

Designing a Portfolio Based On Risk and Return of Various Asset Classes

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Abstract

Every investor's dream is to maximize return with minimum risk. Since this is practically impossible, the target is to optimize the risk and return. Different asset classes perform differently at different points of time. The performance is affected by the business as well as other local and global macroeconomic parameters. Crude oil, real estate, gold etc. have given very high returns previously but have turned unattractive in recent times. Equity market has over a long term returned handsome benefits but is highly volatile and hence fraught with risks. The risk free investments like fixed, on the other hand, fall in the low-risk low-return category. The purpose of this study is to analyze the returns of various asset classes and correlate these with their risk characteristics in order to verify whether there is always a positive relation between risk and return across all asset classes and to find out the portfolio mix of the various asset classes corresponding to the desired return and risk.

Keywords: portfolio, equity, gold, debt, assets class, risk, return

1. Introduction

A resource with economic value to any entity or with the potential to provide benefits in the future is an asset. An asset class is a group of financial instruments with similar characteristics. Securities in an asset class behave similarly in the marketplace and are also subject to the same laws and regulations. Equity, fixed deposits, bonds, real estate, gold, cash equivalents and alternative assets are some of the varied asset classes available to investors in India.

Equity represents ownership in a company and is also known as stock. In this paper we will consider stocks of publicly traded companies only. Investors categorize equities into growth stock and value stock. A growth stock is characterized by a price which is high compared to its current earnings and book value and is expected to reach its current price levels in eventually. A value stock on the other hand is priced lower than its actual earnings and book value and it is expected that market will soon discover its intrinsic value leading to an eventual rise in its share price.

Debt is a fixed income instrument through which an investor lends money to a corporate or government entity at a fixed or variable rate of interest. Such instruments are usually termed as bonds and are available for public trading. The rate of interest on a bond is called the coupon rate and the internal rate of return of the bond is known as yield. The bond price holds an inversely proportional relationship with its yield. For a country, the government bonds are considered risk-free and hence the yield on a government bond is assumed as the risk free rate of return. Fixed deposits are another kind of fixed income investment where the interest rate is fixed but cannot be traded. In the Indian context, fixed deposits can be issued only by banks and are considered the safest mode of investment.

In the Indian context, investments in equity and debt can also be done through mutual funds which are pool of funds collected from multiple investors for investing in stated securities. Mutual funds are of particular benefit to small investors with small capital base who get access to well diversified and professionally managed portfolios.

Another asset class providing stable income returns, besides providing partial protection against inflation, is real-estate. It has the advantage of bearing low correlation to the performance of other financial assets therefore and hence is a significant diversifier in a portfolio. For investors who do not wish to lock in their money by investing in physical real-estate, Real Estate Investments Trust (REIT) provides a highly liquid stake in real

estate. REITs are professionally managed funds which are tradable in the exchanges and receive tax consideration and usually offer high dividend-yields.

Gold is another asset class which has relatively low correlation with investments in other asset classes. It has played a major role in trade historically and has been the most favor precious metal for investment purpose mainly because of its liquidity and portfolio diversifying characteristic. Gold Exchange Traded Funds (ETF) is a professionally managed fund allowing investors to gain exposure to gold without holding physical gold.

Speaking of liquidity, the most liquid asset class is the cash equivalents consisting of cash, savings account deposits and money market funds like treasury bills, certificates of deposit issue by banks, corporate commercial papers and other money market instruments. These are short term securities with have high credit quality and have a low-risk, low-return profile.

Apart from these traditional assets discussed above, some other assets available for investment are arts, antiques and collectibles. Together these non-traditional assets are classified as alternate assets. These are usually less liquid long term investments requiring comparatively larger capital base and are therefore mostly limited to high net worth individuals (HNIs). Because of no evident co-movement with other assets such as equity and debt, it can sustain market volatility and thus helps in effective portfolio diversification.

The two fundamental aspects of investment are risk and return. Return measures the gain or loss on any investment over a specified time period and is inclusive of income and capital gain or loss relative to the investment. The amount of return anticipated based on historical data while making an investment is the expected rate of return. The actual gain or loss on the investment is the actual or realized return and is also known as Ex-post return. The possibility that the actual return will different than the expected return is known as risk. It also includes the possibility that all or part of the investment will be lost. It is usually measured by calculating the standard deviation of returns. The risk which is inherent to the market as a whole is known as the systematic risk or market. Such risks contribute to the market volatility and are undiversifiable, mostly unpredictable and not completely avoidable. If the risk is specific to an issuer or security, it is known as unsystematic risk or business risk and can be diversified with the help of a well balanced portfolio. A fixed-rate debt instrument faces interest rate risk when there is a rise in interest rates and hence its value declines. It also faces a credit risk whereby the issuer defaults on the payment of interest or principal. In a declining interest rate scenario an investor faces reinvestment risk because the cash flows from the investment have to be reinvested at lower rates. Every investment also faces an inflationary risk which is the possibility that the purchasing power of the cash flow generated from the investment will decline due to future inflation. Liquidity risk arises from the possibility that the investor may not be able to buy or sell the securities in sufficient quantity as and when desired because of limited opportunities. An investment in some foreign asset or currency also bears the exchange rate risk in case of currency rate fluctuations.

Every investor's dream is to maximize return with minimum risk. Since this is practically impossible, the target is to optimize the risk and return (ICICIdirect, 2013). Different asset classes perform differently at different points of time. The performance is affected by the business cycle (Dzikevicius & Vetrov, 2012) as well as other local and global macroeconomic parameters. Crude oil, real estate, gold etc. have given very high returns previously but have turned unattractive in recent times. Equity market has over a long term returned handsome benefits but is highly volatile and hence fraught with risks. The risk free investments like fixed, on the other hand, fall in the low-risk low-return category. Standard theory predicts a positive relationship between risk and return (Han, 2013). The purpose of this study is to analyze the returns of various asset classes and correlate these with their risk characteristics in order to verify this theory and to find the other major factors which influence them.

2. Literature Review

Each asset class has its own merits and demerits. Investors evaluate each of these assets based on multiple factors. Such factors which determine the choice of an investment avenue have been the subject of study for academics since long. Dr. Rama (2015) surveyed and found that safety, returns and liquidity are the primary concerns for investors, followed by concerns about absence of entry barrier, tax efficiency and cash flow effectiveness. Allocation in each of these asset classes needs to be a well-educated decision. Dzikevicius and Vetrov (2012) combined business cycle and asset allocation theories by adding valuable information about performance of asset classes during different phases of the business cycle and demonstrated that different asset classes have different return/risk characteristics over the business cycle. They thus demonstrated how business cycle approach can be used for decision making. Thomas and Maciej (2013) compared factor-based asset allocation and asset-class-based asset allocation and addressed the issue of the alleged superiority of

risk-factor-based asset allocations over the more traditional asset-class-based asset allocation. Through the use of both an idealized model, capable of precise mathematical treatment, and optimizations based on different periods of historical data, it was shown that neither approach is inherently superior to the other.

Taking the various asset classes into consideration independently we now look at the various academic researches that have been done in the past. Equity is a major investment asset-class and value stocks are seen as the most profitable in the Indian stock market. An empirical study by Jaspal Singh and Kiranpreetkaur (2014) have revealed that the portfolio selected on the basis of tangible book value rule of Benjamin Graham provided significantly positive mean market adjusted returns in maximum number of years when the holding period of the portfolio is extended from 12 months to 24 months. This valuation metric is aimed at buying the securities whose prices are lesser than the tangible book value of the assets of the company. The portfolio also showed lesser volatility than the market portfolio. Hence, it can be safely assumed that investment period and volatility are important parameters to be considered while investing. As far as Indian stock markets are concerned, return and volatility for both the index are scattered over a period of time where risk averse investors are willing to commit huge amount to high risk transactions hoping that market discounts all information and reacts immediately towards news shocks (Shanthi, Thamilselvan, & Srinivasan, 2015). Also, the presence of seasonality in the stock market makes the equity prices predictable based on past pattern, though this violates the Efficient Market Hypothesis (Ash, 2010). Stock prices are also affected by investor sentiments apart from fundamental risk factors (Saumya & Jitendra, 2013). Rajni (2015) had calculated that the Indian equity market (Sensex) had provided an average return of 16.59% as against the expected rate of 10.84% during the period of 2003-2013 with a delivered risk premium of 9.78% per annum. Such a high risk premium may be the reason why Indian equity market is able to attract the foreign investors. The risk premium is however lower than the 12.5% as calculated by Verma and Barua (2006) signaling that the Indian equity market is maturing gradually.

Debt is another significant asset class for the investors and the major debt instruments are the bonds, mostly the government securities. Bond returns depends on changes in macroeconomic factors such as expected inflation, long term interest rate, money supply, forex reserves, exchange rate and LIBOR (Thenmozhi & Karthika, 2014). The relationship between India's stock and bond markets returns has also been the subject of many academic researches. Bharat and Mahmoud (2010) have found the evidence of substitution of risky stocks for risk-free bonds in Indian markets suggesting that stock market volatility drives up bond returns through a flight-to-quality and/or cross-hedging trades of stock market risk. They were also able to establish that the covariance between foreign exchange rates changes and stock returns is empirically small, while the covariance between exchange rate changes and bond returns is much larger.

Gold as an asset class which is very famous among Indians because of reasons both cultural and financial. It has the ability to provide liquidity as well as transparent price discovery. Currently gold Exchange-Traded Funds (ETFs) and gold mutual funds provide an alternative to investment in physical gold. Analysis has shown that investment in gold has negative correlation with that in equity, and therefore, can act as a perfect instrument for hedging equity investment risk to reduce the overall portfolio risk (Mukesh, Vikrant, & Sougata, 2012). Overall, gold has been found to be a valuable asset class that can improve the risk-adjusted performance of a well-diversified portfolio of stocks while acting as a hedge against various market and macroeconomic factors (Dilip, 2014).

Another asset class which has gained prominence with the rapidly growing economy of India is real-estate. Physical property, REITS, real-estate mutual funds and real estate stocks are the avenues available for investing in real-estate in India. However, the real estate markets were found to under-perform the stock market in India over 1998-2005 although there was some improvement in their performance in more recent years (Graeme & Rajeev, 2007).

Alternative assets, such as art, antiques and collectibles, are driven by the same risk factors like that of stock and bond volatility, besides depending on changes in interest rates, cash flows, credit spreads, liquidity and other specialized factors (Niels, Sébastien, & Fei, 2014).

3. Research Methodology

3.1 Research Objective

The purpose of this study is to analyze the returns of various asset classes and correlate these with their risk characteristics in order to verify whether there is always a positive relation between risk and return across all asset classes and to find out the portfolio mix of the various asset classes corresponding to the desired return and risk.

3.2 Data Description

Secondary data corresponding to last ten quarters ending 31st March 2015 were. For equity we have considered Nifty 50, for debt 10 year G-sec yield has been taken, for fixed deposit we have taken the RBI data for term deposit rates corresponding to 1-3years maturity period and for real estate we have taken the Residex Index published by National Housing Board. Portfolios have been constructed using the variance-covariance method and

3.3 Research Design

To design a portfolio with these assets using the calculated returns and risk through simulation by Solver tool in Excel we have used the Variance-Covariance method.

4. Data Analysis

As can be seen from Figure 1, each year has seen a different winner in terms of return. Also, each asset class has different risk characteristics. It therefore becomes necessary to build a portfolio to diversify the risk in accordance with the required rate of return. However, we must study the individual risk and return characteristics of each of the asset classes before we move on to building a portfolio.

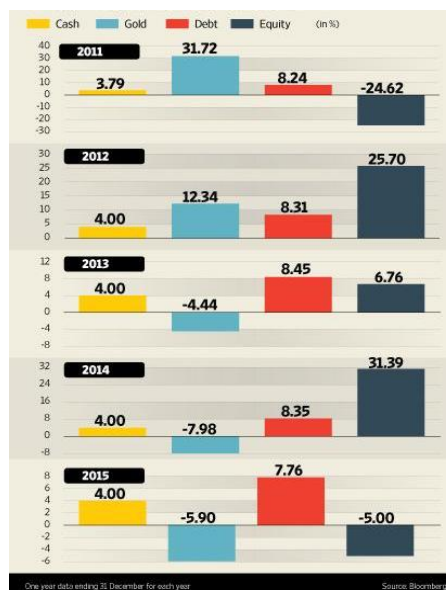


Figure 1. Year-wise returns 2011-15

Data corresponding to last ten quarters ending 31st March 2015 were collected and average annualized risk and returns were calculated. Risk has been calculated using standard deviation of returns. For equity we have considered Nifty 50, for debt 10 year G-sec yield has been taken, for fixed deposit we have taken the RBI data for term deposit rates corresponding to 1-3years maturity period and for real estate we have taken the Residex Index published by National Housing Board. By analyzing we get the following result:

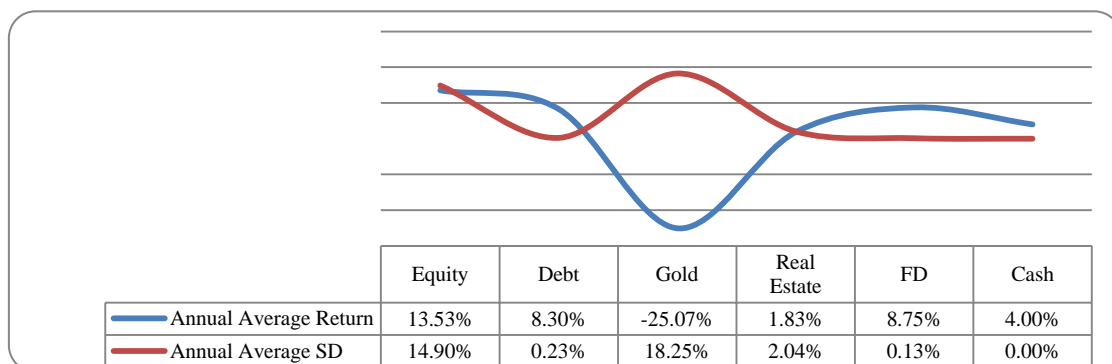


Figure 2. Risk vs return January 2013 – April 2015

From the above analysis, it can be seen that for the mentioned period gold had the highest volatility, implying the highest risk, while delivering the lowest return. On the other hand, fixed income securities such as government bonds and fixed deposits had reasonably high return with very little risk. The positive relation between risk and return could be verified only for equities and cash savings and hence cannot be generalized for all individual asset classes.

We now try to design a portfolio with these assets using the calculated returns and risk through simulation by Solver tool in Excel. The Minimum Variance Portfolio is attained by minimizing the standard deviation and the Optimal Risky portfolio is attained by maximizing the Sharpe's Ratio. Sharpe's Ratio is the measure of risk adjusted return and is calculated as the average return earned in excess of the risk free rate per unit of volatility of total risk. Risk free rate has been taken as the 10 year Indian Government bond yield on 1st April 2015.

The portfolio of a person will depend on his required rate of return and his/her risk appetite. Hence various situations have been simulated by keeping a minimum of 10% allocation to cash in each case, except for the optimal risky portfolio, since this much of liquidity is always necessary. The different portfolios are as follows:

Table 1. Optimal portfolios

	Min Variance portfolio	Optimal risky portfolio	Portfolio mean return 9%	Portfolio mean return 10%	Portfolio mean return 11%	Portfolio mean return 12%	Max Return Portfolio
Expected Return	8.09%	8.75%	9.00%	10.00%	11.00%	12.00%	12.57%
SD	0.11%	0.13%	8.63%	8.95%	9.28%	11.62%	13.41%
Sharpe's Ratio	2.190	6.780	0.132	0.239	0.338	0.356	0.352
Equity	0%	0%	54%	58%	62%	78%	90%
Debt	11%	0%	1%	0%	0%	0%	0%
Gold	0%	66%	5%	3%	1%	0%	0%
Real Estate	2%	0%	2%	1%	0%	0%	0%
FD	78%	20%	28%	27%	27%	12%	0%
Cash	10%	14%	11%	11%	10%	10%	10%

From Table 1 it can be seen that the minimum risky portfolio gives a return of 8.09%, which is higher than the risk-free rate, while the maximum return possible is 12.57%, which is lower than the return of Nifty 50. The optimal risky portfolio provides a return of 8.75%. At 9% expected return, slightly above the average fixed deposit rate of return, we get a well balanced portfolio but the risk component is higher. In fact, by designing a portfolio we have been able to diversify our risk and we can see that the risk component increases as the expected rate of return increases, thereby giving us a high risk-high return scenario.

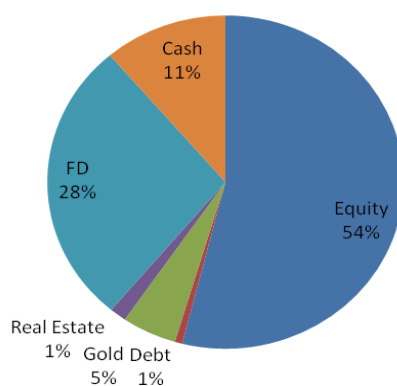


Figure 1. Portfolio for 9% return

From the above analysis we observe that real estate never forms a significant part of the portfolio. Also, cash component of portfolio depends on individual's liquidity requirement which is broadly based on one's lifestyle and life stage. Hence, we reanalyze keeping these two components aside. Also, for better accuracy we use monthly returns of equity, gold, debt and fixed deposit from last ten years ending April 2015.

By analyzing the risk and returns of these asset classes we obtain the following result:

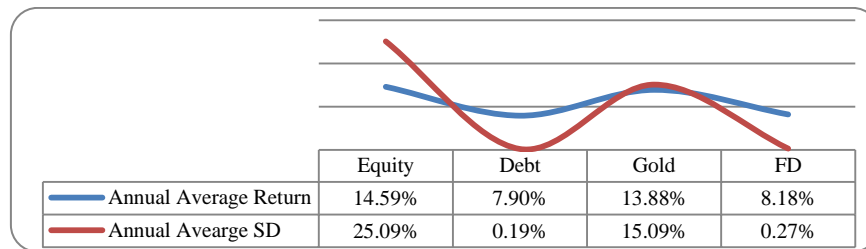


Figure 2. Risk vs return April 2005 - April 2015

From this analysis we can see that there is always a positive relationship between risk and return where equity has the highest risk and return and debt the lowest. To further analyze the relation we run a regression between the risks and return values considering return depends on risk.

From the linear regression analysis we obtain a strong positive relation with a R square value of 0.93 indicating that around 93% of variation in return can be explained by change in the risk component. The relation between risk and return can be defined by the equation:

$$y = 72.69x^3 - 30.67x^2 + 3.412x + 0.072 \tag{1}$$

where x is the average annualized return and y is the average annualized standard deviation, with fair degree accuracy where MAPE (Mean Absolute Percentage Error) is 0.006.

Table 2. Return derivation from risk

Asset Class	Annual Average SD	Calculated Return	Actual Return	Absolute % Error
Equity	25.09%	14.55%	14.59%	0.002
Debt	0.19%	7.83%	7.90%	0.009
Gold	15.09%	13.83%	13.88%	0.004
FD	0.27%	8.11%	8.18%	0.008
Mean Absolute Percentage Error (MAPE)				0.006

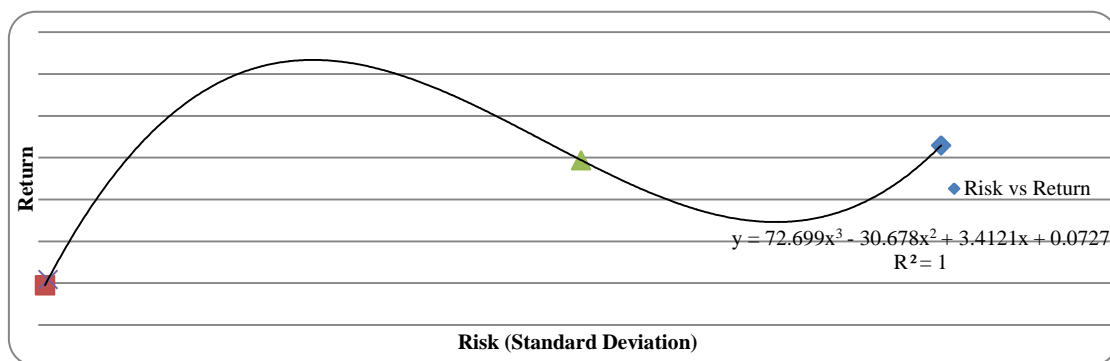


Figure 3. Regression analysis - Risk vs Return

With this background, we now try to find out the portfolios with minimum variance, optimal risk, maximum return and mean returns in the range of 9-14%. The results are as below:

Table 3. Optimal portfolios

	Min Variance portfolio	Optimal risky portfolio	Portfolio mean return						Max Return Portfolio
			9%	10%	11%	12%	13%	14%	
Expected Return	7.95%	8.26%	9%	10%	11%	12%	13%	14%	14.59%
SD	0.18%	0.28%	2.57%	6.55%	10.59%	14.63%	18.67%	22.72%	25.09%
Sharpe's Ratio	0.528	1.424	0.443	0.327	0.297	0.283	0.275	0.270	0.268
Equity	0%	1%	11%	27%	43%	59%	75%	91%	100%
Debt	11%	0%	43%	36%	28%	20%	12%	5%	0%
Gold	0%	1%	5%	4%	3%	2%	1%	0%	0%
FD	78%	99%	41%	34%	27%	19%	12%	4%	0%

From Table 3 it can be seen that the minimum risky portfolio gives a return of 7.95%, which is higher than the risk-free rate of 7.86%, while the maximum return possible is 14.59%, which is equal to the return of Nifty 50. The optimal risky portfolio provides a return of 8.26%.

Apart from these conventional asset classes, there are the alternate assets such as arts, antiques and collectibles which can be considered for investment but the risk and returns cannot be generalized or quantified.

4.1 Limitations of the Study

It is always preferable to take as much data for study as is available for analysis. Our first analysis was limited to quarterly data of last ten quarters ending financial year 2014-15. This is because the only index for real estate in India available is the Residex which was launched by National Housing Board from Q2 FY 2012-13 with 2007 as the base year. Hence, for comparability we had to limit our data for other asset classes to the same period. The second analysis based on 10 years data appears to be more accurate.

For equity returns we have considered the widely traded CNX Nifty 50 index. However, the result might change if some other index such as the S&P BSE Sensex is used for the study. Similarly, for debt we have considered only 10 year G-sec yield. Result might vary of other forms of debt instruments such as the corporate bonds, are included in the portfolio.

Fixed deposit rates in India vary depending of the maturity period and also from bank to bank. For simplicity purpose we have taken the 1-3 year term deposit rates published by RBI. If longer period term deposits are included the portfolios might change. The returns used above for portfolio calculation are pre-tax returns and unadjusted for inflation. An investor must also consider the different tax implications arising from various asset classes and also how much return they provide when inflation is taken into consideration.

The investor's age and life-stage is another very important factor which must be taken into consideration for designing a portfolio since the liquidity requirement, risk appetite and other parameters change through one's life.

5. Conclusion

From our study we can conclude that there is a strong positive relation between risk and return of individual asset classes. However, when a diversified portfolio of various asset classes is considered, the risk can be mitigated to a large extent and is usually higher for higher expected return. This helps in planning one's investment corresponding to his/her expected rate of return and the risk appetite. From the various portfolios it can be seen that simply keeping the whole money as cash is not desirable since almost double the savings interest can be earned at very low risk level. On the other hand, investing only in equity markets is also not desirable since risks exceed returns. Also, we can earn a higher return compared to the risk free return with a lower risk component compared to 10 year G-sec bonds. Investing in a well-diversified portfolio also helps in evening out the variations in the returns from different asset classes over the years thereby introducing an element of certainty.

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