Practical Application of Modern Portfolio Theory in Context to Asset Allocation by Investing in Negatively Correlated Assets Reduces Your Risk

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Abstract:
CNX ENERGY represents the movement of the entire CNX ENERGY industry in India whereas the Auto index does the same for Auto industry in India. This combination of portfolio has been selected in line with the basic principle of economics of complementary goods, i.e. the reduction in prices of oil will boost automobile sales.

Keywords: *CNX AUTO, CNX ENERGY, Correlation, Portfolio Return, Portfolio Risk*

1. Introduction

The CNX Auto Index is designed to reflect the behaviour and performance of the Automobiles segment of the financial market. The CNX Auto Index comprises 15 tradable, exchange listed companies. The index represents auto related sectors like Automobiles 4 wheelers, Automobiles 2 & 3 wheelers, Auto Ancillaries and Tyres.

CNX ENERGY sector Index includes companies belonging to Petroleum, Gas and Power sectors. The Index comprises of 10 companies listed on National Stock Exchange of India (NSE).

CNX ENERGY Index is computed using free float market capitalization method, wherein the level of the index reflects the total free float market value of all the stocks in the index relative to particular base market capitalization value. CNX ENERGY Index can be used for a variety of purposes such as benchmarking fund portfolios, launching of index funds, ETF's and structured products.

2. Theoretical framework

One of the most important and influential economic theories dealing with finance and investment, MPT was developed by Harry Markowitz and published under the title "Portfolio Selection" in the 1952 Journal of Finance. MPT says that it is not enough to look at the expected risk and return of one particular stock. By investing in more than one stock, an investor can reap the benefits of diversification chief among them, a reduction in the riskiness of the portfolio. MPT quantifies the benefits of diversification, also known as not putting all of your eggs in one basket.

MPT is the philosophical opposite of traditional asset picking. It is the creation of economists, who try to

understand the market as a whole, rather than looking for what that makes each investment opportunity unique.

3. Review of literature

A. R. Dani, Nusarat Ali, Suresh Simhadri and Dakshina Murthy (2012) had discussed assets include real as well as financial assets. However, in the context of this paper, the discussion is restricted to financial assets or securities. It is better than the returns of the five best performing mutual funds for the period 2006-2009 as well as portfolios constructed using CAPM approach. The Min-Max approach ensures high level of returns, which are better than index, equal allocation, best performing mutual funds, and a managed fund. Future work would include incorporating transaction cost in the model.

One article written by Cowles (1933), examined the outcome from passive versus active managed portfolios. The result from this research was that the managed portfolio underperformed the passive benchmark. Cowles examined return but did not take into consideration risk, but the Modern Portfolio Theory (MPT) states that risk as well as return must be considered according to Elton and Gruber (1997). This makes the use of risk as an important factor when constructing a portfolio. Markowitz (1959) argues that risk can be minimized but not eliminated, and this without changing a portfolios' return.

Wheelwright & Clark (1992) identified the importance of the right set of projects in project portfolio for a company's future or market growth overtime. However, it is not easy to evaluate the rightness of the project portfolio in aspect of contributing to corporate strategy since strategies are dynamic and change over time.

4. Research Methodology

4.1 Research Problem

We might have different theories and models but we need to identify in Indian market up to which extent we can use it.

4.2 Data Collection

This study is completely based on the secondary data. Secondary research can be described as the most widely used method for data collection.

4.3 Hypothesis

There is negative correlation between CNX ENERGY and Auto Index.

4.4 Equation for the study

1. Standard deviation [total risk]

$$\text{S. D} = \frac{\sum(R-R)^2}{n-1}$$

Or when probability is given, $\text{S.D} = \sum \text{Pi}[\, ri - \sum(r)\,]^2$

Where, pi= probability ri = return $\sum(r)$ = sum of/ total return

1. Beta [measurement of systematic risk]

$$\beta = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

3. Portfolio return

$$E(r) = \sum X1R1$$

4. Portfolio risk

$$\sigma(p) = \sqrt{X_1^2 \sigma^2_1 + X_2^2 \sigma^2_2 + 2X1X2\ (r12,\sigma1,\sigma2)}$$

Where,
X_1 = weights (percentage value)
R= Expected return on the securities

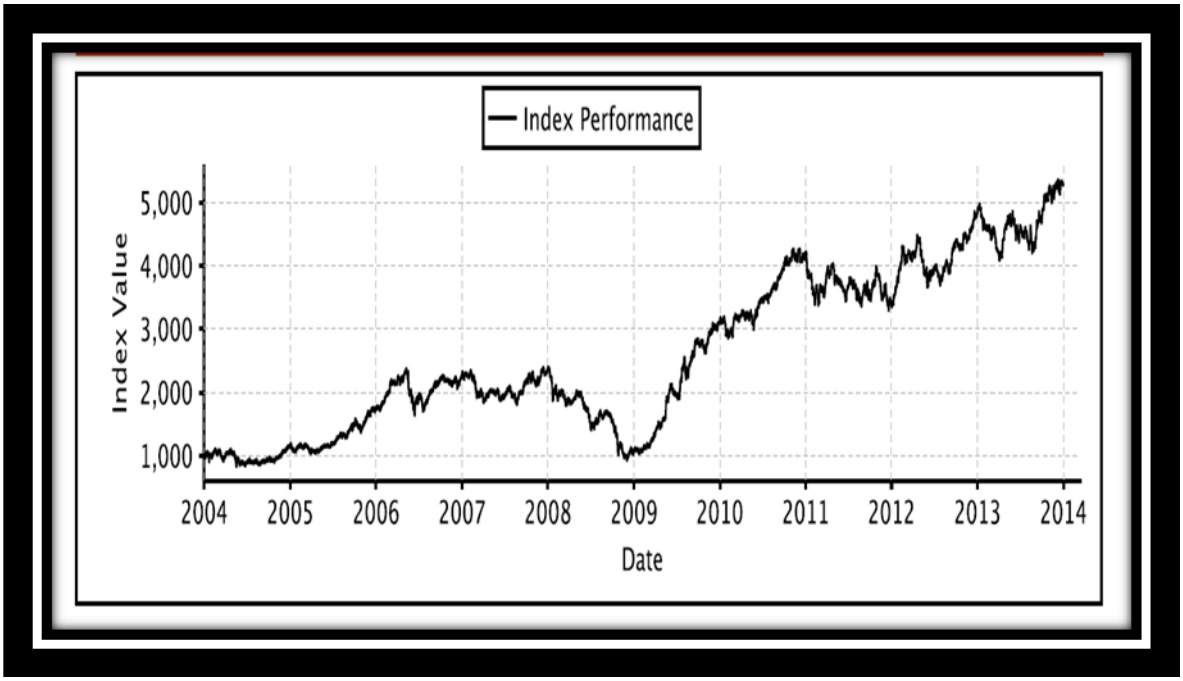
4.5 Statistical data of sample unit of presentation

To test this hypothesis author has taken two pairs of index and its empirical analysis is done using its 10 years closing value i.e. from 2004 to 2013.

4.6 Statistical data of CNX AUTO

Particulars	QTD	YTD	1 Year	5 Year	Since Inception
Returns (%)	12.88	9.41	9.41	37.87	18.1
Std. Deviation			1.25	1.45	1.61
Beta (Nifty)			0.85	0.83	0.81
Correlation (Nifty)			0.77	0.80	0.83

Fig. 1: Performance of CNX Auto



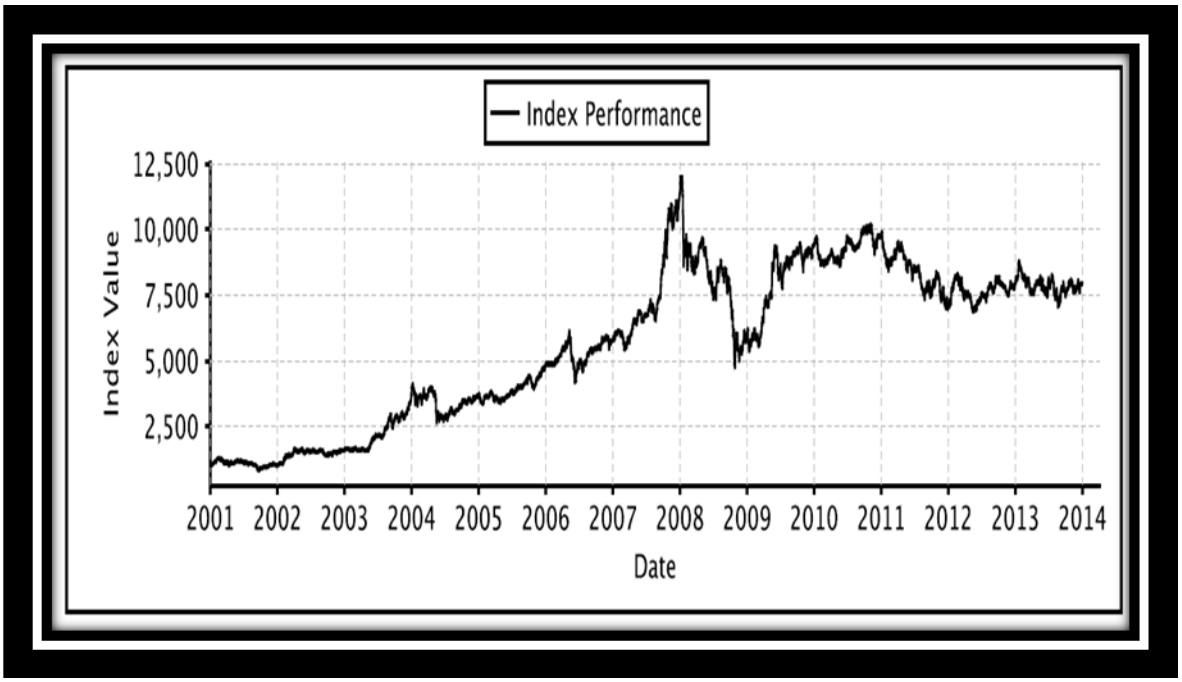
(Source: IISL reports)

4.7 CNX ENERGY

4.7.1 Statistical data of CNX ENERGY

Particulars	QTD	YTD	1 Year	5 Year	Since Inception
Returns (%)	5.93	0.43	0.43	6.28	17.29
Std. Deviation			1.36	1.44	1.75
Beta (Nifty)			0.99	0.9	0.96
Correlation (Nifty)			0.83	0.87	0.86

Fig. 2: Performance of CNX ENERGY



(Source: IISL reports)

4.8 Data analysis and Interpretation

So here to test main hypothesis first sub hypothesis is tested and then main hypothesis would be tested. So it is assumed that there is negative relation between these two stock and its calculation can be done as follows:

Closing value of last ten years is taken as base of calculations.
The following data has been calculated by Author from the daily closing value of each Index.

Table 1: Individual Risk Assessment of CNX ENERGY and AUTO INDEX

Yearly (Closing value)	Closing Value		Return (%)	
	CNX AUTO Index	CNX ENERGY Index	CNX AUTO Index	CNX ENERGY Index
31-Dec-03	1000	3592.74		
31-Dec-04	1157.66	3664.84	15.766	2.006824875
30-Dec-05	1746.28	4791.08	50.84567144	30.73094596
29-Dec-06	2239.67	5755.42	28.25377374	20.12782087
31-Dec-07	2351.16	11322.97	4.977965504	96.73577254
31-Dec-08	1060.02	5870.89	-54.91502067	-48.15061773
31-Dec-09	3118.78	9450.72	194.218977	60.9759338
31-Dec-10	4206.08	9775.68	34.8629913	3.43846818
30-Dec-11	3390.55	6968.1	-19.38931261	-28.72004812
31-Dec-12	4830.55	7927.4	42.47098553	13.76702401
31-Dec-13	5285	7961.2	9.407831406	0.426369301
Average Return			**30.64998626**	**15.13384937**

Table 2: SD and Correlation of CNX ENERGY and AUTO INDEX

Standard Deviation	**CNX AUTO Index**	65.39030202	**Correlation (r)**	0.563620133
	CNX ENERGY Index	41.47816928		

Table 3: Portfolio Risk Assessment of CNX ENERGY and AUTO INDEX

Particulars	Weight (wn)	Volatility (σn)	Average Return	Wnσn
CNX ENERGY	50%	41.47816928	15.13384937	20.73908464
CNX AUTO	50%	65.39030202	30.64998626	32.69515101
Total	100%			

Table 4: Correlation Matrix of CNX ENERGY and AUTO INDEX

Correlation Matrix		
Stock	**CNX ENERGY**	**AUTO**
CNX ENERGY	1	0.563620133
AUTO	0.563620133	1

Table 5: Portfolio outcomes of CNX ENERGY and AUTO INDEX

Portfolio Return =	22.89191782
Variance =	2263.427525
RISK ;σ =	47.5754929

Transpose this to get this matrix

$$= \begin{bmatrix} w_1\sigma_1 & \cdots & w_n\sigma_n \end{bmatrix} x \begin{bmatrix} 1 & \rho_{12} & \cdots & \rho_{1n} \\ \rho_{21} & 1 & \cdots & \rho_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \rho_{n1} & \cdots & \cdots & 1 \end{bmatrix} x \begin{bmatrix} w_1\sigma_1 \\ \vdots \\ w_n\sigma_n \end{bmatrix}$$

5. Conclusion

Though the selection of portfolio has been made in conformity with the economic principle of complementary goods but the indices exhibited a good positive correlation (r = +0.563620133) against the expected negative one.

The possible reason for this sort of deviation can be the increased purchasing power of individuals in the Indian economy which is boosting the automobile sales even in the backdrop of increased oil prices.

But still the portfolio risk being calculated (σ p = **47.5754929**) is lower than the individual risk of auto index (σ = 65.39030202) thereby making the portfolio less risky investment than the individual assets. But CNX ENERGY index portfolio risk is lower than portfolio risk (σ=41.47816928).

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