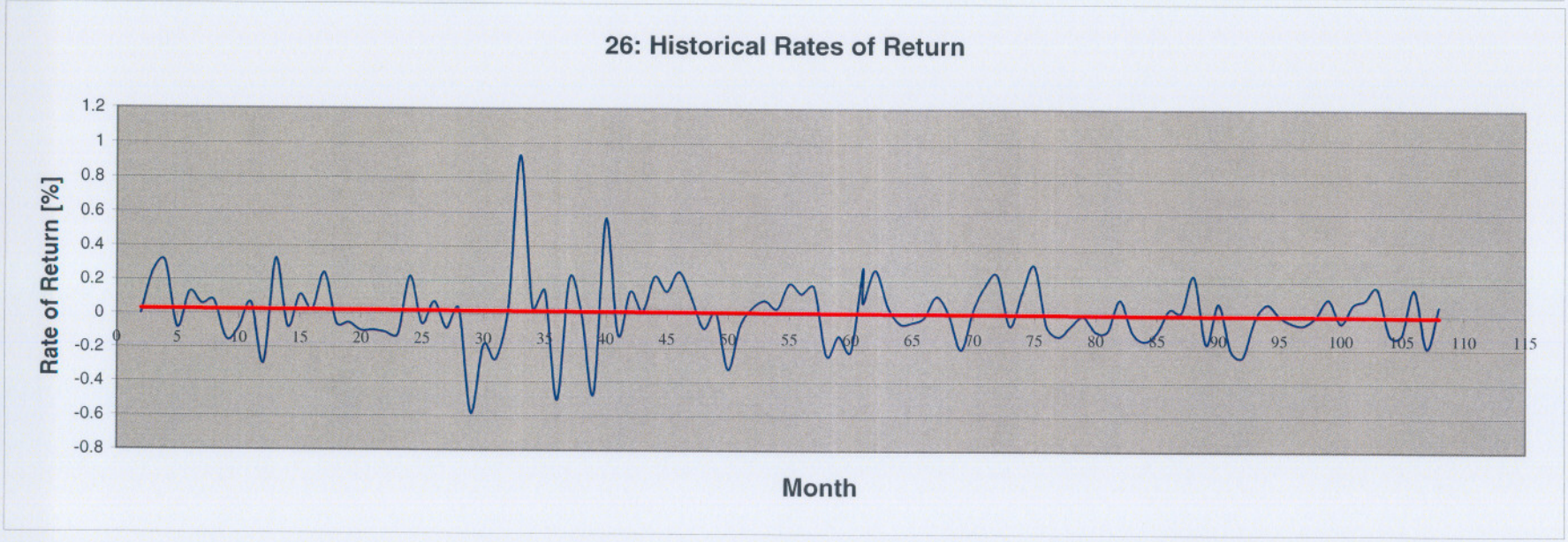
Company 25: Summary Calculation period: Week 28, 1997 to Week 28, 2004	
Historical Return	
Geometric Average	0.62%
Standard Deviation	0.1657
Market Standard Deviation	0.0651
Beta	1.1525
Risk Free Rate of Return	1.05%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.56%
Correlation Coefficient	0.4528
Coefficient of Determination	0.205
Coefficient of Variation	26.92
Sharpe Ratio	0.05
Required Rate of Return	1.63%



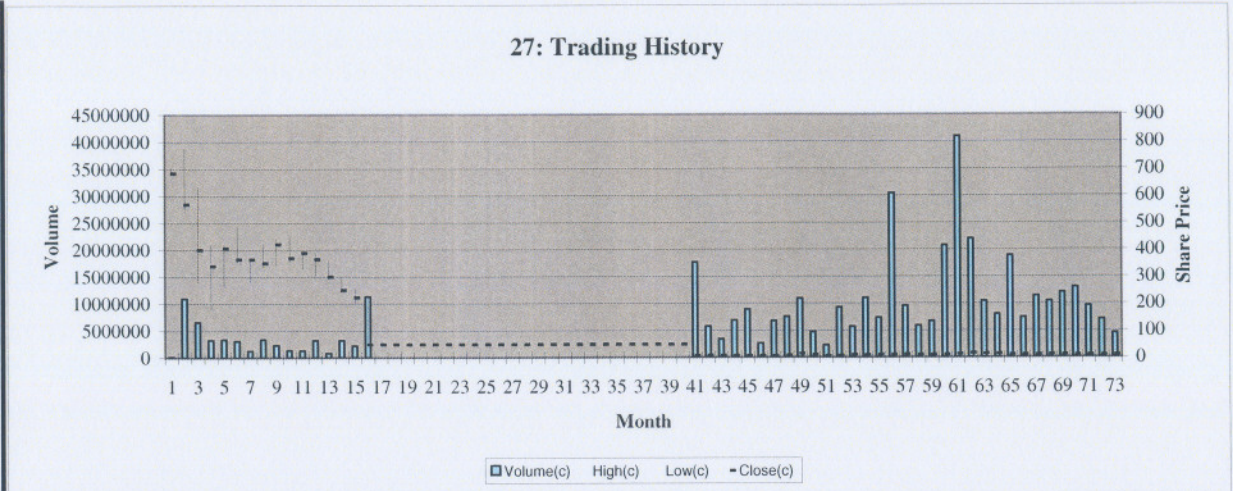


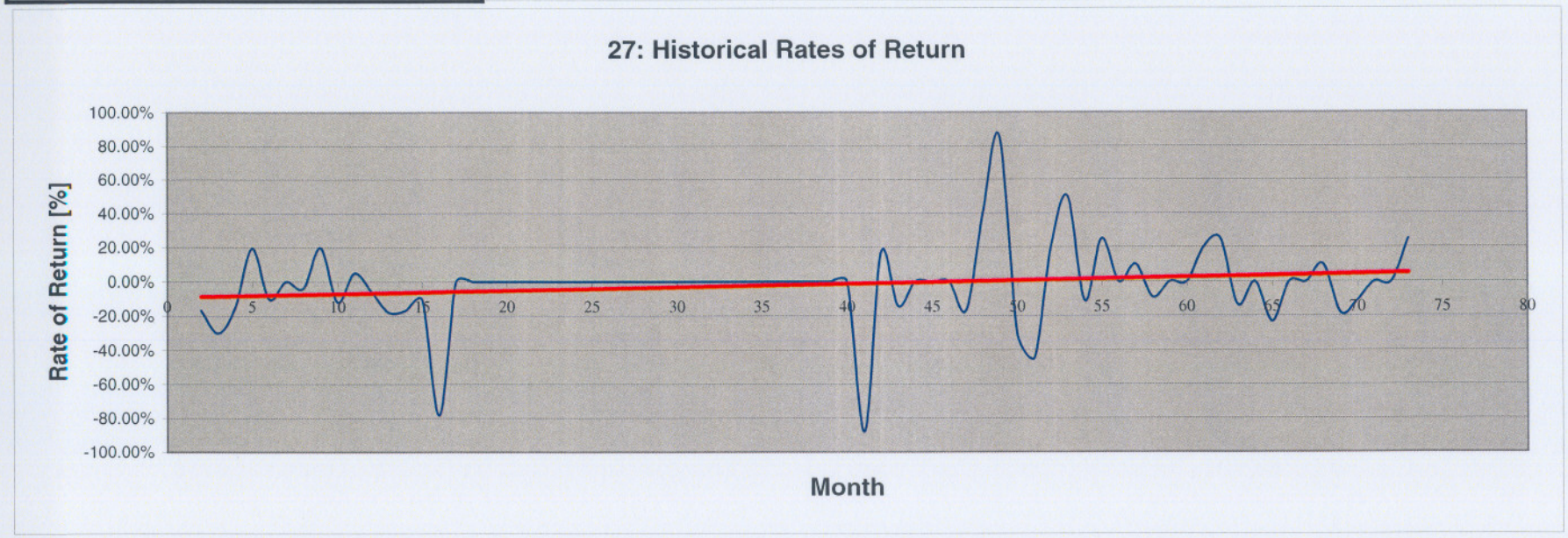
Company 26: Summary Calculation period: Week 28, 1999 to Week 28, 2004	
Historical Return	
Geometric Average	-0.47%
Standard Deviation	0.4493
Market Standard Deviation	0.0503
Beta	0.8968
Risk Free Rate of Return	0.98%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.82%
Correlation Coefficient	0.1005
Coefficient of Determination	0.010
Coefficient of Variation	-95.49
Sharpe Ratio	0.00
Required Rate of Return	1.43%



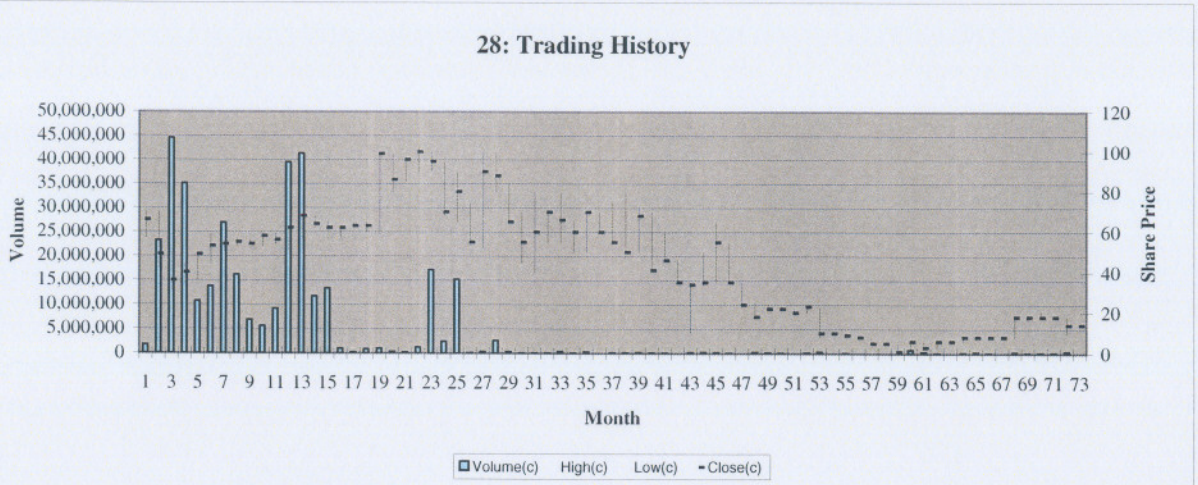


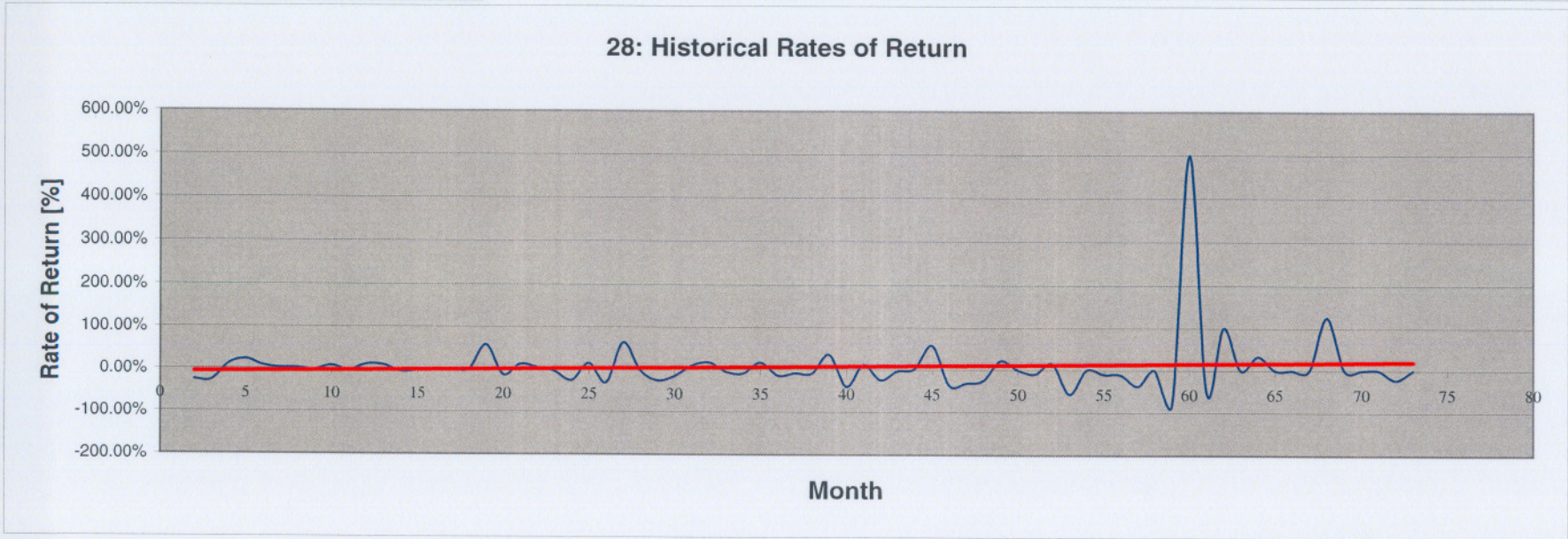
Company 27: Summary Calculation period: Week 28, 1998 to Week 28, 2004	
Historical Return	
Geometric Average	-5.63%
Standard Deviation	0.2055
Market Standard Deviation	0.0625
Beta	0.7546
Risk Free Rate of Return	1.03%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.55%
Correlation Coefficient	0.2297
Coefficient of Determination	0.053
Coefficient of Variation	-3.65
Sharpe Ratio	-0.25
Required Rate of Return	1.41%



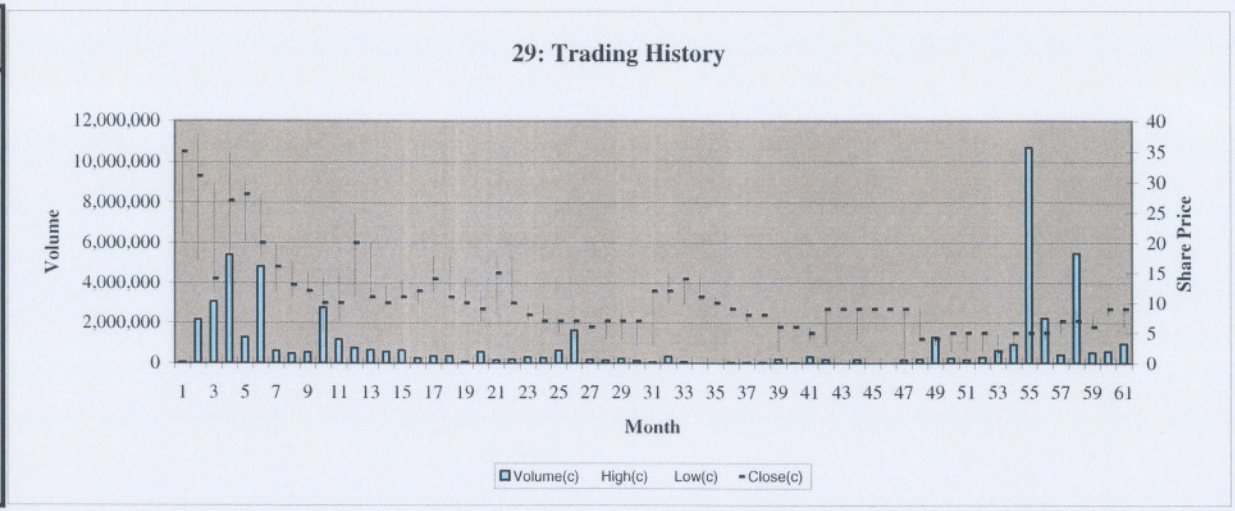


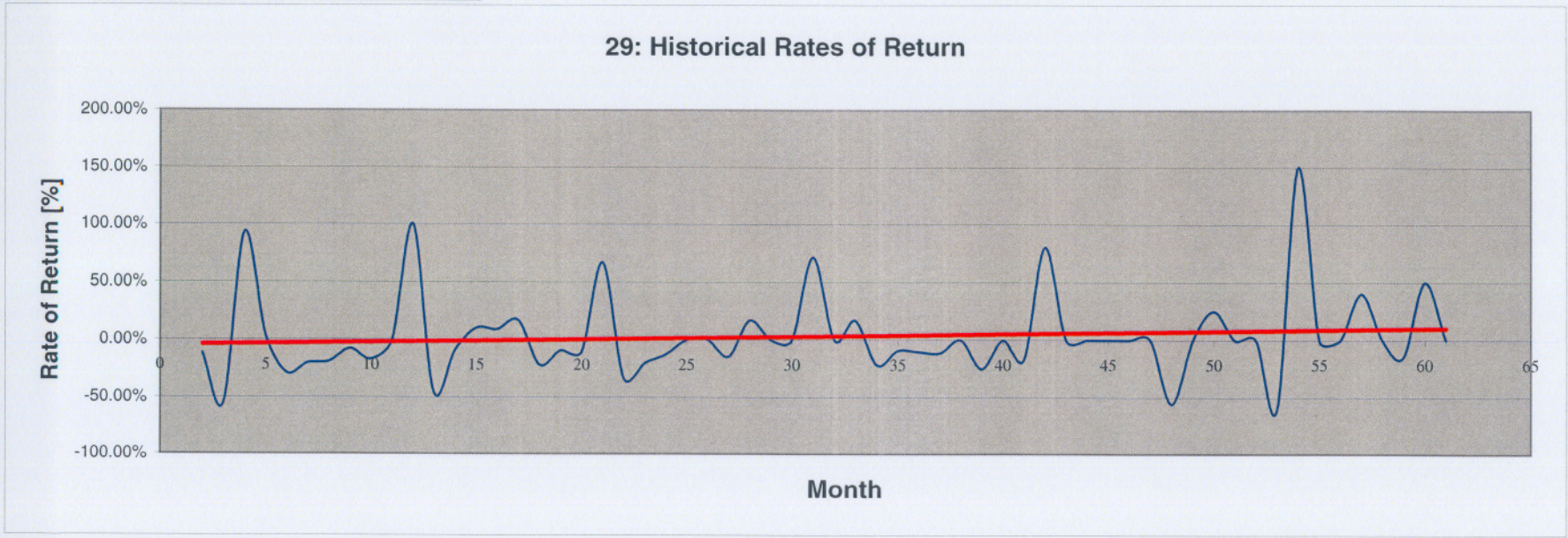
Company 28: Summary Calculation period: Week 28, 1998 to Week 28, 2004	
Historical Return	
Geometric Average	-2.10%
Standard Deviation	0.2688
Market Standard Deviation	0.0625
Beta	1.236
Risk Free Rate of Return	1.03%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.55%
Correlation Coefficient	0.2876
Coefficient of Determination	0.083
Coefficient of Variation	-12.79
Sharpe Ratio	-0.04
Required Rate of Return	1.65%



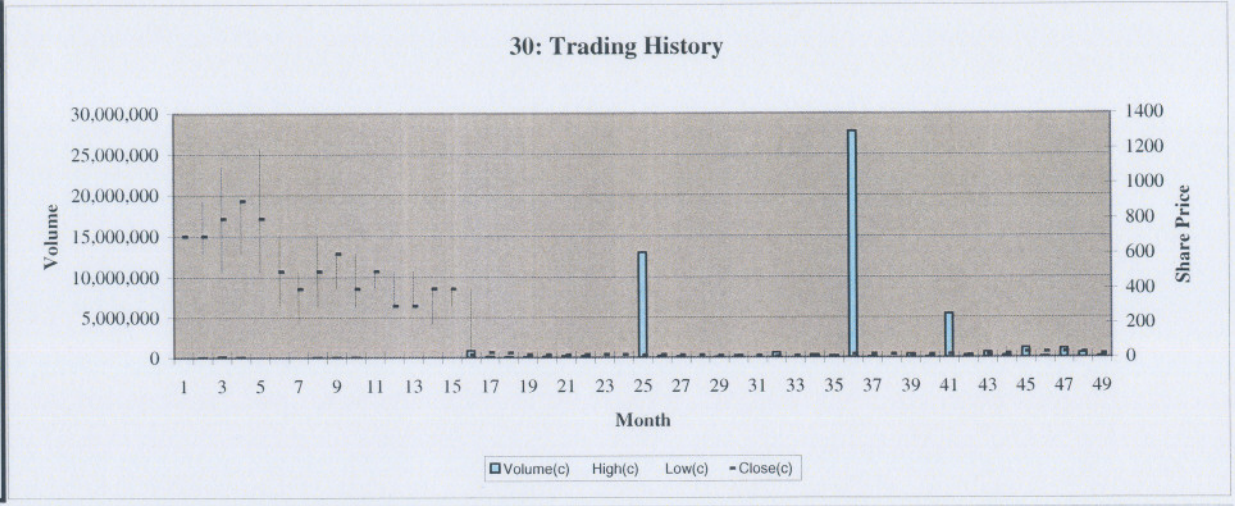


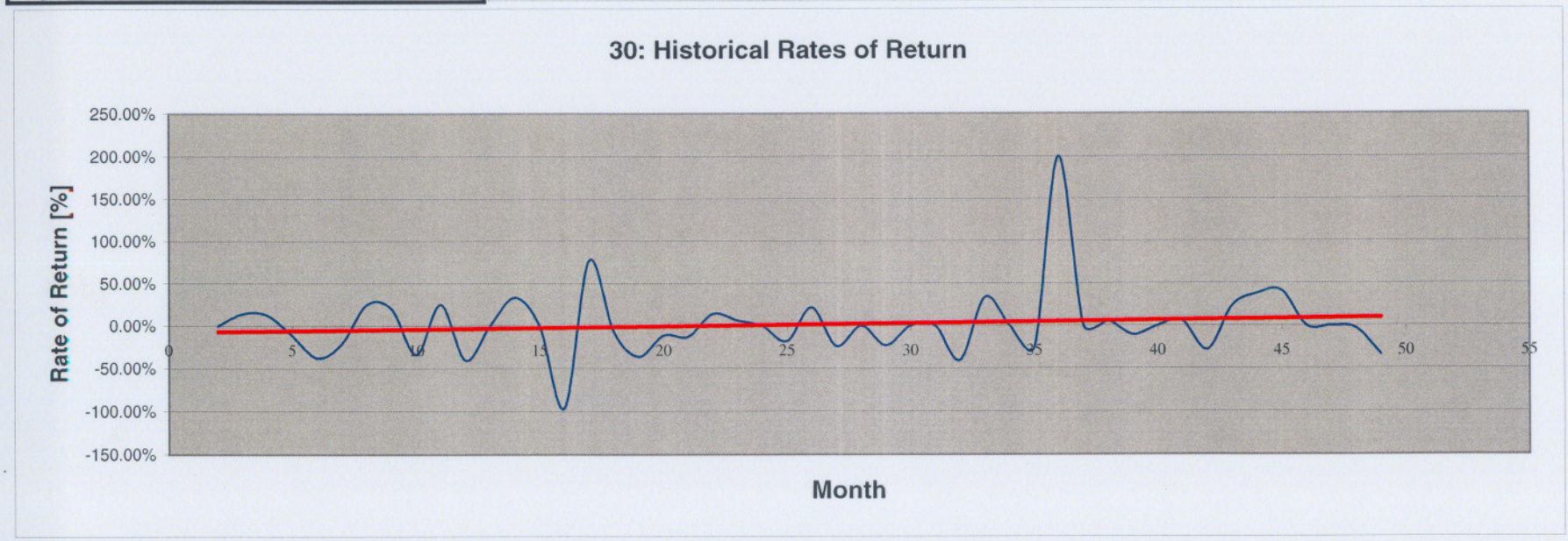
Company 29: Summary Calculation period: Week 28, 1999 to Week 28, 2004	
Historical Return	
Geometric Average	-2.20%
Standard Deviation	0.2782
Market Standard Deviation	0.0503
Beta	-0.516
Risk Free Rate of Return	0.98%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.82%
Correlation Coefficient	-0.093
Coefficient of Determination	0.009
Coefficient of Variation	-12.63
Sharpe Ratio	-0.08
Required Rate of Return	0.72%



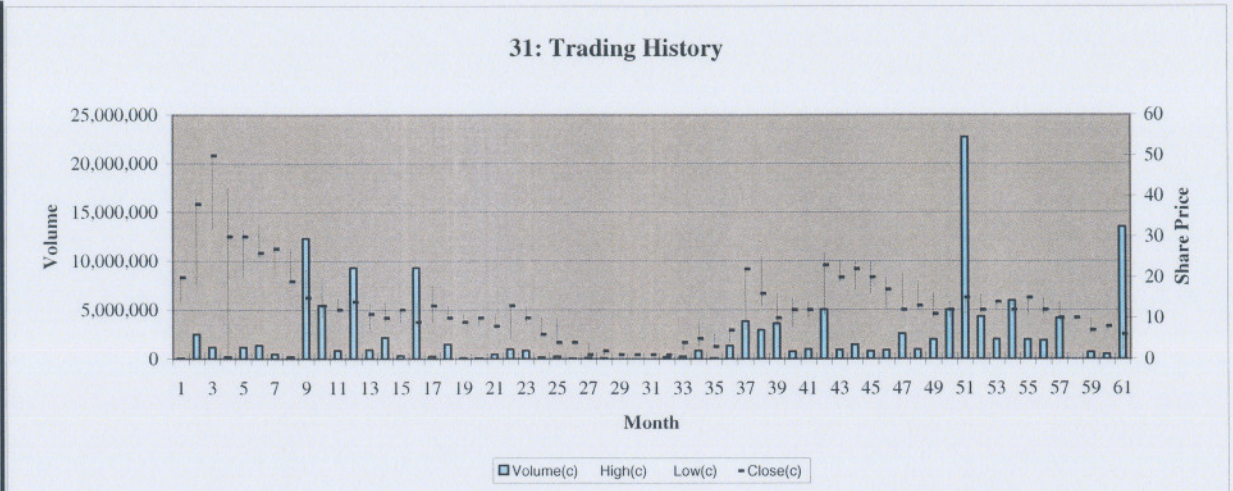


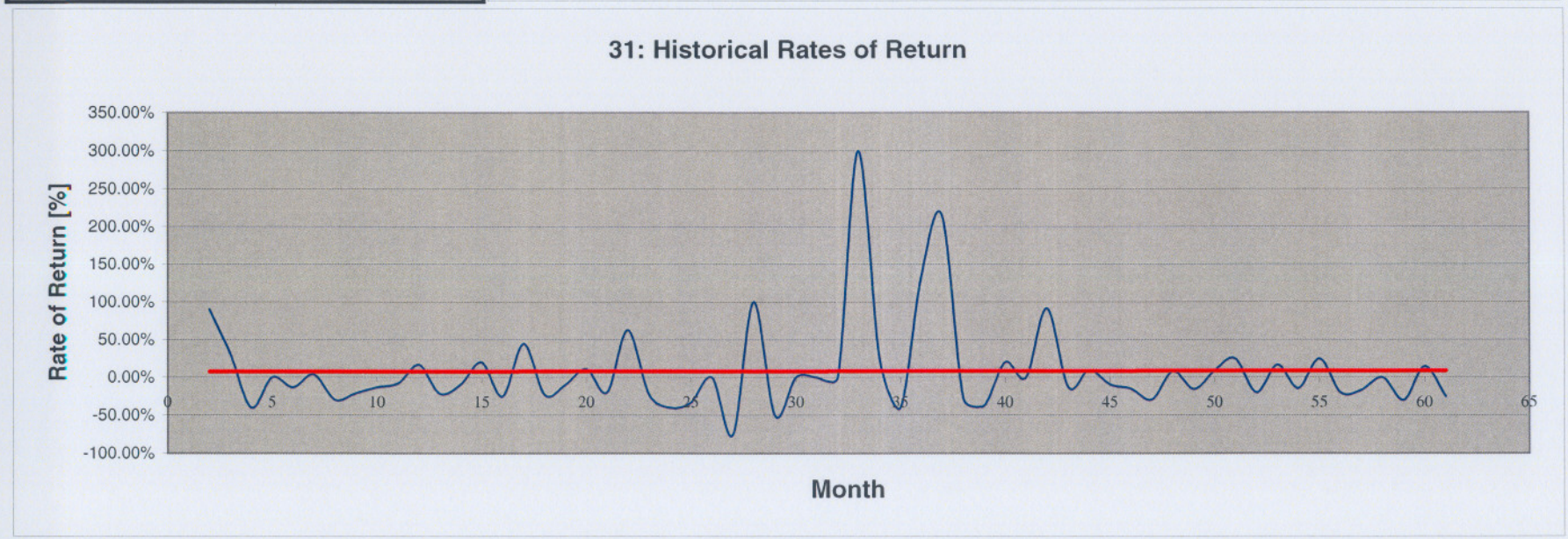
Company 30: Summary Calculation period: Week 28, 2000 to Week 28, 2004	
Historical Return	
Geometric Average	-7.00%
Standard Deviation	0.3411
Market Standard Deviation	0.0481
Beta	1.4777
Risk Free Rate of Return	0.92%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.70%
Correlation Coefficient	0.2086
Coefficient of Determination	0.044
Coefficient of Variation	-4.87
Sharpe Ratio	-0.19
Required Rate of Return	1.66%



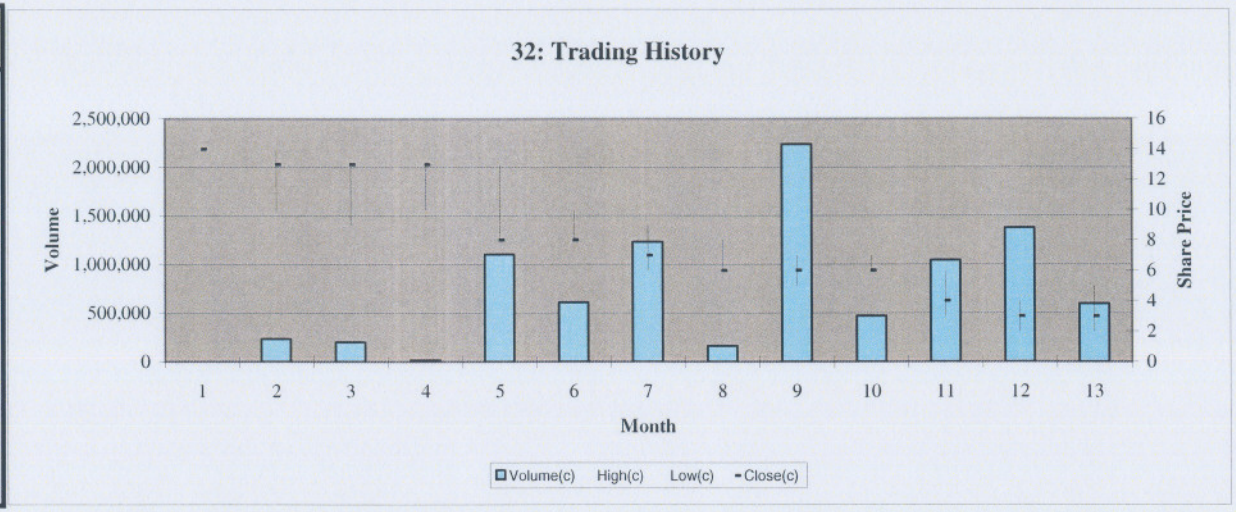


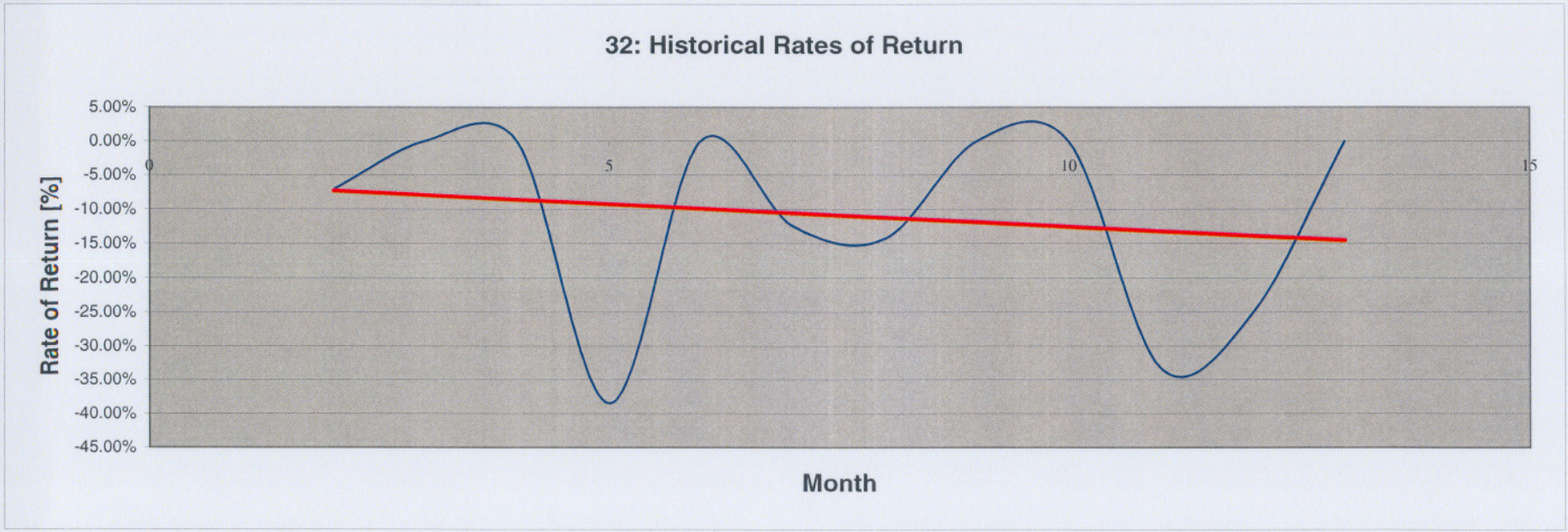
Company 31: Summary Calculation period: Week 28, 1999 to Week 28, 2004	
Historical Return	
Geometric Average	-1.95%
Standard Deviation	0.4689
Market Standard Deviation	0.0503
Beta	0.0069
Risk Free Rate of Return	0.98%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.82%
Correlation Coefficient	0.0007
Coefficient of Determination	
Coefficient of Variation	-23.99
Sharpe Ratio	-0.03
Required Rate of Return	0.98%



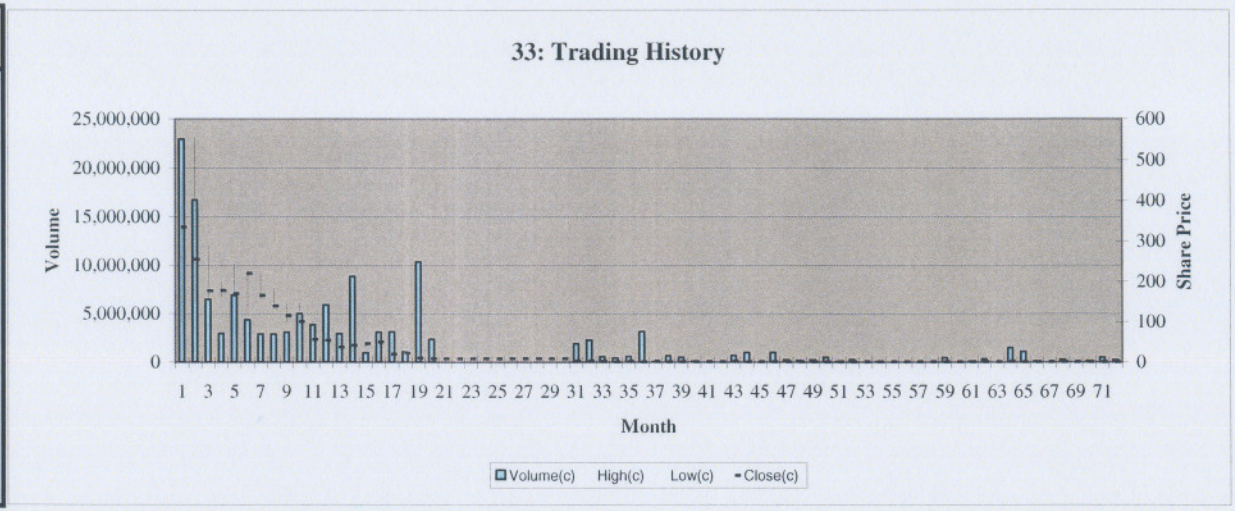


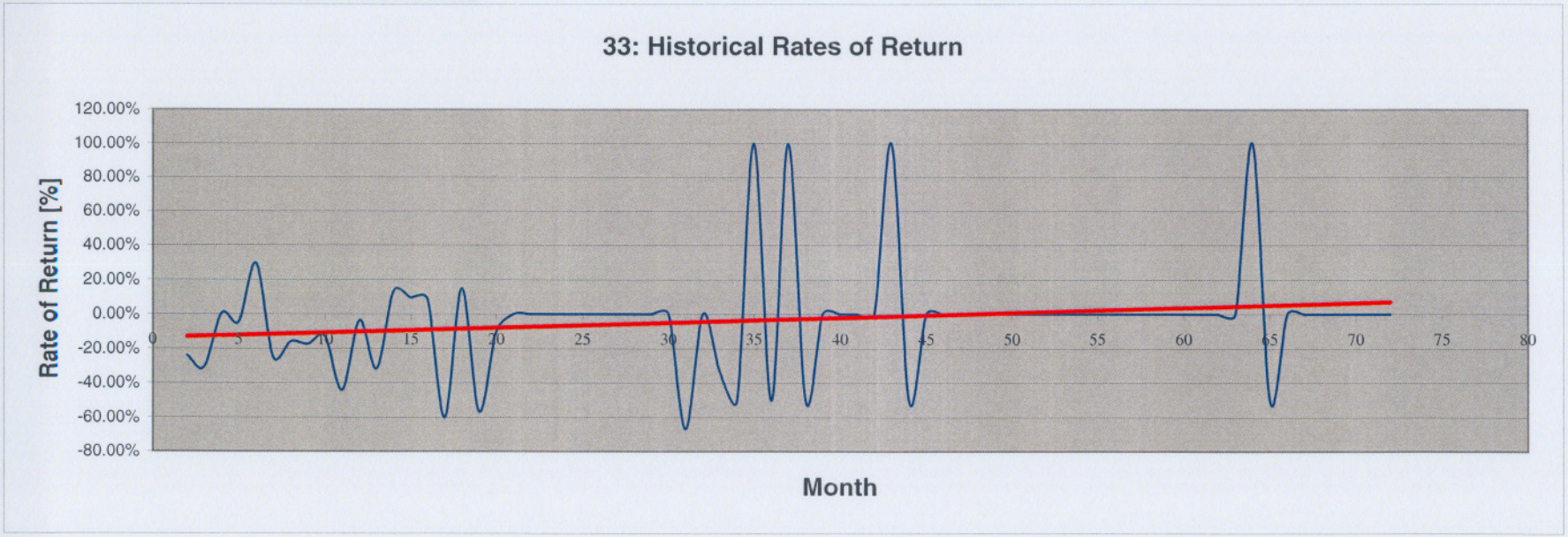
Company 32: Summary Calculation period: Week 28, 2003 to Week 28, 2004	
Historical Return	
Geometric Average	-11.17%
Standard Deviation	0.2693
Market Standard Deviation	0.0397
Beta	0.6218
Risk Free Rate of Return	0.78%
Market Risk Premium	0.50%
Market Historical Rate of Return	1.28%
Correlation Coefficient	0.0917
Coefficient of Determination	0.008
Coefficient of Variation	-2.41
Sharpe Ratio	-0.57
Required Rate of Return	1.09%



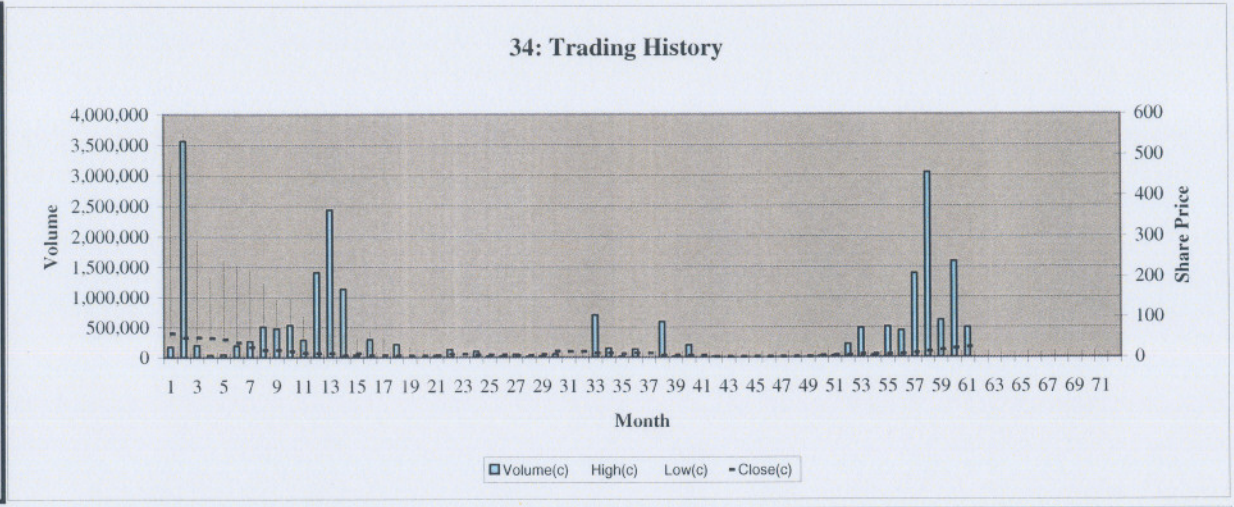


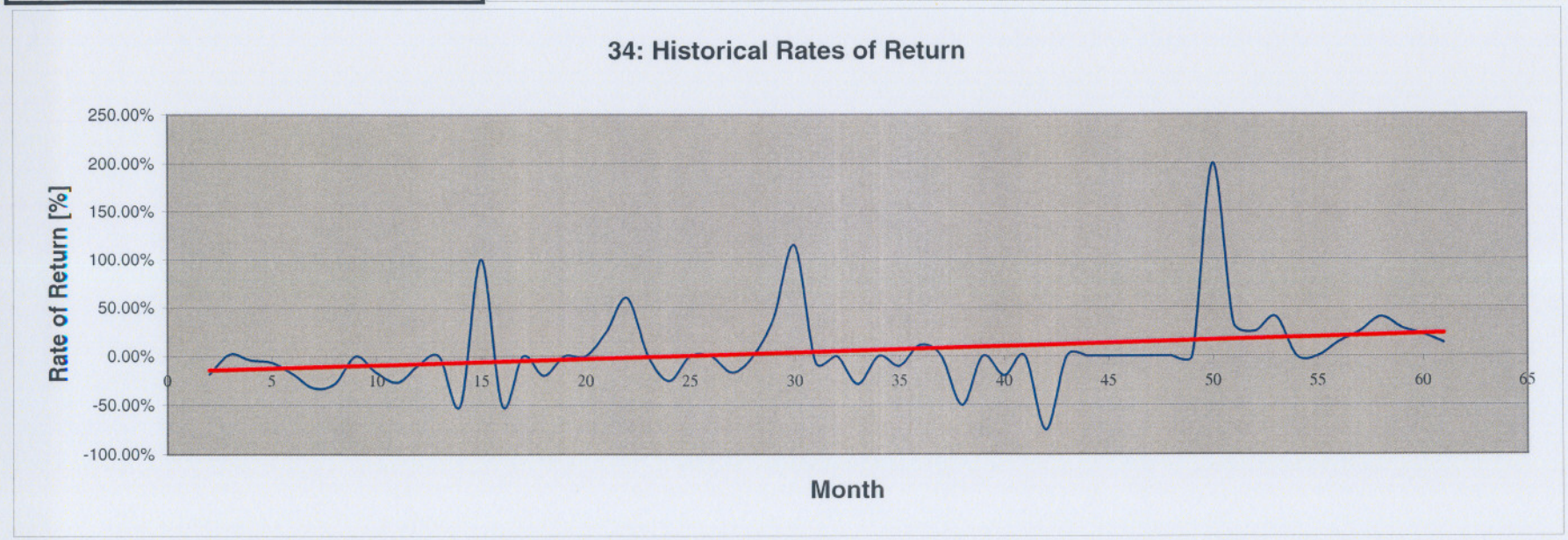
Company 33: Summary Calculation period: Week 32, 1998 to Week 28, 2004	
Historical Return	
Geometric Average	-7.76%
Standard Deviation	0.2839
Market Standard Deviation	0.0625
Beta	-0.391
Risk Free Rate of Return	1.03%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.55%
Correlation Coefficient	-0.086
Coefficient of Determination	0.007
Coefficient of Variation	-3.66
Sharpe Ratio	-0.23
Required Rate of Return	0.84%



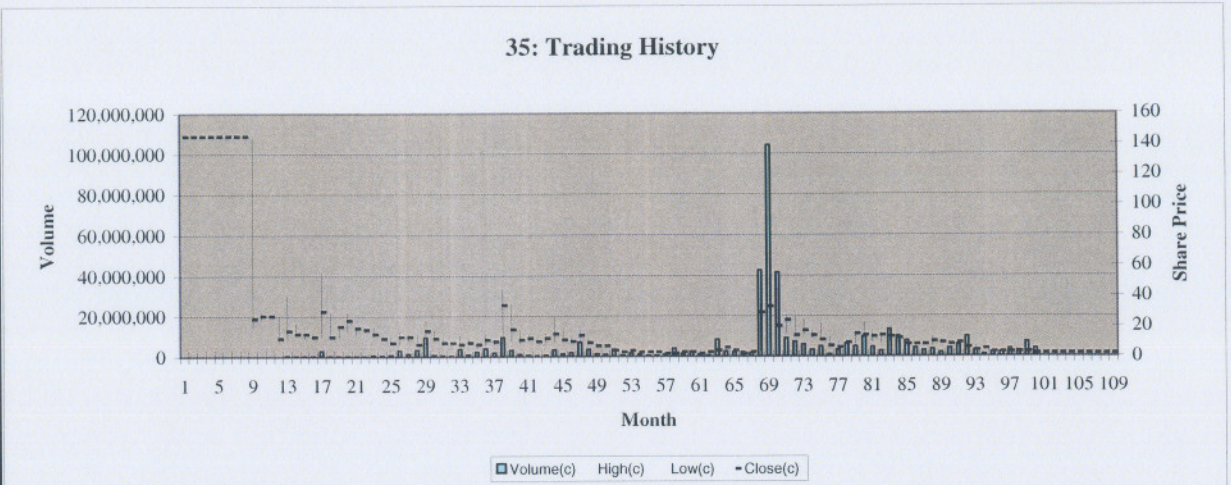


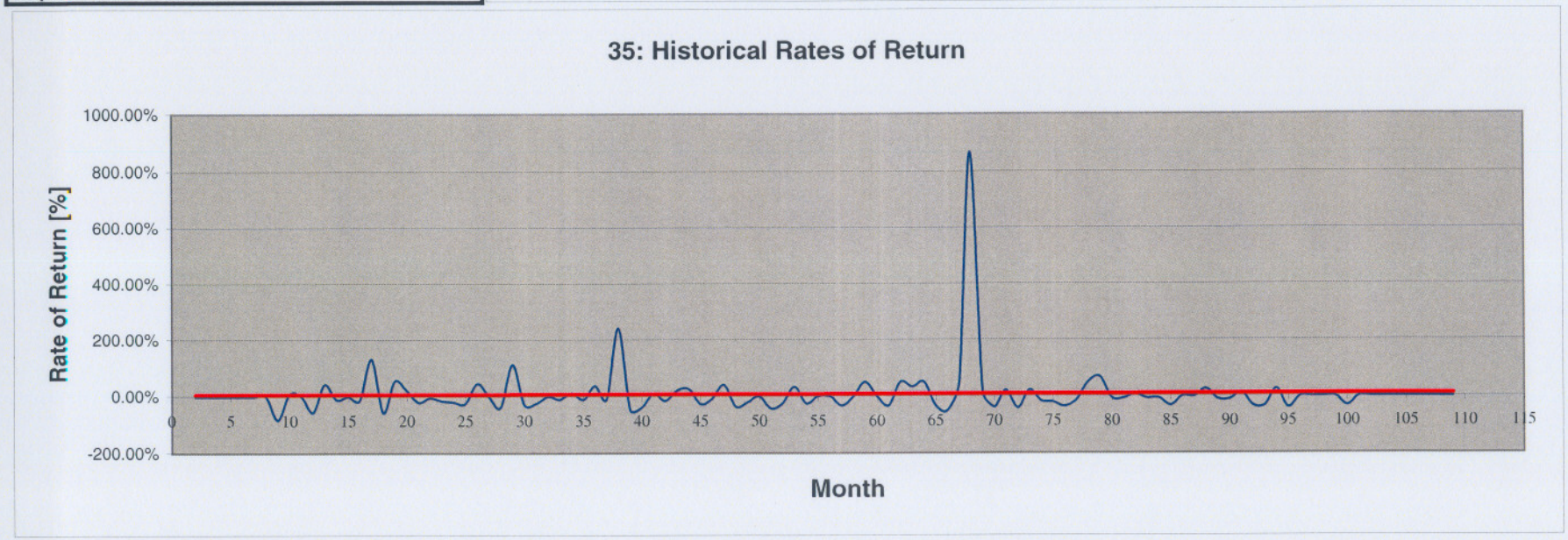
Company 34: Summary Calculation period: Week 28, 1999 to Week 28, 2004	
Historical Return	
Geometric Average	-2.78%
Standard Deviation	0.396
Market Standard Deviation	0.0503
Beta	0.1082
Risk Free Rate of Return	0.98%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.82%
Correlation Coefficient	0.0137
Coefficient of Determination	0.050
Coefficient of Variation	-14.22
Sharpe Ratio	-0.06
Required Rate of Return	1.03%



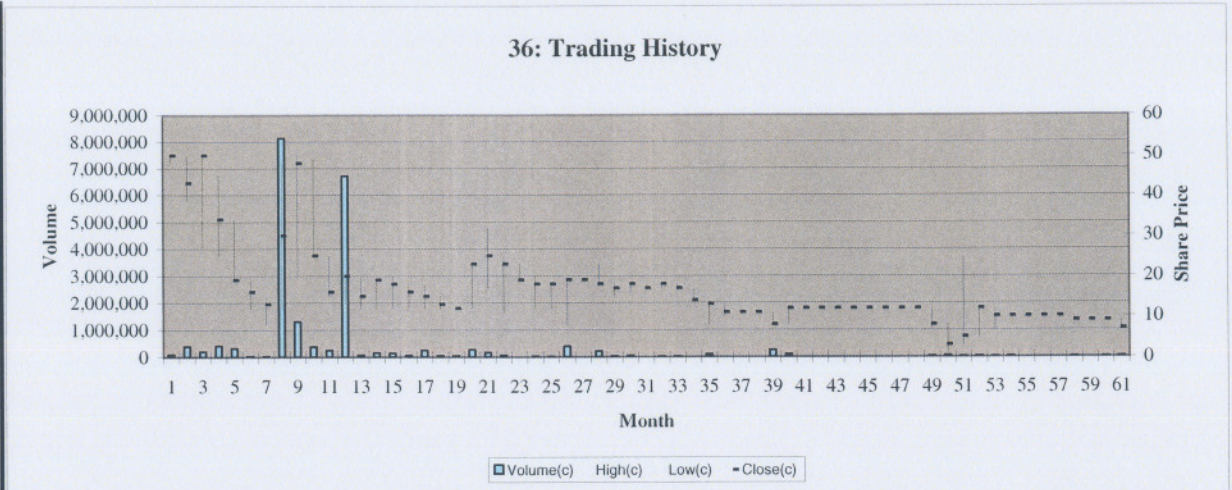


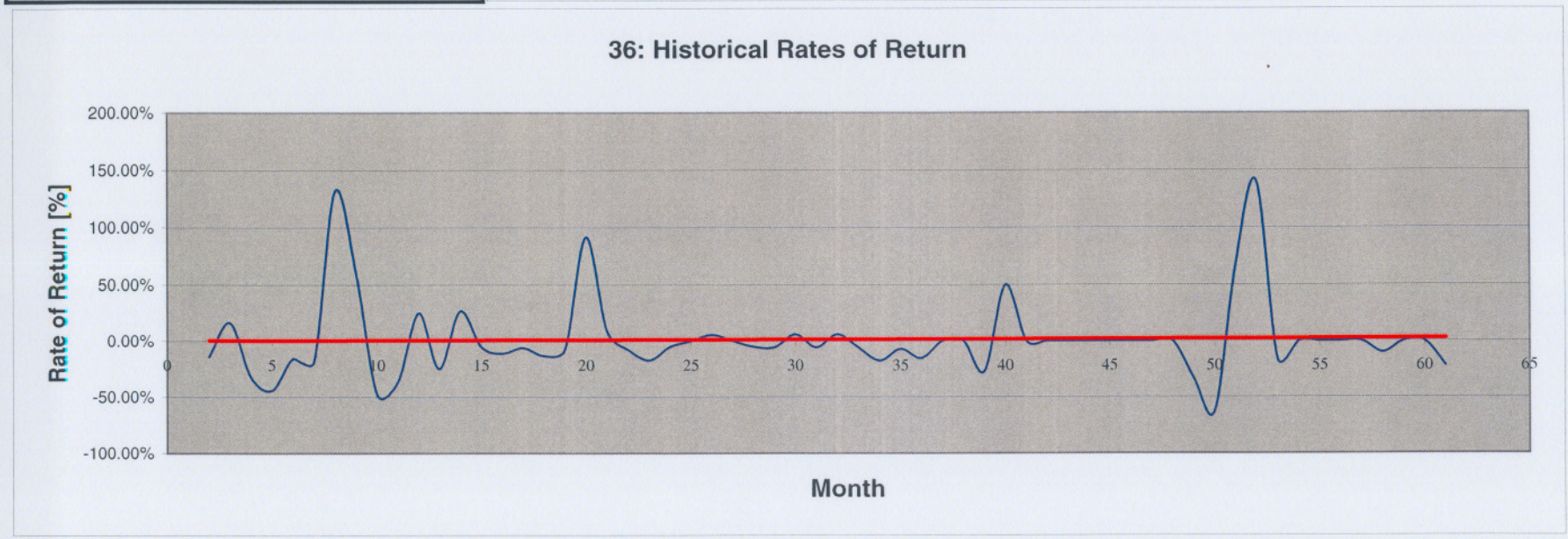
Company 35: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	-3.85%
Standard Deviation	0.4424
Market Standard Deviation	0.0595
Beta	1.341
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.1805
Coefficient of Determination	0.033
Coefficient of Variation	-11.48
Sharpe Ratio	-0.04
Required Rate of Return	1.77%



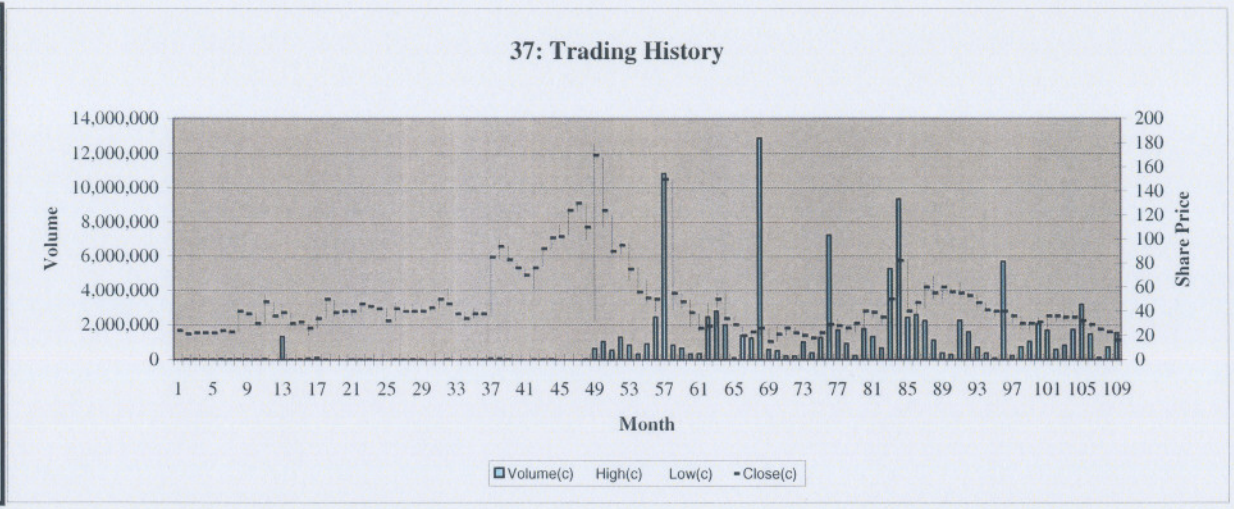


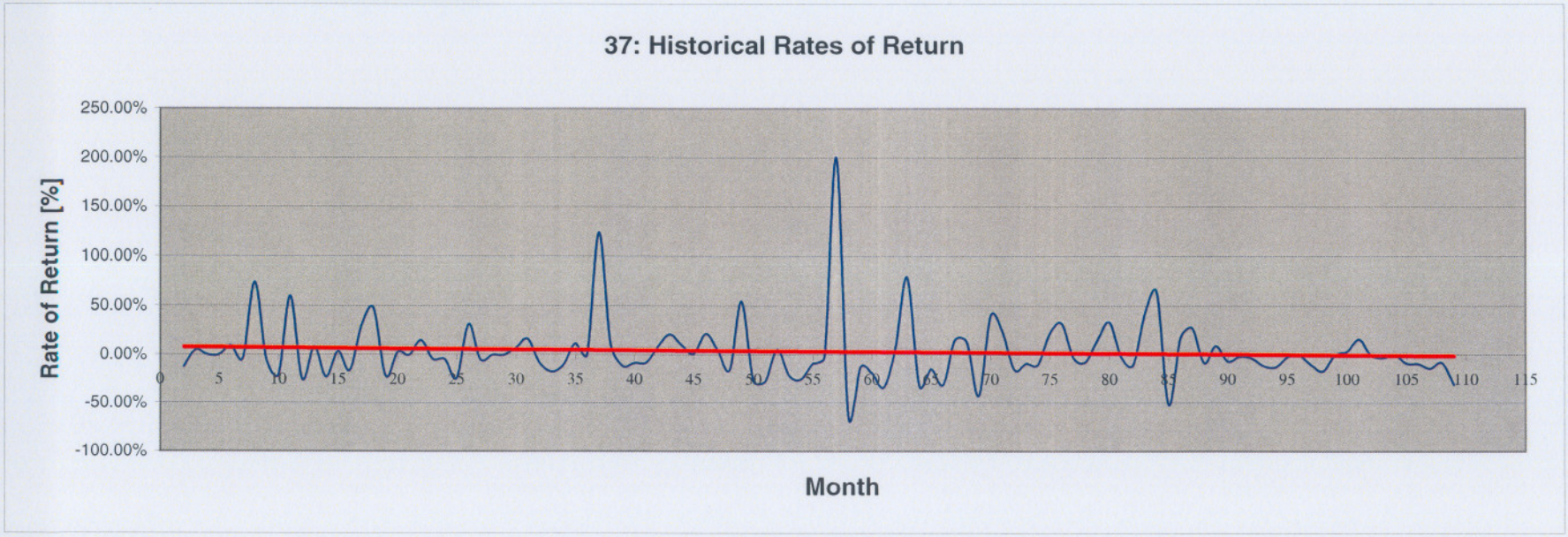
Company 36: Summary Calculation period: Week 28, 1999 to Week 28, 2004	
Historical Return	
Geometric Average	-3.17%
Standard Deviation	0.3332
Market Standard Deviation	0.0503
Beta	-0.15
Risk Free Rate of Return	0.98%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.82%
Correlation Coefficient	-0.023
Coefficient of Determination	0.001
Coefficient of Variation	-10.51
Sharpe Ratio	-0.09
Required Rate of Return	0.90%



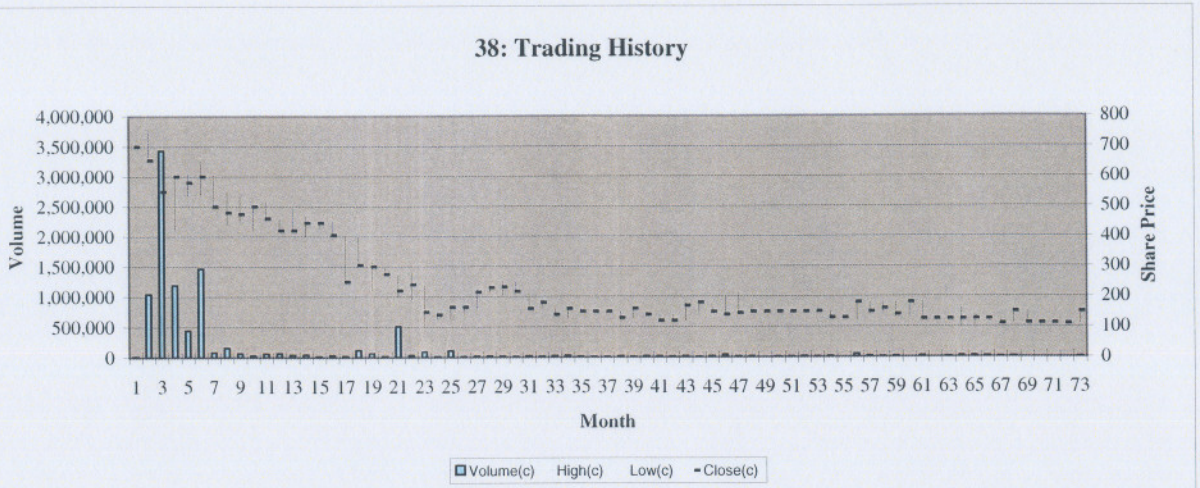


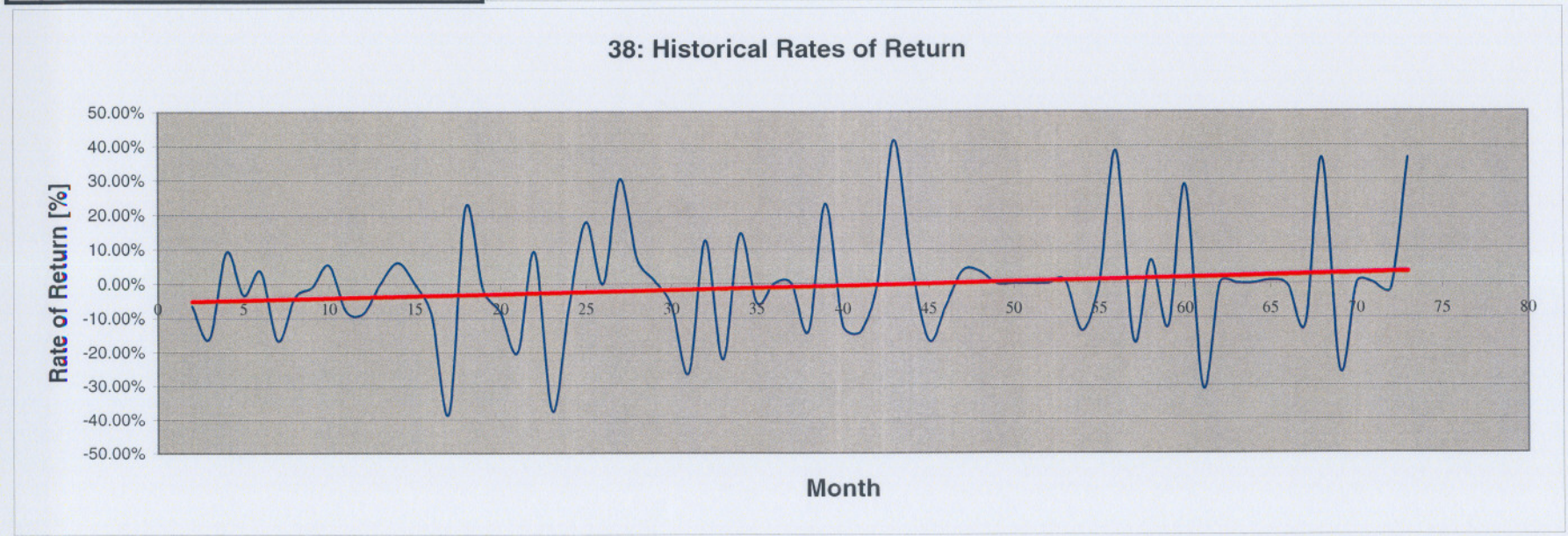
Company 37: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	-0.37%
Standard Deviation	0.2654
Market Standard Deviation	0.0595
Beta	-0.342
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	-0.077
Coefficient of Determination	0.006
Coefficient of Variation	-71.48
Sharpe Ratio	0.02
Required Rate of Return	0.93%



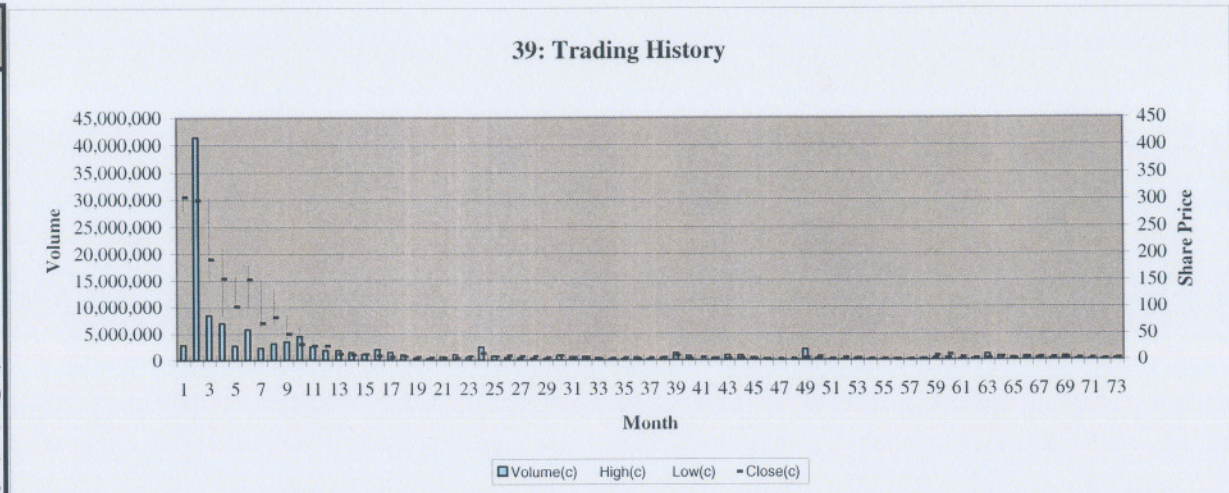


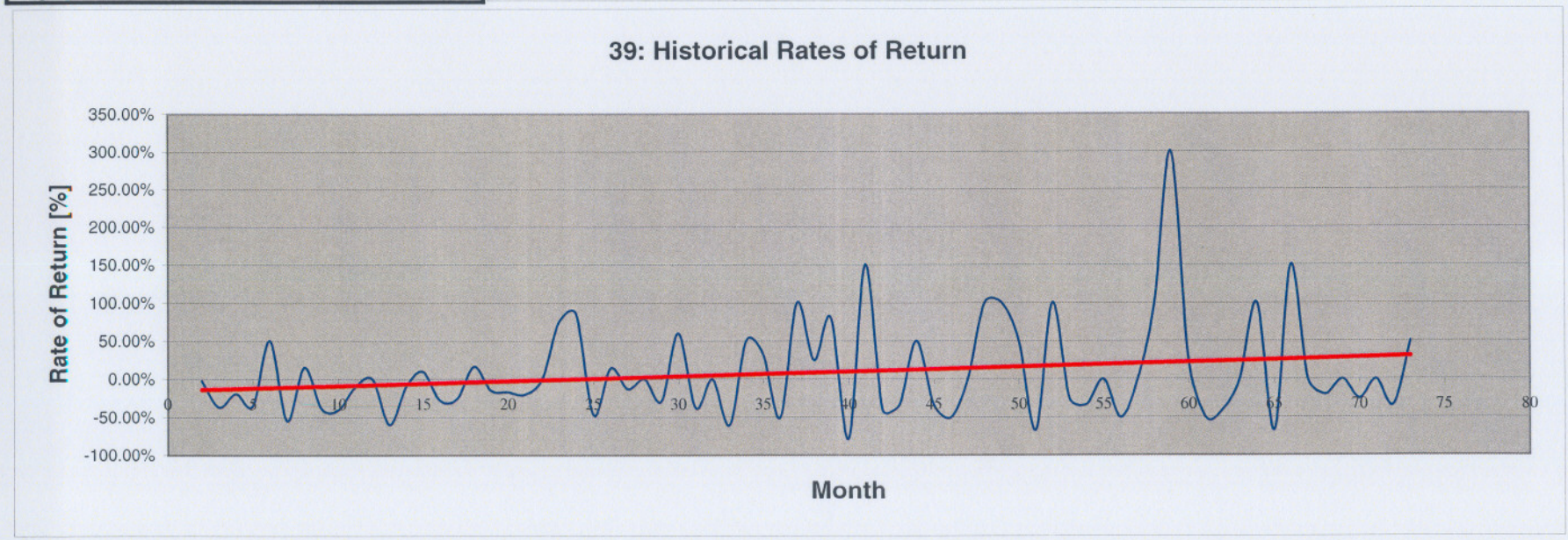
Company 38: Summary Calculation period: Week 28, 1998 to Week 28, 2004	
Historical Return	
Geometric Average	-2.09%
Standard Deviation	0.1618
Market Standard Deviation	0.0625
Beta	0.5589
Risk Free Rate of Return	1.03%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.55%
Correlation Coefficient	0.2161
Coefficient of Determination	0.047
Coefficient of Variation	-7.75
Sharpe Ratio	-0.12
Required Rate of Return	1.31%



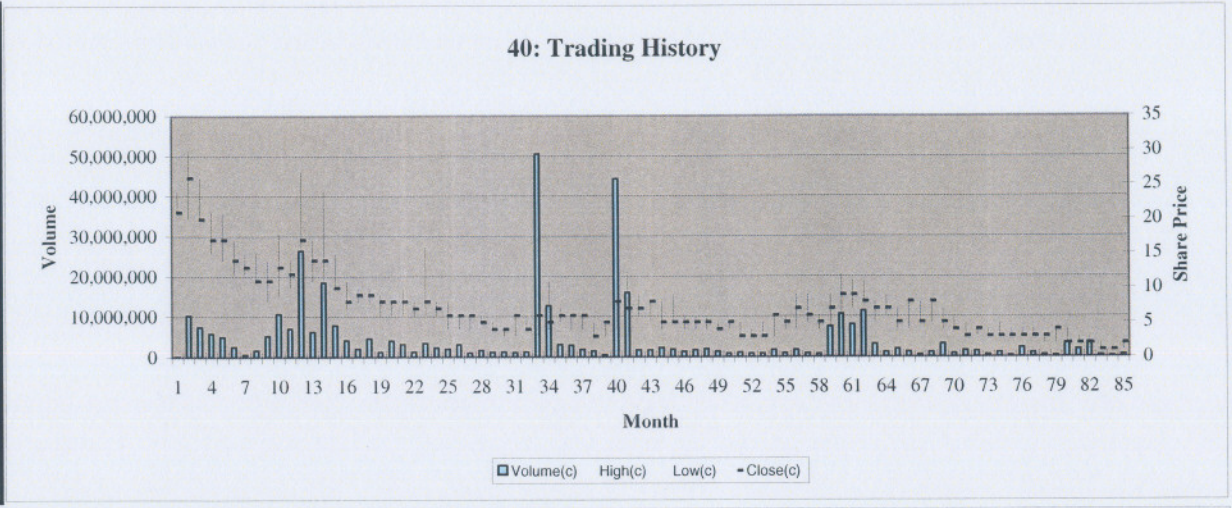


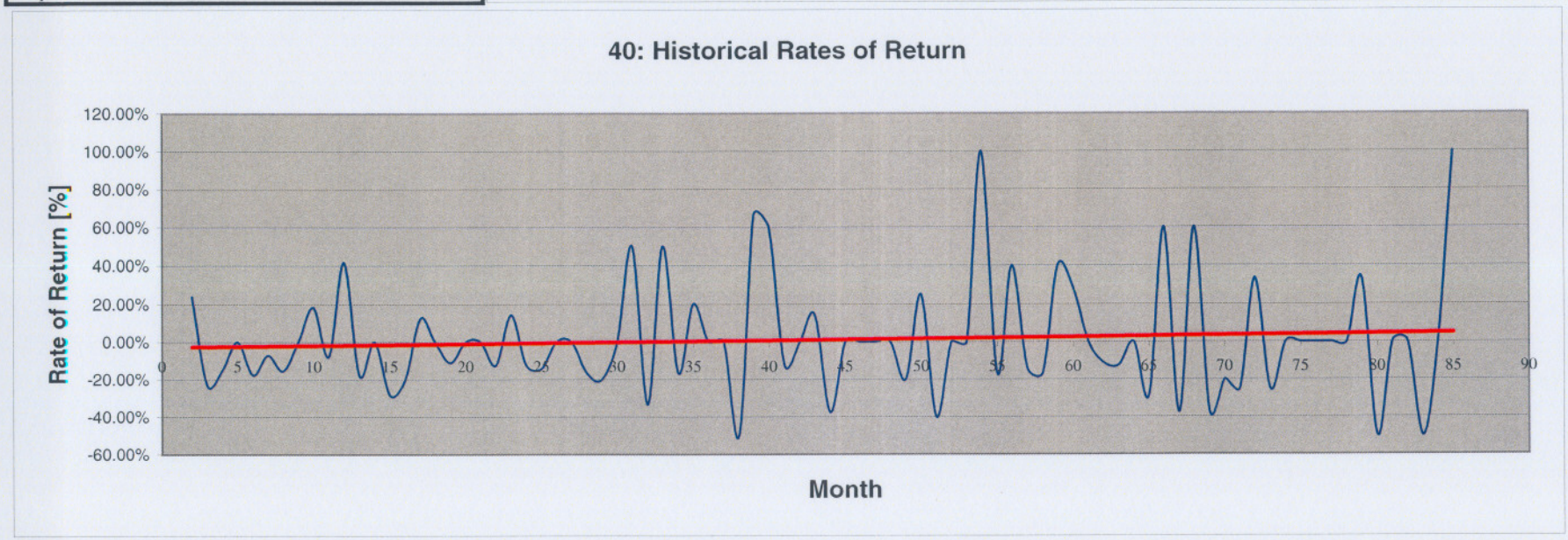
Company 39: Summary Calculation period: Week 28, 1998 to Week 28, 2004	
Historical Return	
Geometric Average	-6.13%
Standard Deviation	0.6522
Market Standard Deviation	0.0625
Beta	-0.141
Risk Free Rate of Return	1.03%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.55%
Correlation Coefficient	-0.014
Coefficient of Determination	0.000
Coefficient of Variation	-10.63
Sharpe Ratio	-0.03
Required Rate of Return	0.96%



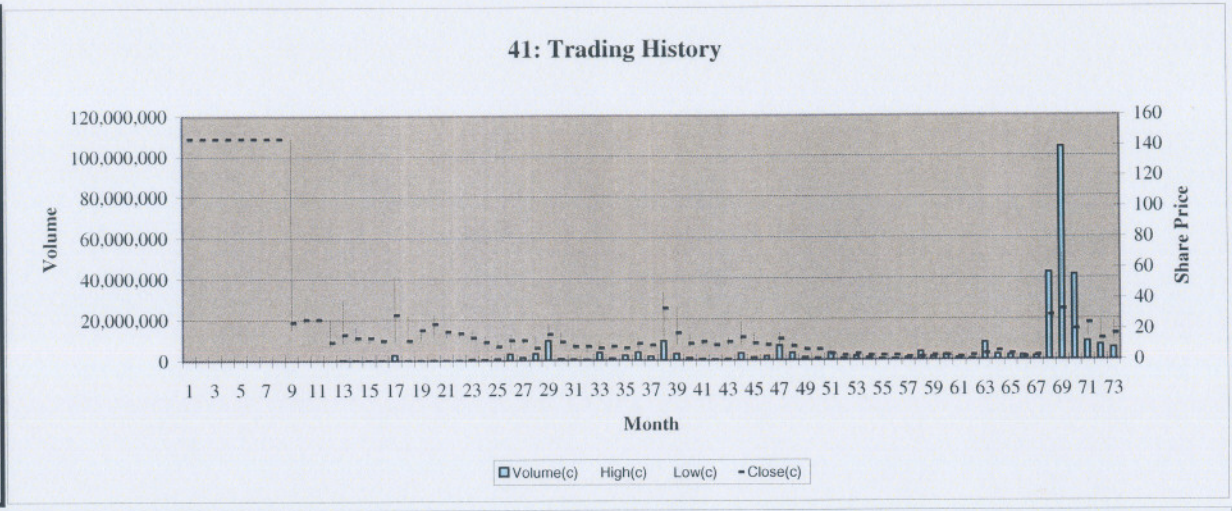


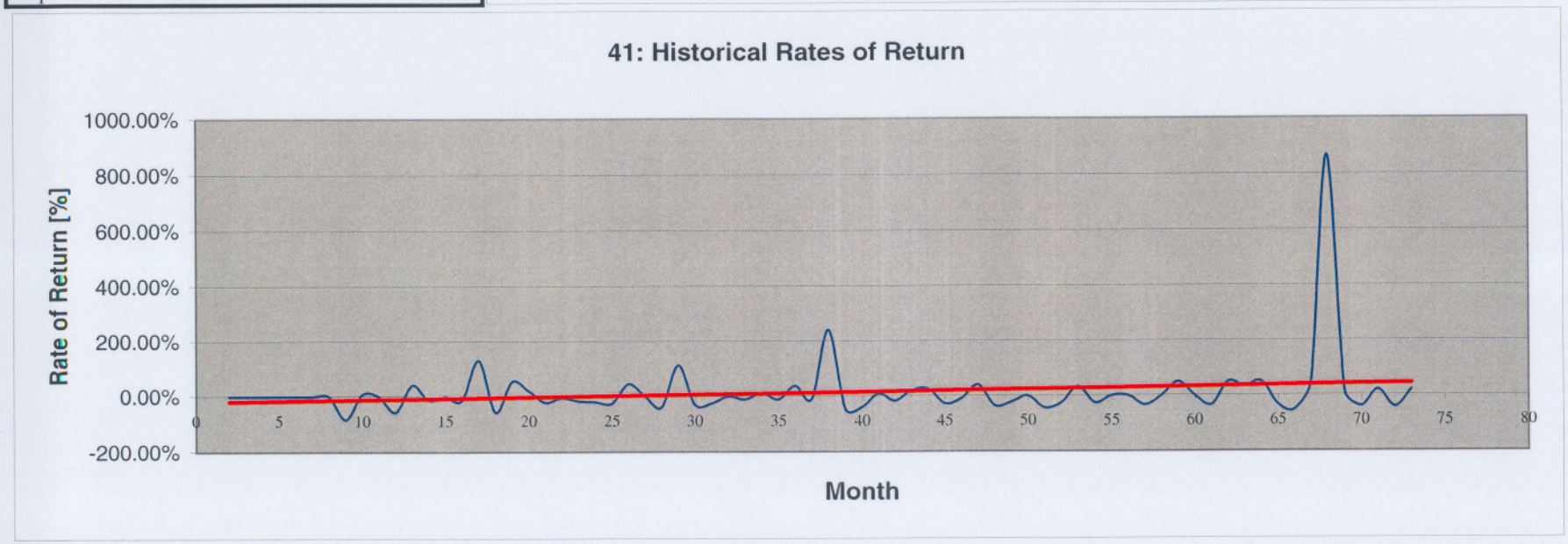
Company 40: Summary Calculation period: Week 28, 1997 to Week 28, 2004	
Historical Return	
Geometric Average	-2.73%
Standard Deviation	0.2926
Market Standard Deviation	0.0651
Beta	0.4873
Risk Free Rate of Return	1.05%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.56%
Correlation Coefficient	0.1084
Coefficient of Determination	0.012
Coefficient of Variation	-10.72
Sharpe Ratio	-0.05
Required Rate of Return	1.29%



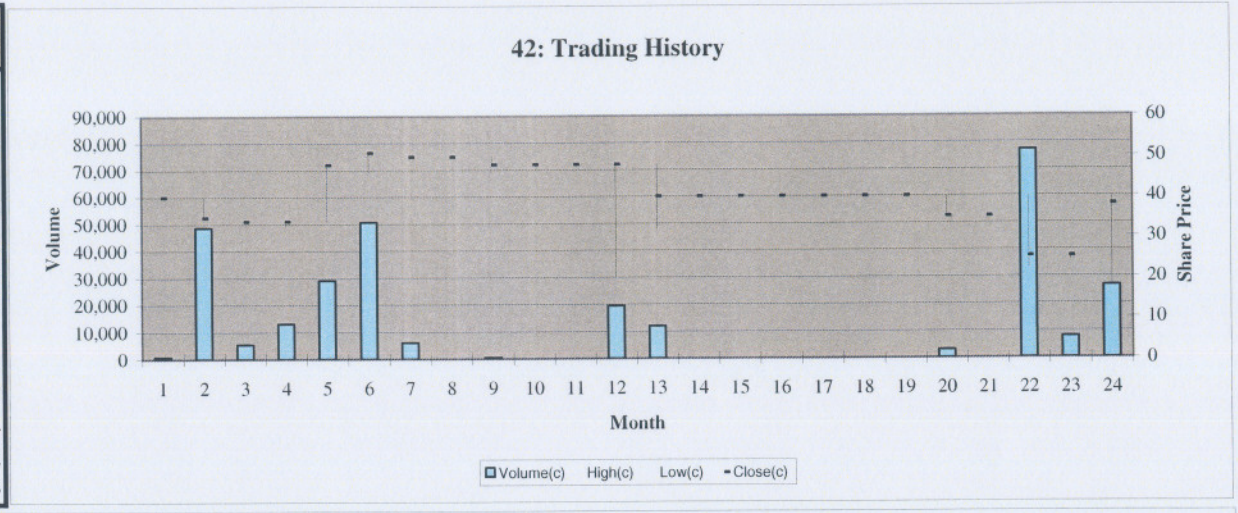


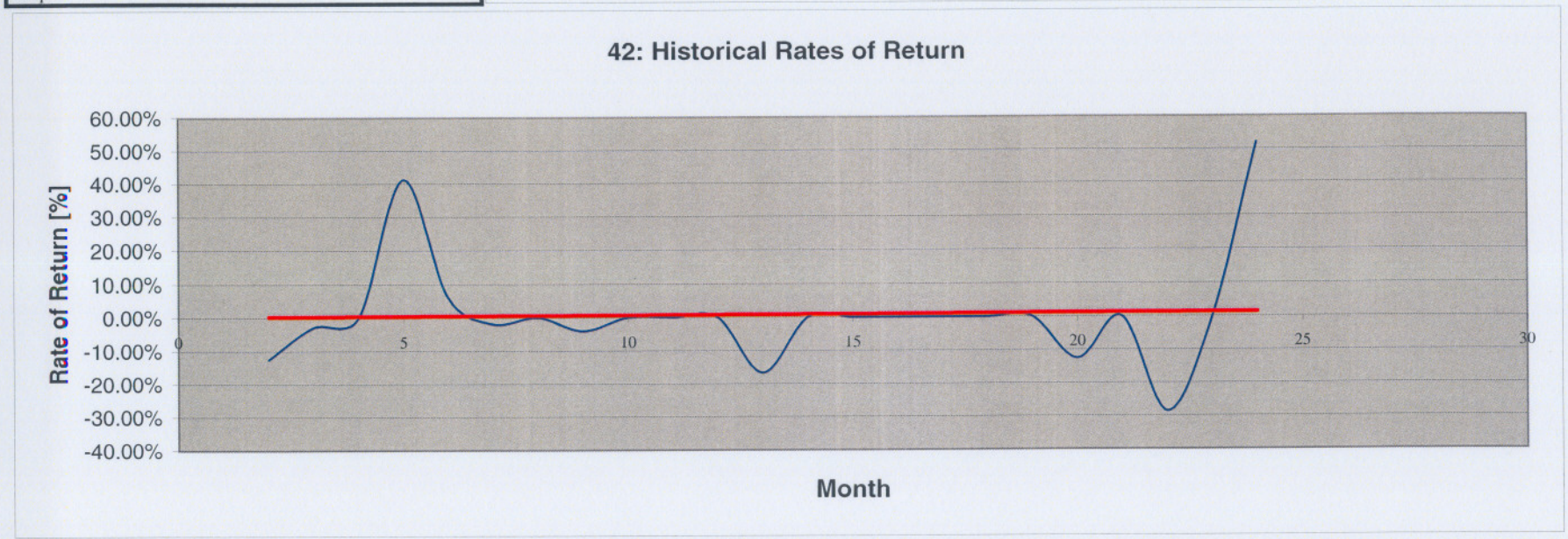
Company 41: Summary Calculation period: Week 28, 1998 to Week 28, 2004	
Historical Return	
Geometric Average	-2.89%
Standard Deviation	2.3394
Market Standard Deviation	0.0625
Beta	-2.604
Risk Free Rate of Return	1.03%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.55%
Correlation Coefficient	-0.07
Coefficient of Determination	0.005
Coefficient of Variation	-80.85
Sharpe Ratio	0.06
Required Rate of Return	-0.27%



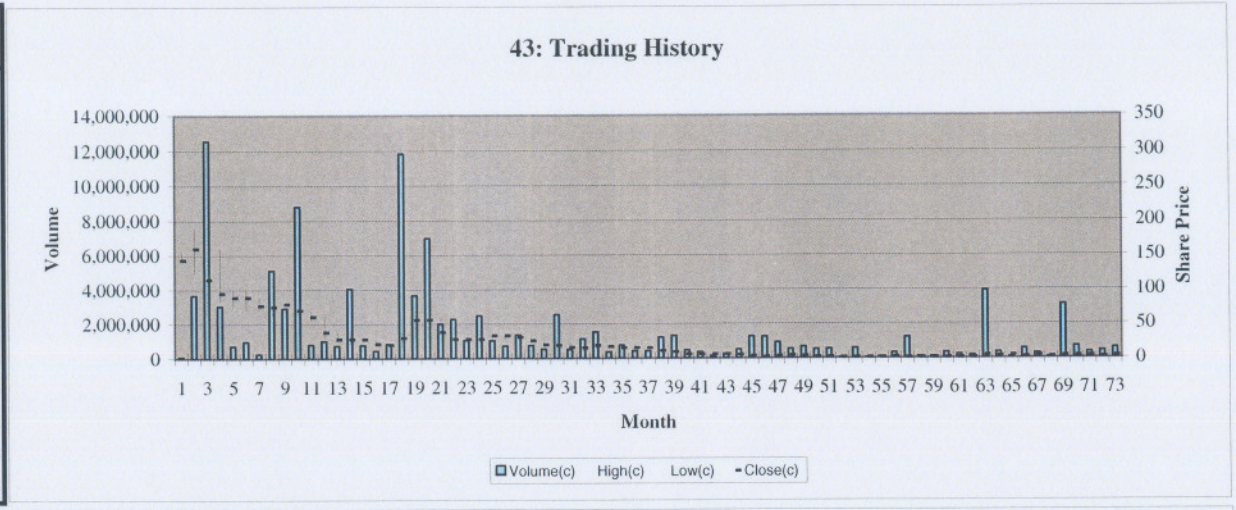


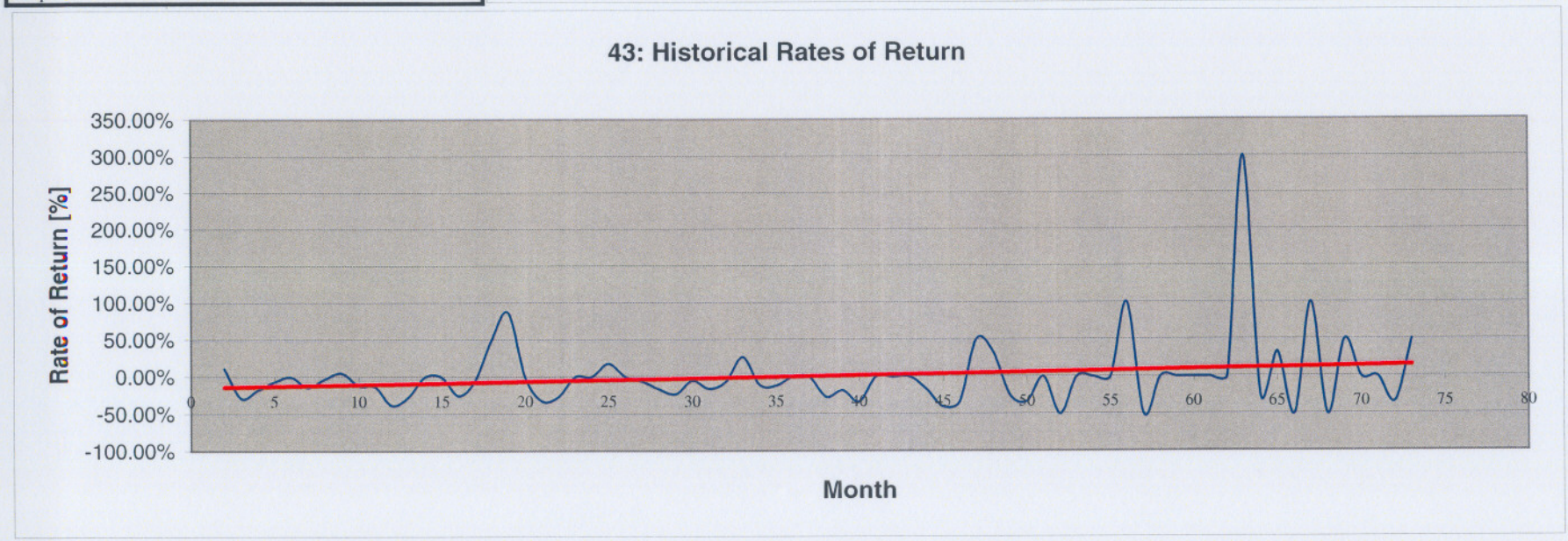
Company 42: Summary Calculation period: Week 32, 2002 to Week 28, 2004	
Historical Return	
Geometric Average	-0.21%
Standard Deviation	0.1602
Market Standard Deviation	0.0431
Beta	-0.316
Risk Free Rate of Return	0.84%
Market Risk Premium	0.50%
Market Historical Rate of Return	-0.41%
Correlation Coefficient	-0.085
Coefficient of Determination	0.007
Coefficient of Variation	-75.04
Sharpe Ratio	0.22
Required Rate of Return	0.68%





Company 43: Summary Calculation period: Week 28, 1998 to Week 28, 2004	
Historical Return	
Geometric Average	-5.16%
Standard Deviation	0.3556
Market Standard Deviation	0.0625
Beta	1.5742
Risk Free Rate of Return	1.03%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.55%
Correlation Coefficient	0.2769
Coefficient of Determination	0.077
Coefficient of Variation	-6.90
Sharpe Ratio	-0.10
Required Rate of Return	1.82%





Company 44: Summary Calculation period: Week 28, 1995 to Week 28, 2004	
Historical Return	
Geometric Average	-1.69%
Standard Deviation	0.48
Market Standard Deviation	0.0595
Beta	0.712
Risk Free Rate of Return	1.10%
Market Risk Premium	0.50%
Market Historical Rate of Return	0.68%
Correlation Coefficient	0.0883
Coefficient of Determination	0.008
Coefficient of Variation	-28.36
Sharpe Ratio	0.01
Required Rate of Return	1.46%

