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Determining optimum P/E ratio regarding the risk and return in Iran Stock Exchange using goal programming

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Abstract: Investors usually try to find best ways and models to get the best decisions in the capital markets. So they use some tools for evaluating the overall situation of their choices. In this way, the price-earnings ratio has received considerable attention within the broader field of finance. Because of twosome aspect of this ratio, usually achieving a final best result is very hard. But as simple calculation, this ratio can't be ignored. So investors attempt to look the price-earnings ratio in context with other factors to get the better results. However, existing research will show how we can confine this ratio and suggest adaptable limitation for that in the Iran(Tehran) Exchange Market regarding to the risk and return. For doing this, the concept of Goal Programming GP) for suggesting the best answers have been used.

Key words: Beta, Goal Programming, P/E ratio, Return, Risk

1. Introduction

Since calculating the size of risk and return in the dynamic stock markets are not very simple, we should find a faster way to look these aspects. One of the most famous and common tools in stock markets that has both return and risk content is P/E ratio. According to the twosome aspects of P/E coefficient, in this research will be tried to find the best limitation of this coefficient regarding to the risk and return. In the process of defining the best answer, Goal Programming content will be used. The first step is to define the P/E, risk and return for cases.

The remainder of this paper proceeds as follows. Section 2 reviews the content of return and risk in assets. In this section, the risk and different aspects of it will be discus and describes the methodology employed in the calculations of risk. Section 3 reviews the existing literature on the P/E effect. Section 4 describes Goal Programming procedure. Section 5 examines methodology of the research. In section 6 we'll analyze the data that employed. And finally in section 7 results of research will be discus.

2. Return and Risk

The annual return on an investment, expressed as a percentage of the total amount invested, also called rate of return. This can be calculated in different periods simply by dividing all gains from an asset to the money that have spent for it. For stocks, the price in first of a period is spending, dividend and last price in that period are the gains.

In finance, risk has no one definition, but some theorists, notably Ron Dembo, have defined quite general methods to assess risk as an expected after-the-fact level of regret. Such methods have been uniquely successful in limiting interest rate risk in financial markets. Financial markets are considered to be a proving ground for general methods of risk assessment. However, these methods are also hard to understand.

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Different measurements are used for calculating the risk in financial markets. Standard deviation and beta are most useful measurements. Standard deviation calculates deviance of return from its average whereas beta presents the sensitivity of stock return relating to the market return.

An asset exhibits both systematic and unsystematic risk. The portion of its volatility which is considered systematic is measured by the degree to which its returns vary relative to those of the overall market. To quantify this relative volatility, a parameter called beta was conceived as a measure of the risk contribution of an individual security to a well diversified portfolio:

$$\beta_a = \frac{\mathrm{Cov}(r_a, r_p)}{\mathrm{Var}(r_p)}, \quad \text{where:} \tag{1}$$

r_a is the return of the asset
r_p is the rate of return of the portfolio
$\mathrm{Var}(r_p)$ is the variance of the return of the portfolio, and
$\mathrm{cov}(r_a, r_p)$ is covariance between the return of the portfolio and the return of the asset.

3. Price – earning ratio

The P/E ratio (price-to-earnings ratio) of a stock (also called its "P/E", or simply "multiple") is a measure of the price paid for a share relative to the annual net income or profit earned by the firm per share. The P/E ratio can therefore alternatively be calculated by dividing the company's market capitalization by its total annual earnings.

$$\mathrm{P/E\ ratio} = \frac{\text{Price per Share}}{\text{Annual Earnings per Share}} \tag{2}$$

Historical P/E and estimated P/E are perhaps the statistics most widely used to describe a company. That the historical P/E can be used as an indicator of future returns has been known for almost fifty years, since Nicholson (1960). Value or contrarian investment styles essentially involve purchasing stocks that are out of favour with other investors, and are employed by many large fund managers. Holding low P/E stocks as an investment strategy was also one of the main themes in Dreman (1998).

4. Goal programming

The Goal Programming(GP) can be regarded as one of the most widely used multi criteria decision-making techniques. This model has been introduced by Charnes, Cooper and Ferguson (1955) and more explicitly defined by Charnes and Cooper (1961). Since then, a great number of works related to GP have been appeared in the scientific literature. GP is simply a mathematical technique which investigates the relationships among a set of desired goals and the resources available to achieve them. Goals may be either economic or noneconomic. Goals are achieved according to priority; the higher priority goals being given precedence in the allocation of resources over those of lower priority. Within a particular priority level, sub goals may be specified by use of a weighting factor.

In its most basic form, GP consists of an objective function which minimizes deviations from specified goals:

$$\text{Minimize } Z=\sum_{j=1}^{n} wt\ Pt(d_t^{\ -} + d_t^{\ +}) \tag{3}$$

and a set of constraint equation:

$$\sum_{j=1}^{m} a_{tj}X_j + d_t^{\ -} - d_t^{\ +} = b_t$$

The constraint equations specify various goal or physical constraint levels(bi) , Assignment of activities(X_j),which may be in the form of hours of labor, dollars, trees, acres, etc., is dictated by the objective function, which minimizes both negative(d_i^-) and positive(di^+) deviations from specified goals according to their respective priority (P_i), and a weighting factor (w_i), if any. Production coefficients(a_{ij}) represent the relationship between the particular activity and the magnitude of its contribution to achieving the specified goal.

Steuer and Na (2003) found that the GP is the most used category of multi criteria decision-making in the finance area, including, portfolio analysis, capital budgeting, financial planning, commercial bank management. Azmi and Tamiz (2010) presented a review of the application of GP and its variants to

portfolio analysis. Original portfolio selection problems, with risk and return optimization can be viewed as a GP with two objectives. For a more realistic approach to portfolio selection problem, additional objectives representing other factors can be introduced.

5. Methodology

Over 450 companies were listed in Tehran Stock exchange. In this market, transactions of stocks when they want to disclose new significant information or to carry on the stockholder's meetings are stopped. In some cases the stopping period is very long, so a stock may has no any transaction in a season or more.

The time horizon of this research is beginning of the spring season in 2003 to the end of the spring season in 2008. Because of long close periods, considering all stocks in all periods is not a good deal. So in this research a filter was noticed. This filter stands in a way that only stocks will be examine that haven't closed more or equal one season. Regarding to this filter, 107 companies were obtained from all.

Next step is finding P/E ratio, return and beta for this new group. These data have considered seasonally. In the case of P/E ratio, historical prices and earning were used to achieve daily P/E and then these data were employed for calculating an average for per season. For achieving rate of return in every season, adjusted prices have been used. And finally beta was used as proxy of risk. For calculating beta, first data gathered in monthly base with opening of 36 months before, for every beta. In this research for measuring time variation of the betas, rolling windows procedure was used. So the sizes of windows have been 36 months.

After of gathering all needed data, they were entered in Eviews for further examinations. In this stage relations between P/E ratios and rates of returns in one side and between P/E ratios and beta in the other side were examined.

6. Results analysis

The Panel Data procedure in kind of Fixed Effect was used for analyzing data in Eviews and finding any relationship between P/E ratios and rates of return in one side, and between P/E ratios and beta in other side. Both of two relationships were significant and the regressive equations acquired as below:

$$\text{Beta} = 1.142977 + 0.267618 \times \text{P/E} \quad (4)$$

$$\text{Return} = 0.051996 + 0.180618 \times \text{P/E} \quad (5)$$

Now using this equations and the concept of Goal Programming, the optimum values of P/E ratios would be determined. So we can introduce GP as below:

Objective: determining optimum measure of P/E ratios.

Decision variables: there are three decision variables:

X_1: P/E ratio of every company

X_2: Beta of every company

X_3: Rate of return in every company

Goals: in the GP models, goals are determined regarding to the structure of the model and other existing conditions. Since investors usually entering the capital markets when they expect at least risk free rates of returns, one of goals in this research identifies the risk free rate of return. Risk free rate in Iran is about 15.5 percent that equals with rate of part payment securities of governmental organizations. Beta in fact is the risk's degree of a stock regarding to the risk of the overall market. So because of the risk aversion of investors, market's beta is assumed as maximum acceptable risk. In other words, another goal is supposed to be in a way that determines value of beta equals to 1 as desired, and divergence from it seen as undesired.

So the GP model defined as below:

$$\text{Min } Z = d_1^- + d_1^+ + d_2^- \quad (6)$$

S.t:

$X_2 - d_1^- + d_1^+ = 1$

$X_3 - d_2^- + d_2^+ = 0.155$

$X_2 + 0.267618\ X_1 - C_2 = 0$

$X_3 + 0.180618 - C_3 = 0$

In this model, first constraint confines beta around 1(market's beta), the second defines returns of stocks and confines returns to at least risk free rate, third has acquired from regressive equation of beta, and forth is related to regressive equation of return. C2 and C3 also represent fixed coefficients for regressive equations of beta and return respectively. In next step, data have been entered in WinQSB in the structure of acquired model and then the optimum P/E ratios for every company regarding to risk and return have achieved. The results have showed in the table1.

Table 1. optimum P/E ratios regarding risk and return

Symbol	P/E	Symbol	P/E	Symbol	P/E	Symbol	P/E	Symbol	P/E	Symbol	P/E	Symbol	P/E	Symbol	P/E
FALOOM	5.8	KHEPARS	5.6	BEKAB	10.9	DEFARA	5.5	VATOSHE	9.8	VANAFT	3.4	SEFAROD	4.8	BEHRAN	6.8
KHAHEN	4.4	DEPARS	6.1	KECHAD	5.4	DELOGHM	7.0	VAPETRO	13.2	LESARMA	8.2	KAZAR	3.0	SHENAFT	6.1
CHAFSET	6.4	KESRAM	5.4	RANFOR	5.7	DEJABER	7.4	VATOOS	4.3	SAROOM	6.3	KHETOGA	5.9	FANAVARD	5.9
DALBER	5.7	SHEPAKSA	6.0	TAKSHA	6.4	VAPAKHS	7.6	VATOOSA	4.6	SEBHAN	10.6	GHESHRIN	4.2	SHEKOLOR	5.9
KHESHARGH	3.0	SHEPETRO	12.0	GHEDAM	12.3	DEROOZ	7.2	VARENA	10.3	SETRAN	10.4	KHEBAMAN	7.6	DAROO	6.2
KHODRO	2.7	SHARAK	6.7	MADARAN	7.7	KHETRAK	3.2	VASHAKHT	8.9	SEPAHA	10.7	GHEPAK	5.2	FASMIN	4.8
KHAVAR	3.8	SHEKHARK	6.4	DASVEH	6.1	KHERING	3.7	SAMAN	6.3	SEROOD	13.5	FELOOLE	3.8	TEKOMBA	4.3
NEMERINO	10.2	SHEFARA	7.9	DAMIN	7.1	KHEZAMI	9.7	VASEPAH	6.5	SESOOFI	6.6	KHEMOHRE	8.7	AKONTOR	4.2
PASA	2.8	KEMASE	7.7	DELOR	4.7	SASFA	3.1	VASANAT	6.2	DESINA	6.7	FABAHONA	9.6	DEKIMI	4.5
KAMA	7.8	TAYRA	5.7	DEDAM	5.7	KHESAPA	3.3	VABIME	5.1	GHESHAD	6.8	KEROOY	9.3		
VANOVIN	6.9	VABSHAR	5.3	DERAZAK	11.1	KHAZIN	4.7	VASENA	13.1	KEGHAZVI	5.8	MANGENEZ	4.8		
VAKAR	8.9	SHETOOLI	15.2	DEZAHRA	10.7	VALBER	6.0	SMASKAN	9.4	KEHAMDA	5.3	KHEMEHR	4.4		
GHEBEHNO	5.7	TEKNO	4.8	DESOBHA	9.6	VASANDO	4.5	VAMADEN	4.9	DESHIMI	3.4	KHEMOTOR	3.2		
SHEPAMCH	7.1	FEJAM	5.5	DEABID	5.9	VABOOALI	3.2	VANIKI	13.1	SADRA	3.6	BEMOTO	6.1		

7. Conclusion

There are two important aspects that people usually look when they want to start an investment. One of them is return and the other is risk. But usually determining the size of these aspects is not easy, so people try to find faster ways to embrace risk and return together. One of the most common tools in capital markets for this purpose is P/E ratio. In this research for 107 listed companies in Iran (Tehran) stock exchange, first seasonal return, risk and P/E ratios were calculated. Then regressive equations were fund between them and in the main step, these equations accompanied with by couple of constraints made a Goal Programming model. This model was entered in WinQSB, and finally the optimum P/E ratio regarding to risk and return acquired. So this P/E ratios show how people could undertake enough risk for obtaining suitable return.

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