Investment Risk and Returns: The Relationship Between A Stock and An Index Using the Modern Portfolio Theory

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ABSTRACT
The aim of this report is to examine investment risk and returns by looking at the relationship between a stock and an index using the Markowitz Modern Portfolio theory. Monthly Data on IBM and Dow Jones were obtained from yahoo finance for the period 1995 to 2015. A linear regression was utilized to analyze the relationship between the Dow Jones index and the IBM stock returns. The results revealed that there is a positive relationship between IBM stock returns and the Dow Jones index. In their decision making, investors and policy makers are, recommended to additionally consider the micro and macro demand and supply forces that could possibly influence ROI. In other to avoid or reduce risk.
Keywords: Portfolio, investment, risk, index, relationship, stocks

1. INTRODUCTION

This article aims to demonstrate, in practice, the application of Markowitz's modern portfolio theory as an important tool for making investment decisions. Markowitz won the Nobel Prize in 1990 for his enormous contribution in the field of investment and finance. Its Role as Portfolio Selection: Rational Diversification (1952) His paper "portfolio Selection: efficient Diversification (1959) has Influenced Many Lives in Making Investment Decisions.

The Markowitz theory of today is what has come to be regarded as the "Theory of Modern Portfolio" (MPT). This theory allows potential investors to analyze portfolio risks and returns before making any attempt to select one.

In 1964, William Sharpe, built another theory, which has its justification from Markowitz MPT, William Sharpe's current theory is what is known by both investors and the academic world as the asset valuation model.

Investors are very keen to know the returns they will have on their investment, this can be said to be one of the main reasons why people invest in diverse portfolios. In other for this returns to be optimized hence reduce risk implies investors to diversify their investment. Holding multiple portfolios alone isn't prudent enough to justify one's ability to maximize return on investment.

Investors are very interested in learning about the benefits they will have on their investment, this can be said to be one of the main reasons why people invest in different portfolios. In other to reduce the risks involved on portfolio selection investors diversify their investments Holding multiple portfolios alone isn't prudent enough to justify one's ability to maximize return on investment

The world of financial investment is a very risky and volatile field to venture as such a careful and critical investment risk and returns analysis is required to avoid any shocks.

It is based on the above highlighted that this paper seeks to aid all investment and financial stake holders to acquire the knowledge and dealings of the financial market. This paper will focus on the Modern Portfolio theory as an efficient investment decision making analysis tool. Specifically this paper will discuss specific issues such as the review and framework of the MPT, risk and returns, expected returns, risk measurement and volatility and well as risk diversification.

It is based on the above highlights that this document aims to assist all investment owners and financial stakeholders to acquire knowledge and dealings of financial markets. This paper will focus on the portfolio theory as a tool for the analysis of efficient investment decision. In particularly, this paper will address specific topics such as the revision and framework of the MPT, risk and returns, risk measurement and volatility, as well as risk diversification.

This paper will focus on using the monthly returns of IBM stock from 1996 to 2015 to analyse Markowitz MPT using the Dow jones as the benchmark.

It is the aim of this paper to contribute to the pool of knowledge existing in investment decision making as well as academia on the above subject.

The paper's emphasis is on risk and returns focusing on the relationship between the monthly stocks returns of Dow Jones index and IBM using a liner regression model. It analyses the modern portfolio theory as an investment tool. It avoids the complex mathematical calculations by using simple techniques to analyse the MPT.

Data gathered included the monthly adjusted stock prices for the Dow Jones Index and the IBM stocks drawn from S&P500 from 2015 to January 1996. The computations were done using Microsoft excel.

2. A REVIEW OF RELATED LITERATURE

The investment decision-making process is the ability to make appropriate decisions and be guided by the various theories of portfolio investments. The most important aspect of the Markowitz model was its description of the impact on portfolio diversification by the number of securities within a portfolio and covariance relationships (Megginson, 1996). In 1958, James Tobin in the evaluation of the conditions of economic studies proposed the "efficient frontier" and the ideas of the "Market Line Capital" built on MPT. His model proposed that investors, regardless of their level of risk tolerance, hold equity portfolios in the same portion, as long as the expectations remain the same with respect to the future (1996 Megginson quoting Tobin, 1958). Tobin concluded that the investment portfolios of these investors only vary in their relative proportions of stocks and bonds.

There are basically two approaches to managing investments:

2.1 The Passive investment approach:
This approach is based on the belief that markets are efficient, market returns cannot be outdone repeatedly overtime and low cost investments held for a long term will provide the best returns.

2.2 Active asset management:
- This approach is based on the belief that a specific style of management or analysis can produce returns that beat the market.
  The active approach seeks to take advantage of inefficiencies in the market and is typically accompanied by higher-than-average costs (for analysts and managers who must spend time to seek out these inefficiencies).
- Market timing is an extreme example of active asset management. It is based on the belief that it's possible to anticipate the movement of markets based on factors such as economic conditions, interest rate trends or technical indicators. Many investors, particularly academics, believe it is impossible to correctly time the market on a consistent basis.

3. THE MODERN PORTFOLIO THEORY (MPT)

Harry Markowitz in 1952 published an article "Portfolio Selection" in the Journal of Finance, he developed a hypothesis which is an investment theory based on the concept that the risk-averse investors can develop their portfolios to maximize expected returns based on a particular market, Level of risk, emphasizing that risk is an inherent aspect of higher premiums. MPT is an investment framework for building and selection of a portfolio based on performance maximizing and minimizing investment risks (Fabozzi, Gupta and Markowitz, 2002).
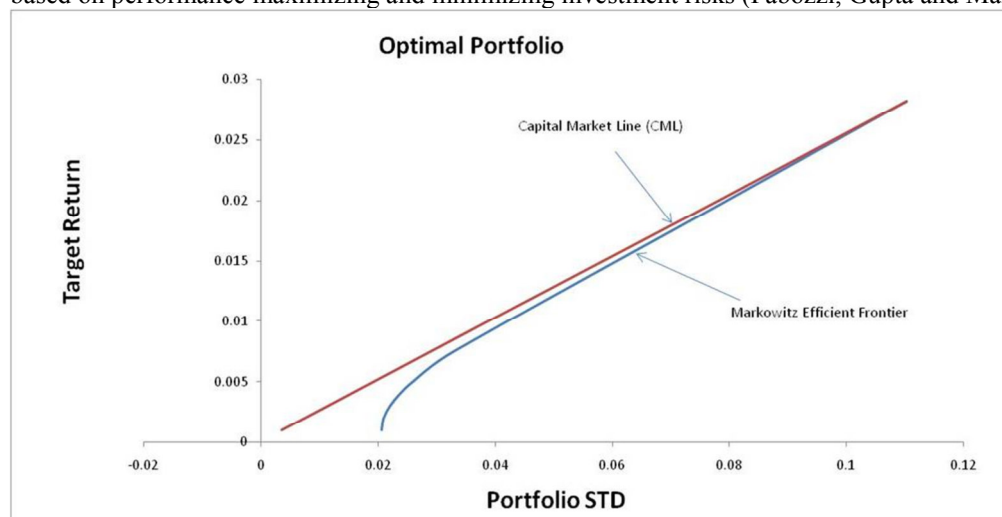

Fig 1. Markowitz Modern Portfolio Theory.(Source:…….)

4. THE EFFICIENT FRONTIER

In order to weigh investment options, Markowitz propounded a system to describe each investment or each class of asset with mathematical formulas using unsystematic risk statistics. He then applied that to the portfolios that has the investment options. He considered the expected rate of return and the expected volatility for each investment. He named this risk and reward equation "The Efficient Frontier". Fig 2 is a typical example of what the efficient frontier equation looks like when plotted which has an aim of maximizing returns while minimizing volatility. To evaluate investments, Markowitz proposed a system which describes any investment or any asset

class with mathematical formulas with the use of unsystematic risks. Then he applied this to portfolio investment opportunities, he carefully considered the expected return and expected volatility for each investment. He called this equation risk and reward "Efficient Frontier". Fig 2 below is typical of what appears to be a comparison of the efficient frontier when plotted with the aim of maximizing returns and reducing volatility.
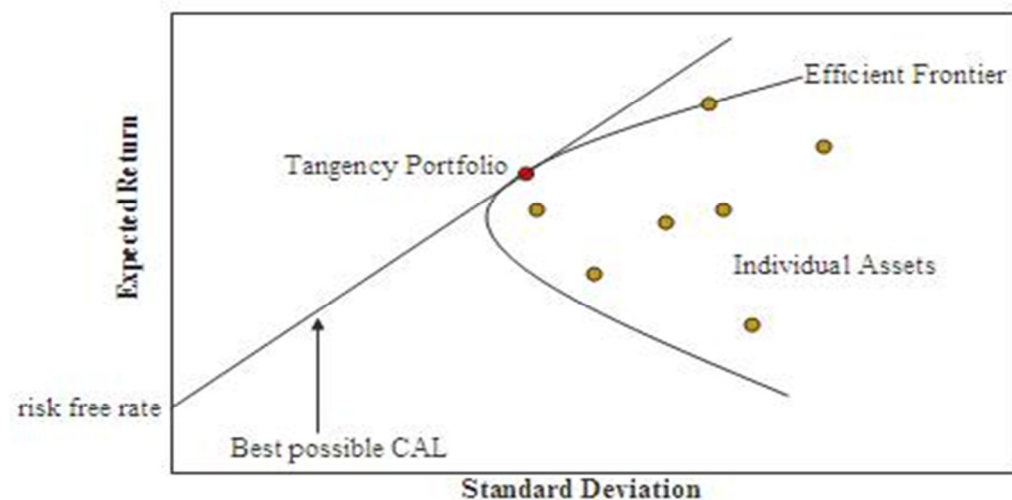

Fig 2 The Efficient Frontier (retrieved from Wikipedia)

Portfolios along the efficient frontier should have higher returns on average, for the level of risk the portfolio assumes. From the graph it's seen that a typical efficient frontier line starts with lower expected risk and returns as more and more the returns of an asset increase the greater the risk. Which implies that the greater the returns of a particular stock the greater the risk thereof. There is a limit to returns on investment as such it is seen from the graph that the efficient frontier curve flattens as it goes higher. Investing is a trade-off between risk and expected returns, this concept is true with what (Taleb, 2007) stated, generally, assets with higher expected risk are riskier. The MPT provides a means to properly select a portfolio with the highest possible expected return, thus the MPT proposes a trade-off between the selection of risk with higher expected return with lower risk and other risky portfolios.

A greater emphasis of the theory is the quantification of the relationship between risk and returns and the philosophy that investors must be compensated for holding risk. Portfolio theory departs from the traditional security analysis in shifting emphasis from the analyzing the characteristics of individual investments to determining the statistical relationships among the individual securities that comprise the overall portfolio (Edwin and Martins 1997)

The risk component of MPT can be measured using mathematical formulas via the concept of diversification in investment with the aim of selecting a collection of investment assets that has the lower risk than any individual asset or singular asset class. Diversification is the core concept of MPT and mainly lies on the adage of "never putting all your eggs in one basket" (fabozzi, Gupta, & Markowitz, 2002; McClure, 2010; Veneeya, 2006).

According to the work of (Bofah, n.d.; Wecker, n.d.; Markowitz, 1952) the framework for MPT includes numerous assumptions about markets and investors, some of these assumptions are explicit, while others are implicit

Modern Portfolio Theory lies on the following conventions and fundamentals:

- For buying and selling securities there are no transaction costs. There is no spread between bidding and asking prices. No tax is paid, its only risk that plays a part in determining which securities an investor will buy.
- An investor has a chance to take any position of any size and in any security. The market liquidity is infinite and no one can move the market. So that nothing can stop the investor from taking positions of any size in any security.
- While making investment decisions the investor does not consider taxes and is indifferent towards receiving dividends or capital gains.
- Investors are generally rational and risk adverse. They are completely aware of all the risk contained in investment and actually take positions based on the risk determination demanding a higher return for accepting greater volatility.
- The risk-return relationships are viewed over the same time horizon. Both long term speculator and short term speculator share the same motivations, profit target and time horizon.
- Investors share identical views on risk measurement. All the investors are provided by information and

their sale or purchase depends on an identical assessment of the investment and all have the same expectations from the investment. A seller will be motivated to make a sale only because another security has a level of volatility that corresponds to his desired return. A buyer will buy because this security has a level of risk that corresponds to the return he wants.

- Investors seek to control risk only by the diversification of their holdings.
- In the market all assets can be bought and sold including human capital.
- Politics and investor psychology have no influence on market.
- The risk of portfolio depends directly on the instability of returns from the given portfolio.
- An investor gives preference to the increase of utilization.
- An investor either maximizes his return for the minimum risk or maximizes his portfolio return for a given level of risk.
- Analysis is based on a single period model of investment.

According to (Iyio O, et al 2012), the theory does not really model the market. The risk, return and correlation used by MPT are based on expected values, which means that they are mathematical statements about the future.

5. DATA AND METHOD

5.1 DATA

The Data for the Dow Jones Index and the IBM stocks for the period January 1996 to 2015 was obtained from S&P500. This study further adjusted the stock prices into monthly returns.

The Dow Jones Industrial Average (DJIA) was employed because it is undoubtedly the most cited financial barometer in the world and has become synonymous with financial markets in general. When individuals say that the market has increased or decreased by some digits, they mostly denote the Dow. On the other hand the IBM stocks were selected randomly out of the number of stocks listed under the index

5.2 METHOD

This study tested the risk-return relationship using the model estimated in equations 1-3

$$E(R_P) = \sum W_i E(R_i) \ldots\ldots\ldots \quad (1)$$

The equation 1 is further extended into

$$E(R_P) = W_A E(R_A) + W_B E(R_B) \quad \ldots\ldots\ldots.(2)$$
$$E(R_P) = W_A E(R_A) + (1-W_A) E(R_B) \quad \ldots\ldots\ldots.(3)$$

Where R_p is the return on the portfolio, R_i is the return on the asset i and Wi is the weighing of the component asset

RISK (R_i)

Risk is demonstrated whenever an investor is not sure of his return on investment. (Bofah,& ; McClure, 2010) defined risk as a deviation from expected historical returns in a particular period. Notwithstanding, Markowitz' portfolio selection theory maintains that "the essential aspect pertaining to the risk of an asset is not the risk of each asset in isolation, but the contribution of each asset to the risk of the aggregate portfolio" (Royal Swedish Academy of Sciences, 1990). As discussed, the idea of risk generally is the possibility that actual return may vary from expected return. Investment of greater variance in terms of risk are considered very risky and vice versa.

Risk is different from uncertainty. Risk is the situation at which the tendency of expected return deviating from actual return can be quantified whereas uncertainty happens in a situation at which this condition can't be quantified or the fact and figure regarding investment is not readily available.

Low levels of uncertainty are accompanied with low probable returns, whereas high levels of uncertainty are associated with high probable returns. With regards to the **risk-return** tradeoff, money invested can produce greater benefits only when the investor is willing to accept the possibility of losses. Hence investments with high risk has a high probability of ROI and vice versa

6. RISK MEASUREMENT AND VOLATILITY: BETA COEFFICIENT

MPT, however, do not define risk as the probability of loss, but as the volatility, which is defined by statistical measures of variations, such as standard deviation and beta. The greater the standard deviation or beta, the greater the risk, according to the theory.

Beta measures risk of an asset relative to the market risk. The market risk is measured using the fluctuations of the market benchmark (market Index). Shares with β factor is more than 1 are considered less risky. One must note that β is a measure of systematic risk which cannot be diversified.

$$\beta = \frac{\text{Covariance } (r_s, r_b)}{\text{Variance } (r_b)}$$

thus,

$\beta_\alpha = \underline{Cov(r_s, r_b)}$

$Var(r_b)$ where rs is the return on the stock and r_b is the return on a benchmark index .

Beta helps us to understand the idea of passive and active risk. Fig 3 shows a time series of each returns labeled "+" for a particular portfolio R(p) against the market return R(m). The returns are cash adjusted, the point fit through the data point at which the x and y axes intersect is the cash – equivalent return. Drawing a line of best fit through the data points allows us to quantify the beta, which is referred to as alpha.

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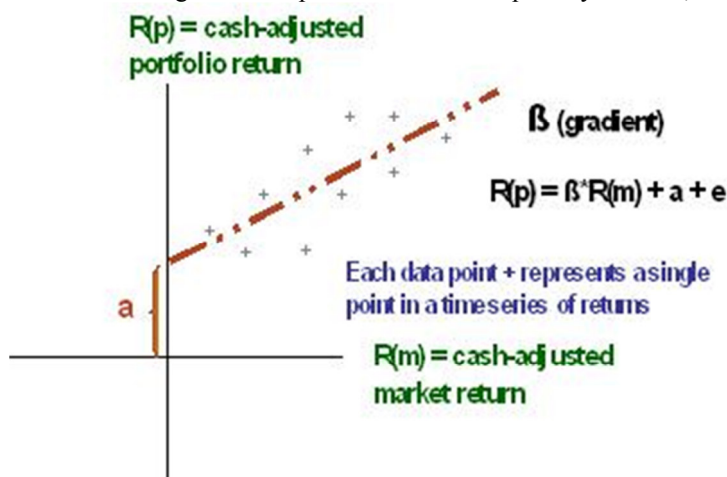
Fig 3 Time Series Beta

The slope of the line is referred to as the beta.

A slope of 1.0 means that for each unit of market profitability increase, the performance of the portfolio increases by one. A manager using a passive management strategy may be tempted to increase portfolio performance by assuming more market risk (ie, a beta greater than 1), or alternatively, decreasing portfolio risk through Reducing the beta portfolio of less than 1. Essentially, beta expresses the fundamental balance between minimizing risk and maximizing profitability.

7. RESULTS AND DISCUSSION

Table 1

Date	PRICE IBM	PRICE DOW J	RETURN IBM	RETURN. DOW J
01/12/2015	134.9264	17425.03	-1.70%	-1.70%
02/11/2015	136.6911	17719.92	0.30%	0.30%
01/10/2015	136.062	17663.54	8.50%	8.50%
01/09/2015	140.8117	16284.7	-1.50%	-1.50%
03/08/2015	143.6479	16528.03	-6.60%	-6.60%
01/07/2015	156.0481	17689.86	0.40%	0.40%
01/06/2015	156.6935	17619.51	-2.20%	-2.20%
01/05/2015	163.4271	18010.68	1.00%	1.00%
01/04/2015	163.7676	17840.52	0.40%	0.40%
02/03/2015	153.4514	17776.12	-2.00%	-2.00%
02/02/2015	154.8282	18132.7	5.60%	5.60%
02/01/2015	145.5561	17164.95	-3.70%	-3.70%
01/12/2014	152.3255	17823.07	0.00%	0.00%
03/11/2014	153.968	17828.24	2.50%	2.50%
01/10/2014	155.0242	17390.52	2.00%	2.00%
02/09/2014	179.004	17042.9	-0.30%	-0.30%

Date	PRICE IBM	PRICE DOW J	RETURN IBM	RETURN. DOW J
01/08/2014	181.3331	17098.45	3.20%	3.20%
01/07/2014	179.6764	16563.3	-1.60%	-1.60%
02/06/2014	169.9272	16826.6	0.70%	0.70%
01/05/2014	172.8238	16717.17	0.80%	0.80%
01/04/2014	183.1099	16580.84	0.70%	0.70%
03/03/2014	179.4006	16457.66	0.80%	0.80%
03/02/2014	172.5783	16321.71	4.00%	4.00%
02/01/2014	163.7679	15698.85	-5.30%	-5.30%
02/12/2013	173.862	16576.66	3.00%	3.00%
01/11/2013	166.5486	16086.41	3.50%	3.50%
01/10/2013	165.2257	15545.75	2.80%	2.80%
03/09/2013	170.7298	15129.67	2.20%	2.20%
01/08/2013	168.0469	14810.31	-4.40%	-4.40%
01/07/2013	178.9259	15499.54	4.00%	4.00%
03/06/2013	175.3206	14909.6	-1.40%	-1.40%
01/05/2013	190.8336	15115.57	1.90%	1.90%
01/04/2013	184.9395	14839.8	1.80%	1.80%
01/03/2013	194.7644	14578.54	3.70%	3.70%
01/02/2013	183.3781	14054.49	1.40%	1.40%
02/01/2013	184.6462	13860.58	5.80%	5.80%
03/12/2012	174.1714	13104.14	0.60%	0.60%
01/11/2012	172.8256	13025.58	-0.50%	-0.50%
01/10/2012	176.1103	13096.46	-2.50%	-2.50%
04/09/2012	187.8069	13437.13	2.60%	2.60%
01/08/2012	176.4	13090.84	0.60%	0.60%
02/07/2012	176.6686	13008.68	1.00%	1.00%
01/06/2012	176.3081	12880.09	3.90%	3.90%
01/05/2012	173.8921	12393.45	-6.20%	-6.20%
02/04/2012	185.8961	13213.63	0.00%	0.00%
01/03/2012	187.3055	13212.04	2.00%	2.00%
01/02/2012	176.6049	12952.07	2.50%	2.50%
03/01/2012	172.2267	12632.91	3.40%	3.40%
01/12/2011	164.4291	12217.56	1.40%	1.40%
01/11/2011	168.1133	12045.68	0.80%	0.80%
03/10/2011	164.4388	11955.01	9.50%	9.50%
01/09/2011	155.7461	10913.38	-6.00%	-6.00%
01/08/2011	153.1098	11613.53	-4.40%	-4.40%
01/07/2011	161.2606	12143.24	-2.20%	-2.20%
01/06/2011	152.1268	12414.34	-1.20%	-1.20%
02/05/2011	149.8034	12569.79	-1.90%	-1.90%
01/04/2011	150.5931	12810.54	4.00%	4.00%
01/03/2011	143.9631	12319.73	0.80%	0.80%
01/02/2011	142.9125	12226.34	2.80%	2.80%

Date	PRICE IBM	PRICE DOW J	RETURN IBM	RETURN. DOW J
03/01/2011	142.4544	11891.93	2.70%	2.70%
01/12/2010	129.0531	11577.51	5.20%	5.20%
01/11/2010	124.3926	11006.02	-1.00%	-1.00%
01/10/2010	125.7158	11118.49	3.10%	3.10%
01/09/2010	117.4339	10788.05	7.70%	7.70%
02/08/2010	107.7951	10014.72	-4.30%	-4.30%
01/07/2010	111.8545	10465.94	7.10%	7.10%
01/06/2010	107.5685	9774.02	-3.60%	-3.60%
03/05/2010	109.1192	10136.63	-7.90%	-7.90%
01/04/2010	111.8041	11008.61	1.40%	1.40%
01/03/2010	111.1541	10856.63	5.10%	5.10%
01/02/2010	110.2094	10325.26	2.60%	2.60%
04/01/2010	105.6029	10067.33	-3.50%	-3.50%
01/12/2009	112.9457	10428.05	0.80%	0.80%
02/11/2009	109.0198	10344.84	6.50%	6.50%
01/10/2009	103.6021	9712.73	0.00%	0.00%
01/09/2009	102.7431	9712.28	2.30%	2.30%
03/08/2009	101.4031	9496.28	3.50%	3.50%
01/07/2009	100.8298	9171.61	8.60%	8.60%
01/06/2009	89.27876	8447	-0.60%	-0.60%
01/05/2009	90.86905	8500.33	4.10%	4.10%
01/04/2009	87.78569	8168.12	7.30%	7.30%
02/03/2009	82.41019	7608.92	7.70%	7.70%
02/02/2009	78.2765	7062.93	-11.70%	-11.70%
02/01/2009	77.5315	8000.86	-8.80%	-8.80%
01/12/2008	71.19533	8776.39	-0.60%	-0.60%
03/11/2008	69.02969	8829.04	-5.30%	-5.30%
01/10/2008	78.21094	9325.01	-14.10%	-14.10%
02/09/2008	98.3925	10850.66	-6.00%	-6.00%
01/08/2008	102.4053	11543.96	1.50%	1.50%
01/07/2008	107.2454	11378.02	0.20%	0.20%
02/06/2008	99.32639	11350.01	-10.20%	-10.20%
01/05/2008	108.4604	12638.32	-1.40%	-1.40%
01/04/2008	100.7331	12820.13	4.50%	4.50%
03/03/2008	96.09283	12262.89	0.00%	0.00%
01/02/2008	95.02457	12266.39	-3.00%	-3.00%
02/01/2008	89.05072	12650.36	-4.60%	-4.60%
03/12/2007	89.8738	13264.82	-0.80%	-0.80%
01/11/2007	87.44613	13371.72	-4.00%	-4.00%
01/10/2007	96.20036	13930.01	0.20%	0.20%
04/09/2007	97.59217	13895.63	4.00%	4.00%
01/08/2007	96.67259	13357.74	1.10%	1.10%
02/07/2007	91.34573	13211.99	-1.50%	-1.50%

Date	PRICE IBM	PRICE DOW J	RETURN IBM	RETURN. DOW J
01/06/2007	86.88783	13408.62	-1.60%	-1.60%
01/05/2007	88.0023	13627.64	4.30%	4.30%
02/04/2007	84.05103	13062.91	5.70%	5.70%
01/03/2007	77.51345	12354.35	0.70%	0.70%
01/02/2007	76.42796	12268.63	-2.80%	-2.80%
03/01/2007	81.2897	12621.69	1.30%	1.30%
01/12/2006	79.64997	12463.15	2.00%	2.00%
01/11/2006	75.36207	12221.93	1.20%	1.20%
02/10/2006	75.45337	12080.73	3.40%	3.40%
01/09/2006	66.96252	11679.07	2.60%	2.60%
01/08/2006	66.16982	11381.15	1.70%	1.70%
03/07/2006	63.00924	11185.68	0.30%	0.30%
01/06/2006	62.529	11150.22	-0.20%	-0.20%
01/05/2006	65.03602	11168.31	-1.70%	-1.70%
03/04/2006	66.78066	11367.14	2.30%	2.30%
01/03/2006	66.8861	11109.32	1.10%	1.10%
01/02/2006	65.07748	10993.41	1.20%	1.20%
03/01/2006	65.77204	10864.86	1.40%	1.40%
01/12/2005	66.50014	10717.5	-0.80%	-0.80%
01/11/2005	71.92047	10805.87	3.50%	3.50%
03/10/2005	66.0828	10440.07	-1.20%	-1.20%
01/09/2005	64.74307	10568.7	0.80%	0.80%
01/08/2005	65.0659	10481.6	-1.50%	-1.50%
01/07/2005	67.19637	10640.91	3.60%	3.60%
01/06/2005	59.74083	10274.97	-1.80%	-1.80%
02/05/2005	60.82777	10467.48	2.70%	2.70%
01/04/2005	61.33312	10192.51	-3.00%	-3.00%
01/03/2005	73.37812	10503.76	-2.40%	-2.40%
01/02/2005	74.34172	10766.23	2.60%	2.60%
03/01/2005	74.8734	10489.94	-2.70%	-2.70%
01/12/2004	79.00899	10783.01	3.40%	3.40%
01/11/2004	75.5306	10428.02	4.00%	4.00%
01/10/2004	71.79319	10027.47	-0.50%	-0.50%
01/09/2004	68.5855	10080.27	-0.90%	-0.90%
02/08/2004	67.74558	10173.92	0.30%	0.30%
01/07/2004	69.50224	10139.71	-2.80%	-2.80%
01/06/2004	70.36433	10435.48	2.40%	2.40%
03/05/2004	70.71555	10188.45	-0.40%	-0.40%
01/04/2004	70.23789	10225.57	-1.30%	-1.30%
01/03/2004	73.16148	10357.7	-2.10%	-2.10%
02/02/2004	76.87372	10583.92	0.90%	0.90%
02/01/2004	78.92056	10488.07	0.30%	0.30%
01/12/2003	73.71114	10453.92	6.90%	6.90%

Date	PRICE IBM	PRICE DOW J	RETURN IBM	RETURN. DOW J
03/11/2003	72.00914	9782.46	-0.20%	-0.20%
01/10/2003	71.03742	9801.12	5.70%	5.70%
02/09/2003	70.12444	9275.06	-1.50%	-1.50%
01/08/2003	65.10704	9415.82	2.00%	2.00%
01/07/2003	64.37444	9233.8	2.80%	2.80%
02/06/2003	65.36482	8985.44	1.50%	1.50%
01/05/2003	69.75416	8850.26	4.40%	4.40%
01/04/2003	67.14335	8480.09	6.10%	6.10%
03/03/2003	62.02653	7992.13	1.30%	1.30%
03/02/2003	61.64692	7891.08	-2.00%	-2.00%
02/01/2003	61.72456	8053.81	-3.50%	-3.50%
02/12/2002	61.17205	8341.63	-6.20%	-6.20%
01/11/2002	68.60741	8896.09	5.90%	5.90%
01/10/2002	62.19424	8397.03	10.60%	10.60%
03/09/2002	45.94054	7591.93	-12.40%	-12.40%
01/08/2002	59.38943	8663.5	-0.80%	-0.80%
01/07/2002	55.34332	8736.59	-5.50%	-5.50%
03/06/2002	56.60112	9243.26	-6.90%	-6.90%
01/05/2002	63.24389	9925.25	-0.20%	-0.20%
01/04/2002	65.71686	9946.22	-4.40%	-4.40%
01/03/2002	81.59686	10403.94	2.90%	2.90%
01/02/2002	76.98351	10106.13	1.90%	1.90%
02/01/2002	84.53742	9920	-1.00%	-1.00%
03/12/2001	94.77844	10021.57	1.70%	1.70%
01/11/2001	90.57076	9851.56	8.60%	8.60%
01/10/2001	84.5741	9075.14	2.60%	2.60%
04/09/2001	71.77882	8847.56	-11.10%	-11.10%
01/08/2001	78.21951	9949.75	-5.40%	-5.40%
02/07/2001	82.22742	10522.81	0.20%	0.20%
01/06/2001	88.70651	10502.4	-3.80%	-3.80%
01/05/2001	87.37787	10911.94	1.60%	1.60%
02/04/2001	89.87956	10734.97	8.70%	8.70%
01/03/2001	75.07918	9878.78	-5.90%	-5.90%
01/02/2001	77.98305	10495.28	-3.60%	-3.60%
02/01/2001	87.32892	10887.36	0.90%	0.90%
01/12/2000	66.27641	10787.99	3.60%	3.60%
01/11/2000	72.90405	10414.49	-5.10%	-5.10%
02/10/2000	76.70507	10971.14	3.00%	3.00%
01/09/2000	87.70466	10650.92	-5.00%	-5.00%
01/08/2000	102.8048	11215.1	6.60%	6.60%
03/07/2000	87.31493	10521.98	0.70%	0.70%
01/06/2000	85.22443	10447.89	-0.70%	-0.70%
01/05/2000	83.47424	10522.33	-2.00%	-2.00%

Date	PRICE IBM	PRICE DOW J	RETURN IBM	RETURN. DOW J
03/04/2000	86.62702	10733.91	-1.70%	-1.70%
01/03/2000	91.96838	10921.92	7.80%	7.80%
01/02/2000	79.82893	10128.31	-7.40%	-7.40%
03/01/2000	87.11801	10940.53	-4.80%	-4.80%
01/12/1999	83.72254	11497.12	5.70%	5.70%
01/11/1999	79.98753	10877.81	1.40%	1.40%
01/10/1999	76.15112	10729.86	3.80%	3.80%
01/09/1999	93.78409	10336.95	-4.50%	-4.50%
02/08/1999	96.54529	10829.28	1.60%	1.60%
01/07/1999	97.32235	10655.15	-2.90%	-2.90%
01/06/1999	100.0809	10970.8	3.90%	3.90%
03/05/1999	89.82113	10559.74	-2.10%	-2.10%
01/04/1999	80.89741	10789.04	10.20%	10.20%
01/03/1999	68.54647	9786.16	5.20%	5.20%
01/02/1999	65.64606	9306.58	-0.60%	-0.60%
04/01/1999	70.77288	9358.83	1.90%	1.90%
01/12/1998	71.20737	9181.43	0.70%	0.70%
02/11/1998	63.77284	9116.55	6.10%	6.10%
01/10/1998	57.26743	8592.1	9.60%	9.60%
01/09/1998	49.55464	7842.62	4.00%	4.00%
03/08/1998	43.43262	7539.07	-15.10%	-15.10%
01/07/1998	51.00988	8883.29	-0.80%	-0.80%
01/06/1998	44.20055	8952.02	0.60%	0.60%
01/05/1998	45.23518	8899.95	-1.80%	-1.80%
01/04/1998	44.52629	9063.37	3.00%	3.00%
02/03/1998	39.91515	8799.81	3.00%	3.00%
02/02/1998	40.1313	8545.72	8.10%	8.10%
02/01/1998	37.86958	7906.5	0.00%	0.00%
01/12/1997	40.12259	7908.3	1.10%	1.10%
03/11/1997	41.9921	7823.1	5.10%	5.10%
01/10/1997	37.70018	7442.1	-6.30%	-6.30%
02/09/1997	40.57076	7945.3	4.20%	4.20%
01/08/1997	38.80057	7622.4	-7.30%	-7.30%
01/07/1997	40.40003	8222.6	7.20%	7.20%
02/06/1997	34.47852	7672.8	4.70%	4.70%
01/05/1997	33.04589	7331	4.60%	4.60%
01/04/1997	30.65818	7009	6.50%	6.50%
03/03/1997	26.21704	6583.48	-4.30%	-4.30%
03/02/1997	27.45865	6877.74	0.90%	0.90%
02/01/1997	29.89524	6813.09	5.70%	5.70%
02/12/1996	28.87094	6448.27	-1.10%	-1.10%
01/11/1996	30.37166	6521.7	8.20%	8.20%
01/10/1996	24.51712	6029.38	2.50%	2.50%

Date	PRICE IBM	PRICE DOW J	RETURN IBM	RETURN. DOW J
03/09/1996	23.66187	5882.17	4.70%	4.70%
01/08/1996	21.73756	5616.21	1.60%	1.60%
01/07/1996	20.3657	5528.91	-2.20%	-2.20%
03/06/1996	18.75539	5654.63	0.20%	0.20%
01/05/1996	20.22362	5643.18	1.30%	1.30%
01/04/1996	20.34558	5569.08	-0.30%	-0.30%
01/03/1996	21.00646	5587.14	1.90%	1.90%
01/02/1996	23.15431	5485.62	1.70%	1.70%
02/01/1996	20.44256	5395.3		#DIV/0!

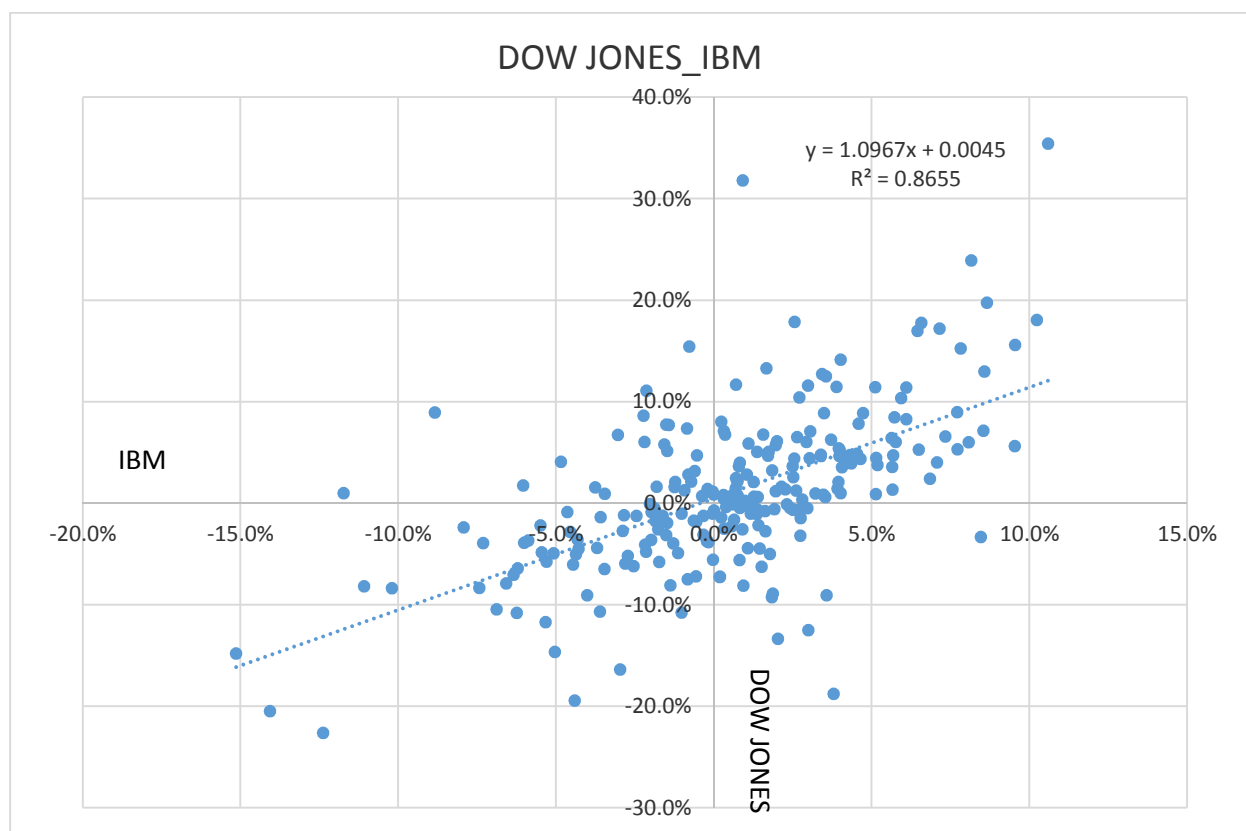(Authors computation: Monthly returns on stock prices of IBM stocks and the Dow Jones index)

Figure 4: Liner Regression Chart

Figure 4 shows linear regression analysis for the monthly stock returns of Dow Jones and IBM from 1996-2015. The regression analysis revealed that **y=1.0967x+0.0045.** This implies that for every increase in 1 unit of Dow Jones returns; there is a 1.0967-unit increase in the returns for IBM this also refers to the slope of the line.

The R^2=0.8655 implies that about 87% of the variation in IBM returns can be explained by the fluctuations in the Dow Jones returns.

In summary as the Dow Jones stock returns increases, IBM stock returns also increases but with a close or smaller variations. It can therefore be concluded that there is a positive relationship between IBM stock returns and the Dow jones index.

Table 2

Average: Dow-Jones	0.6%
IBM	1.1%
Variance: Dow-Jones	0.00184806
IBM	0.006082
Std-Devn: Dow-Jones	4%
IBM	8%
Covariance	0.002026849
Correlation	60%
Beta	1.10
Slope	1.10

Authours Computations

8. Conclusion

From the analysis it can be said that there is a positive relationship between a stock and an index thus IBM stocks and the Dow Jones index.

There are many factors which can have a significant effect on the returns of a particular stock which includes the micro and macro demand and supply forces e.g. Industrial capitalization, corporate governance, political shocks etc.

Investors and policy makers must consider some of these forces that affect stock returns before making any decision as far as returns on equities are concerned. There should investor are advised to hold a diversified portfolio in other to avoid shocks that will arise from ROI failures.

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