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# Commodity Investments: Opportunities for Indian Institutional Investors

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## **Abstract:**

An attempt has been made to establish the fact that by investing in commodities or its alternative channels, institutional investors like banks can not only compensate for the lower risk-free returns in their major chunk of investments in Government securities, but also will be able to diversify some amount of their portfolio risk which is expected to rise by taking exposure in commodity market. The results exhibited in all the tables and figures clearly depict that investment in alternative channels like commodity indices or commodity futures contracts in India will not only allow the institutional investors to leverage their portfolio return, but also will ensure that diversification benefits is achieved. Therefore, even if investment in direct commodities are restricted for Indian banks, but still there is a significant opportunity for them to invest in the available alternative channels like commodity indices or commodity futures contracts

**Key Words** : **Investment Portfolio, Commodity, Commodity Futures, Institutional Investors**

**JEL Classification** : **G10, G14, G15**

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# Commodity Investments: Opportunities for Indian Institutional Investors

Dr. Kedar nath Mukherjee

## 1. INTRODUCTION

Where to invest? This seems to be a very common question for different investors. The typical means of investments where especially the institutional investors can take significant exposures include Equity, Fixed Income Securities like Bonds, other investable funds, Derivatives, Commodities, etc. During recent years, commodities prices and the level of investment in commodities rose significantly. Commodities could provide the yield investors were looking for but, more important, investors began taking greater advantage of the negative price correlation to bonds and equities to diversify their portfolios. Unlike the traditional assets like bonds or equities, the opportunities and challenges in commodity investments has made the scope of investment considerably wider for the investors in world economy. Investors can take reasonably good amount of exposure in commodity market, either through direct investments in different commodities or through various indirect channels. Direct commodity investment has historically been a small part of investors' overall asset allocation. Owning equity or debt issued by companies specializing in commodity markets has been the principal means of obtaining commodity exposure. In recent years, however, the number and variety of commodity-linked investments, offering direct exposure to commodity markets, has considerably increased. Commodity based indices, commodity futures contract are some of the important means to get a direct exposure into the commodity market. However, the investors' benefits of commodity or commodity-based products lie primarily in their ability to offer risk and return trade-offs that cannot be easily replicated through other investment alternatives

Commodity indices are designed to capture the returns to holding long positions in agriculture, metals, energy, or livestock. Such indices can be created not only from the spot prices of core commodities, but also from the prices of the concerned futures contracts on several commodities. In the past decade, several such investable commodity indices have been created which are based on the spot and futures prices of several commodities. Commodity exposures through such indices also enable the investor to avoid the cost of carrying the commodities in physical form. Alternatively, commodity futures contract on

individual commodities and also on commodity indices allows the investors to take a direct exposure in commodity sector without facing the challenges of holding the physical commodities. This facility along with the other basic benefits of financial futures makes the commodity futures contract very interesting for the investors interested in commodity market. Investors like banks may also be restricted to hold any commodities, except bullions, in their physical form, but they can still get the benefits of commodity market through investments in such commodity indices or commodity futures contracts. It is also true that commodity indices differ from the individual commodity in a number of ways, including variations in commodity selection criteria and weighting schemes, as well as operational issues such as rolling mechanism and rebalancing strategy. Even if the physical commodity market in India is quite developed, not from the perspective of wider participation from different level of investors including Indian banks, the concept of commodity indices and commodity futures contract is not yet well taken by the market players in India.

Some of the commodity indices, offered in Indian commodity exchanges like Multi Commodity Exchange (MCX), and National Commodity and Derivatives Exchange (NCDEX), are MCX METAL, MCX ENERGY, MCX AGRI, MCX COMDEX, Dhaanya, etc. MCX AGRI and Dhaanya are the commodity indices created from the prices of various agricultural commodities in different proportion. Several Group Indices, like MCX AGRI, MCX METAL & MCX ENERGY, both on the spot and futures prices of selected commodities, have been developed to represent different commodity segments as traded on the exchange. MCX COMDEX is the maiden Composite Commodity Index in India based on commodity spot and futures prices at MCX. It is essentially the simple weighted average of the three group indices, giving 40 percent weight each to the components of metal and energy index and the balance 20 per cent to the components of agricultural index. Dhaanya is the agriculture index that includes the most liquid agricultural futures contracts traded at NCDEX. These indices are considered to be significant barometers for the performance of commodities market and would be an ideal investment tool in commodities market over a period of time. It is generally perceived that by holding & rolling positions in all such index futures contracts, investors would be able to replicate the returns otherwise generated on the basket of commodities included in the concerned index. The index futures contracts are expected to give users the ability to efficiently hedge commodity and inflation exposure and lay off the residual risk. On the other hand, out of more than 100 commodities listed in the above multi-commodity exchanges in India, futures trading is permitted almost to half of the

total number of commodities. The history of individual commodity futures over the last few decades clearly reveals the importance of commodities as a significant means of investment for domestic as well as international investors.

## **RATIONALE FOR INCLUDING COMMODITIES IN A PORTFOLIO**

The primary reasons for including commodities or commodity-linked exposures in an investment portfolio are Availability of Alternative Commodity Exposure, Return Prospects, Benefits of Diversification, and Inflation Protection.

### ***Availability of Alternative Commodity Exposure***

The option of obtaining commodity exposure through direct physical investments is not practical because of storage costs and the perishable nature of many commodities. Investors, expected to take any long or short position in commodity sector, are not necessarily required to get exposed to any physical commodity. Availability of commodity indices and commodity futures contracts, as discussed in the above section, gives the investors an opportunity to take significant exposure in the commodity sector without physically dealing with any commodity. Equity share of commodity-based companies, which is essentially a financial asset, is also an alternative means to take exposure in the commodity sector. Therefore, the availability of various alternative means of investment in physical commodities makes the commodity sector exposure attractive for the worldwide investors.

### ***Return Prospects***

The average return from direct commodities or commodity-linked investments is comparatively greater than the same from equities or bonds. The prospect of higher return makes such means interesting for the investor to include in their investment portfolio, even if it brings higher volatility comparative to the other traditional assets classes.

### ***The Benefits of Diversification***

Commodities have historically provided an excellent diversification benefit when combined with the traditional asset classes. Commodity Indices generally show very low correlation with several other asset classes that are typically part of a broadly diversified portfolio, including equity, fixed income and real estate. This characteristic, combined with consistently

positive returns, will serve to lower the overall volatility and improve the risk-adjusted returns of a planned portfolio

### ***Inflation Protection***

Diversifying financial assets from inflation risk can often be effectively managed by including commodities in a portfolio. Alternatively, in addition to diversification benefits, commodities have historically provided a strong inflation hedge. Since Commodities are real goods and raw materials, they are directly linked to the rising prices that drive inflation. In times of unexpected inflation, Commodities can act to counter-balance the equity and fixed income asset classes, which typically under-perform during these periods. This premise can be well tested by calculating the correlation of commodity returns, as well as stock, bond, hedge fund, and real estate returns, with a proxy for unexpected inflation.

### **COMMODITIES AS A PART OF BANKS' INVESTMENT PORTFOLIO**

The surplus funds, comes into the treasury of banks and used to create a pool of investments in different assets, cannot be invariably utilized to invest in any commodities. In terms of Section 8 of the Banking Regulation Act, 1949, no banking company can directly or indirectly deal in the buying or selling or bartering of goods. However a Provision of the same section stipulates that restrictions imposed in Section 8 shall not apply to any such business as is specified by Central Government in terms of Section 6(1) (o). Thus the Central Government may consider issuing a notification under Section 6(1) (o) of the B. R. Act, 1949 permitting banks to deal in the business of agricultural commodities including derivatives. In 1997, RBI permitted few banks to import and resell gold as canalizing agencies. However, banks engaged in this bullion market do their business on consignment purchase and sale basis for a transaction fee. Even if Indian banks are legally restricted to directly invest in commodities, the availability of alternative channels like commodity based equities, commodity indices, commodity futures contracts, etc. may lead to a reasonable proposition for the banks to take indirect exposure in the commodity sector. Financing agricultural loans against Warehouse Receipts, commonly known as Warehouse Receipt Financing, even if considered to be one of the important direct exposures that a bank can have in the commodity market; but this exposure is a part of banks' loan book and therefore is not treated as a part of banks' investment portfolio. Above all, even if financial institutions like banks have restricted exposure in the commodity market, there are different alternative channels through which

significant amount of direct or indirect exposure can be taken to create a optimum investment portfolio, giving due consideration to the perspective of both risk and returns.

### **BRIEF OVERVIEW OF THE STUDY**

In light of the recent surge in many commodities, it might be useful to discuss the potential role and use of commodities in the investment portfolio of various levels of investors, especially the institutional investors like Banks and other Financial Institutions. The purpose of this study is to empirically validate the theoretical arguments for the risk and return advantages of commodity investment. The comparative advantage, especially in terms of portfolio diversification, is examined by considering different asset classes like Equity and Bonds, both at the individual asset level and at the index level. The performance of the commodity indices, both Sector wise and Composite indices, is compared with the same on traditional and alternative investments like equities and bonds.

Results, as depicted by the different statistical measures, clearly indicate that commodity indices have sources of risk and return that are distinct from traditional assets like stocks and bonds, and therefore offer investors an important additional area leveraging their returns and also to ensure natural portfolio diversification. Even if different alternative channels can be used to replicate direct investment in commodities, impact of all the available substitute are not found to be similar and therefore could not be used invariable by the institutional investors to construct their investment portfolios. The negative correlation between the returns of commodities and that of selected bonds confirms that institutional investors like Indian banks can easily diversify their portfolio by entering into various alternative investment channels available in the commodity market. The composite results on the movements of annualized average return and volatility among major assets classes in different years starting from 2005 to 2011 (till May) clearly exhibits the requirement of commodities to be a part of investment portfolio of various institutional investors, not only to leverage their returns but also to get the benefits of inverse correlation and to ensure portfolio diversification. The performance of each of the asset classes is briefed in detail in the following section.

## **II. REVIEW OF LITERATURE**

Studies such as Lummer and Siegel (1993), Kaplan and Lummer (1998), Greer (2000), Jensen, Jonson and Mercer (2000 and 2002), Gordon and Rouwenhorst (2005), Erb and Harvey (2006), Ibbotson Associates (2006), Laws and Thompson (2007), Roache (2008), etc., focusing on the role of commodity futures in a diversified portfolio, have commonly found that: under the appropriate circumstances, a diversified portfolio with commodity futures provides higher average returns and a better Sharpe ratio than the traditional portfolio of stocks, bonds and even real estate.

Although commodities have been considered as an investible asset class since at least 1978, widespread inclusion of commodities in the asset allocation decision is a more recent phenomenon. Bjornson and Carter (1997) have found that commodity expected returns are lower during times of high interest rates, expected inflation and economic growth. While, Weiser (2003) reported that commodity futures returns change with different stages of a business cycle. As direct investment in physical commodities is not practical because of storage costs and the perishable nature of many commodities, research on the strategic and tactical asset allocation focuses on the commodity futures.

The attraction of commodity futures is based partially on the view that commodity prices tend to have low correlations with security returns and also provide an inflation hedge, as evidenced by Bodie & Rosansky (1980), Irwin and Brorsen (1985), Lee, Leuthold and Cordier (1985), Elton et al. (1987), Irwin and Landa (1987), Edwards & Park (1996).

Schneeweis and Spurgin (1997) have examined the correlations of oil-based futures contracts with energy-related and non-energy related stock, bond, real estate and commodity markets, and CPI. Their results confirmed that, except in periods of extreme energy price movement, many traditional forms of indirect energy investment such as natural resource mutual funds or energy-based common stocks are not correlated with energy price movements.

Kaplan and Lummer (1998) have considered the performance of two portfolios, consisting of 60% in US stocks, 30% in bonds and 10% in bills in the first, and a second portfolio consisting of 57% US stocks, 28.5% in bonds, 9.5% in bills and 5% in GCSI. Over the period 1970 to 1996, the first portfolio returned 11.1% per annum with a standard deviation of 11.8% whereas the second returned 11.4% with a standard deviation of 11%, suggesting that the second portfolio with commodity index was more efficient.



Becker and Finnerty (2000) have found that the inclusion of portfolios of long commodity futures contracts (CRB and GSCI) improves the risk and return performance of stock and bond portfolios for the period of 1970 through 1990. They observed that the improvement is more pronounced for the 1970s the 1980s due to the high inflation of the 1970s with commodities acting as an inflation hedge.

Jensen et al (2002), over the period January 1973 to December 1999, have calculated monthly returns on a portfolio consisting of four assets, namely domestic (US) and non-domestic stocks and corporate bonds together with a money market instrument and commodity futures represented by Goldman Sachs Commodity (total return) Index (GCSI). They also have found that the inclusion of commodity futures raised the mean monthly return by figures in the region of 4 to 8 basis points per month (i.e. 48 to 96 basis points per annum). The optimal proportion of commodity futures (again the GCSI index) was significantly increased at all risk levels during periods of monetary restraint.

Gorton and Rouwenhorst (2005) have constructed their own commodity futures index for the period 1959 – 2004 and examined how this compares with returns from stock and bond indices. They concluded that the average annualized return on the collateralized futures index was very similar to that on the SP500 over the whole period and both assets outperformed corporate bonds. They also found that the relative performance varied over time and that the diversification benefits of commodities work well when they are needed most. Accordingly they have reached a conclusion that commodity futures are useful in creating diversified portfolios with respect to the idiosyncratic component of returns.

CISDM (2006) in their work have exhibited that direct commodity investment can provide significant portfolio diversification benefits to traditional stock and bond portfolios and can provide return opportunities not only beyond those achievable from commodity-based stock and bond investment, but also beyond that of simple inflation hedging.

Erb, C.B. and C.R. Harvey (2006), have evidenced that commodity futures are an inconsistent, if not weak, hedge against unexpected inflation. Their portfolio analysis suggests that a long-only strategic allocation to commodities as a general asset class is a bet on the future term structure of commodity prices, in general, and on specific portfolio weighting schemes, in particular. They have examined three trading strategies that use both momentum and the term structure of futures prices and have found that the tactical strategies provide higher average returns and lower risk than a long-only commodity futures exposure.

By examining the role of commodities in a portfolio consisting of five futures assets (one commodity and four stock indices) and a money market asset over the period November 1994 to March 2007, Laws and Thompson (2007) have showed that introduction of commodities provided an increase in return without a corresponding rise in risk

Greer (2007) observes that a typical client allocation to commodity futures is about five percent, but the same can easily be made for a fifteen percent allocation based on desired risk and return parameters.

As exhibited by Nguyeny and Sercu (2010), the performance of out-of-sample optimal portfolios show that the proposed strategy with commodity futures performs better than (i) any stand- alone assets (stocks, bonds, commodity futures); (ii) the optimal portfolio without commodity futures and (iii) strategies that consider only one type of information. If the business cycle is divided three stages (early, middle and late), then they have suggested a strategy to go long commodity futures: (i) with a restrictive policy in middle, late stages of booms and during the recession; and (ii) under an expansive policy: in a boom.

Conover, Jensen, Johnson, and Mercer (2010) in their study, based on a sample period of 36 years, have shows substantial benefits to commodity investments regardless of the equity style that an investor pursues. Interestingly they have shown that, adding a commodity exposure enhances an equity portfolio's return mostly during periods when the Central Bank increases interest rates, which is consistent with the belief that a major attraction of commodities is that they serve as an inflation hedge.

### **III. DATA AND METHODOLOGY**

#### **DATA**

The daily price information on three major asset classes, Bonds, Equities, and Commodities, both at the individual asset as well as index levels, has been studied. The seven years sample period, starting from 2005 till 2011 (May) is chosen for the study. Even if the daily price information in the bond market is collected only during 2010, the annual return and volatility details for securities with different tenors are collected separately for the concerned analysis. Five different benchmark, as on May 2011, coupon bonds (8.00% G.S. 2011, 10.25% G.S. 2012, 9.00% G.S. 2013, 12.30% G.S. 2016, and 10.70% G.S. 2020) of different tenors (less than 1 year, 1 year, 2 years, 5 years, and 10 years) along with the four major bond indices

(*CCIL-B-TRI*, *CCIL-B-PRI*, *CCIL-L-TRI*, *CCIL-L-PRI*), both Broad based and Liquid indices brought out by Clearing Corporation of India Limited (CCIL), are used in the study. The tenor specific security wise annual average returns or yields and yield volatility has been collected from the Handbook of Statistics on Indian Economy, published by the Reserve Bank of India (RBI). In regards to the commodity class, 1 overall commodity index (*MCX COMDEX*), 3 sector-specific (*MCX AGRI*, *MCX ENERGY*, and *MCX METAL*) indices, and 6 individual non-agricultural commodities (Aluminum, Copper, Crude Oil, Gold, Natural Gas, and Silver), both from the underlying Spot and Futures segments have been included in the study. 6 equity indices namely *NIFTY*, *NIFTY JUNIOR*, *S&P500*, *BANK NIFTY*, *ENERGY*, and *MIDCAP*; along with 8 individual stocks namely *INFOSYS*, *IOC*, *ONGC*, *RELIANCE*, *SAIL*, *SBIN*, *TELCO*, and *TISCO*, only from the spot segment, are considered to represent the equity segment of the investment portfolio. Since Indian banks are not allowed to trade on equity derivatives contracts, equity futures contracts, even if very actively traded in India, are kept outside the scope of this study. Daily equity price details of another 7 companies, viz. *Hindalco Industries Ltd.*, *National Aluminum Co. Ltd.*, *Hindustan Oil Exploration Co. Ltd.*, *Oil & Natural Gas Corporation. Ltd.*, *Jindal Steel & Power Ltd.*, *Steel Authority of India Ltd.*, *Tata Steel Ltd.*, engaged in various commodity business, have also been collected to understand whether they can be used as an alternative to other direct or indirect channels of commodity investment. All commodities and equity related data have been collected respectively from the website of Multi Commodity Exchange (MCX) and National Stock Exchange (NSE). Data on all commodity futures contract represents the *Nearest Month* contract due to their highest liquidity among all others, expired at different months.

## **METHODOLOGY**

A preliminary attempt has been made to quantify the risk and return in commodity market, in comparison with that of the other conventional asset classes. Different univariate and bivariate basic statistical measures are estimated to understand the risk-return characteristics of individual assets and also to understand the co-movements among different asset classes, over a period of seven years. Annualized average returns and volatility (Standard Deviation), over different annual periods, in all the three major asset classes, viz. Bond, Equity, and Commodity, have been calculated, assuming that there are 250 trading days in a year. The average of daily logarithmic return in equities and commodities over different annual periods has been transformed into annualized figures by multiplying the same with the assumed

number of trading days in a year. At the same time, the average variation (Standard Deviation) over different annual periods have also been transformed into annual volatility by considering the product of daily average variation and square root of the assumed number of trading days per year (i.e. Annual Volatility = Daily S.D.  $\times \sqrt{250}$ ). As far as the annual return or yield in the bond market is concerned, a dual treatment has been followed to deal with the bond indices and the individual bonds. The daily and annualized average return and volatility of the bond indices is calculated in the way similar to the other asset class. But since most of the bonds in market like India are expected to be hold till the maturity and accordingly redeemed at the face value, the average market yield expected to be generated on bond with different tenors are used as the proxy return measures for the individual bonds. The annual average yield on Government Dated securities for various maturities, published on monthly basis, is used to replicate the average annual return expected to be generated from the concerned asset class. Since bonds have a fixed lives and the return from the same also depends on the maturity period, the annual return of a specific fixed income security over different annual periods cannot be compared. Therefore, instead of following the approach of averaging daily logarithmic price change followed by annualizing the same, the annual yield data on fixed income securities of various tenors have been straight way picked up from the concerned data source as published by the RBI. On the other hand, the volatility of such yield of different tenors has been calculated through the SD of monthly annualized return on all the concerned securities.

In order to incorporate the trade-off between the return and risk, annual comprehensive measure, called *Sharpe Ratio*, has also been calculated for all the individual assets in different asset classes. This figure exhibits the strength of excess returns (Concerned Return minus the Risk-free Return) of different assets in relation to their individual risk. Alternatively, the ratio is defined as:

$$\text{Sharpe Ratio} = (\text{Asset Return} - \text{Risk Free Return}) / \text{S. D. of Asset Return}$$

All the figures are annualized and the annual yield on 364 Days Treasury bill has been considered as the risk free returns. Even if the risk-free rate is practically set based on the investment horizon of the investors, the 364 Days T-bill rate is invariably used as a proxy of annual risk-free return to enable the investors to understand the per unit risk premium of different assets under various asset classes. This ratio enables the investors to evaluate the performance of different assets not by taking separate views on their return and risk, but by taking a joint view on both the important parameters.

All the above statistical measures are applied in the study to understand the relative performance of individual assets under different asset classes. But since a typical institutional investor like banks are actually concerned about the performance of their whole investment portfolio created by taking exposure in different asset classes like bonds equities, commodities, etc., the investors may have a serious concern while constructing such portfolio. One of the important facts that investors always try ensure is how to ensure *Portfolio Diversification*. Alternatively, investors generally tries to avoid concentration risk of a specific asset class and prefer to include such securities in their portfolio so that the high risk in one asset class gets set-off by the lower risk of other asset class (s). This possibility again can be ensured by selecting asset classes the prices of which moves inversely, not within the class but across the asset classes. A negative value of coefficient of correlation or at least a significantly small positive correlation across the prices of various asset classes is important to confirm a natural diversification in the portfolio. Therefore, apart from analyzing the risk and return of different commodity related assets, comparative to the traditional asset classes like bonds and equities, the impact of different alternative channels of commodity investments are also examined to ensure the important concern of portfolio diversification. The *Pearson's Coefficient of Correlation* among different pairs of assets are calculated to verify whether the movements of commodity prices, both at the index level and individual commodity level, are inversely or at least poorly related with the price movements in other traditional asset classes. The yearly transformation of the direction and magnitude of such co-movements between the asset classes also exhibit the possibility of strengthening or weakening the diversification opportunity.

#### **IV. EMPIRICAL FINDINGS**

The opportunities of direct investments in several commodities or in other alternative channels, such as commodity indices, commodity futures contracts, or commodity based equities, are analyzed and compared with other assets in various asset classes such as bonds and equities. Results derived from various statistical measures are explained to support the well established fact that commodities or its alternative channels plays a very significant role in creating an optimum investment portfolio, especially for the institutional investors like banks in India. Findings of the basic statistical measures, as discussed in the previous section, are briefed hereunder.

Basic statistical characteristics of some selected assets under various asset classes, during the period 2005 to 2011 (till May), are exhibited in *Table 1* and *Table 2*. The annualized average return figures clearly exhibit the fact that almost all the commodity indices, both spot and futures, and the selected individual commodity futures contracts generate significantly higher return comparative to the other assets such as bonds and equities. But interestingly, the average return, calculated from the price change, during the year 2008 in almost all the assets irrespective to any specific asset class are found to be negative, may be due to the world-wide effect of US sub-prime crisis. Possibility of generating higher return makes the commodity market more interesting for the investors who are looking for leveraging the return on their whole portfolio, but at the same time may be ready to bear little higher risk comparative to other typical investment portfolio only consists of traditional asset classes. The common market view “Greater the Risk, Higher will be the Return” is also duly captured in this study. There is no doubt that investors get a comparative advantage in the commodity market to generate higher return, but the fact, as exhibited in *Table 2*, that it brings greater risk as well is also reflected in the study. The concerned table has shown how the average variation in the commodity returns are higher, comparative to the other assets, in almost all the years from 2005 to 2011.

Giving due consideration to the positive trade-off between risk and return, as validated in the above tables, an attempt has been made to evaluate the performance of individual assets under various asset classes neither looking solely at the return nor at the risk, but by comparing some return measures adjusted with the risk. Accordingly the annual Sharpe Ratio for all the assets under various asset classes is calculated and values are reported in *Table 3*. Even if there is a mixed result between commodities and equities, the risk adjusted performance of commodity indices or individual commodity futures are expected to be quite different than the bonds, not exclusively reflected in the study due to the inconsistency in the selection of return measure among the asset class. As reflected in the returns figures for all the assets during the year 2008, the overall performance of almost all the assets are also found to be negative during the same period due the wider disturbance in the market. The transition of annual performance of the commodity indices, both spot and futures, and also of the selected commodity futures contracts, over the years, is graphically exhibited respectively in *Figure 1* and *Figure 2*. Even if the change in the performance over the sample period is similar for most of the commodity indices, the trend of the performance are slightly inconsistent among different individual commodity futures contracts, especially

during the year 2006 and 2008. Even if the risk adjusted performance of the commodity segment has invariably improved from 2008 to 2009, but subsequently there is a significant deterioration in the performance during the following year, may be due to the post-crisis effect. Since the investing in equities of companies dealing with various commodities can be treated as an alternative channel of commodity investment, an effort has been made to validate the strength of this alternative channel by examining the performance of such commodity based equities during the sample period. The annualized return, risk, and risk adjusted performance measures are reported in *Table 4*. Even if the performance measures, if compared between that of bonds and other non-commodity based equities, exhibit the similar fact as captured otherwise by considering direct commodities, commodities and commodity based equities cannot be a close substitute of each other while deciding the investment strategy. The poor and sometime even negative correlation between the returns of some selected commodities and their related equities, as exhibited in *Table 5*, clearly depict the fact that commodity based equities cannot be invariably used as an alternative to direct commodity investment. It has also been attempted to compare the annual risk adjusted performance of some commodity based equities and their related commodity futures contracts, as figured out in *Figure 4*. Even if 2008 onwards, both the asset classes tends to perform with a close similarity, but there was a significant difference in the trend of performance among the two asset class during 2005 to 2008. Especially, Hindalco Industries and National Aluminum Co. Ltd. have been found to perform quite different in comparison with their related commodities, such as Copper and Aluminum futures contracts. Even if both the asset classes are related to commodities, due to significant differences in the underlying factors affecting the risk and return of both the asset classes, they cannot be used interchangeably while creating an investment portfolio.

When the annual risk adjusted performance of some selected commodity index futures and individual commodity futures contracts are compared with that of some other assets from bond and equity market, as exhibited in *Figure 5*, the results are found to be quite interesting, as also supported by *Table 3*. Even if the direction and degree of movements during the whole period is almost consistent for the equity and bond related assets, the commodity instruments are found to possess a different behavior throughout the period. This possibility makes the commodity market little different than the other conventional asset classes, and will help the investor to ensure that his portfolio can be diversified if commodities or commodity related instruments are included in the investment portfolio.

Apart from being supported by the dissimilar trend in the performance of the traditional asset classes with that of commodities or commodity related instruments, the possibility of achieving diversification benefits to the institutional investors can also be ensured by looking into the co-movements in the returns of different bond and equity related assets with that of actual commodities or their alternatives, as figured out in *Table 6* to *Table 8*. The correlation in the returns of individual commodity futures contracts with that of all other assets during the year 2010 are exhibited in *Table 6*, followed by the correlation among overall and sector specific commodity indices (both spot and futures) and all other assets in *Table 7*. Annual correlations between the returns of major indices in equity, bond and commodity market during 2005 to 2010 are exhibited in *Table 8*. The results are interestingly found to be consistent in all the three tables. Even if the correlations among the returns in equity and commodity related instruments, almost throughout the period, are found to be positive, a negative association has been observed between the bond and commodity market, irrespective of the type (index or individual asset) of the asset, market segment (Spot or Futures), or the period of study. These results invariably support the fact that an institutional investor can easily diversify the risk of their portfolio with a reasonable amount of investment in commodities or commodity related instruments. The negative correlation among the asset in a portfolio always ensures that the portfolio risk can be optimized by including even risky assets, but definitely at an optimum proportion.

## **V. SUMMARY & CONCLUSION**

Unlike in case of developed market, institutional investors like banks in India are restricted to take any direct exposure in commodities except in some bullion. It is very well known that in a competitive world, it is very difficult to make successful investments without optimizing the two important parameters of any investment – Return and Risk. Portfolio return can be maximized only by including some assets that offers a higher yield comparative to normal market rate. Now the assets that offers higher average return also brings higher risk in the portfolio, which again need to be minimized to make the investment portfolio truly optimum, both from the risk and return perspective. It has been well established that commodities gives higher return and also bring higher risk. Therefore, investment in commodities or commodity related instruments is one of the essential ways to leverage the portfolio return. But at the same time, to encounter the higher risk in commodity investment, the portfolio manager needs to ensure that the assets needs to be selected in such a proportion, so that some of the



portfolio risk is naturally diversified. Commodities or commodity related instruments not only offers a higher returns, but also help an investor to create a well diversified portfolio. There are numerous studies in support of commodity investments. But the attention given by the major Indian institutional investors in this segment is comparatively very poor. Even if after a serious attempt from the regulators, the commodity investments in India is restricted only to a few market players, resulting into the existence of an inefficient market. Since banks in India are considered to be the major institutional investors, without having any significant exposure in commodity market except in their loan book, they truly lag behind in creating an optimum investment portfolio. The author has made an attempt to establish the fact that by investing in commodities or it alternative channels, institutional investors like banks can not only compensate for the lower risk-free returns in their major chunk of investments in Government securities, but also will be able to diversify some amount of their portfolio risk which is expected to rise by taking exposure in commodity market. The results exhibited in all the tables and figures clearly depict that investment in alternative channels like commodity indices or commodity futures contracts in India will not only allow the institutional investors to leverage their portfolio return, but also will ensure that diversification benefits is achieved. Therefore, even if investment in direct commodities are restricted for Indian banks, but still there is a significant opportunity for them to invest in the available alternative channels like commodity indices or commodity futures contracts.

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**Table 1: Average Returns of Different Assets in Various Asset Classes**

| <b>Annualized Average Return</b> |             |             |             |             |             |             |                       |
|----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-----------------------|
|                                  | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011<br/>(May)</b> |
| <b><u>BONDS:</u></b>             |             |             |             |             |             |             |                       |
| CCIL-B-TRI                       | -1.74%      | 5.06%       | 3.60%       | 5.43%       | 19.89%      | -5.16%      | 4.09%                 |
| CCIL-B-PRI                       | -8.16%      | -1.54%      | -3.97%      | -1.43%      | 16.73%      | -14.21%     | -1.70%                |
| CCIL-L-TRI                       | -3.46%      | 4.91%       | 4.84%       | 5.18%       | 24.42%      | -11.01%     | 4.47%                 |
| CCIL-L-PRI                       | -9.42%      | -1.00%      | -2.49%      | -1.44%      | 17.44%      | -19.94%     | -1.25%                |
| 8.00% G.S. 2011                  |             |             |             |             |             |             |                       |
| 9.00% G.S. 2013                  |             |             | 7.68%       | 7.25%       | 5.69%       | 6.20%       |                       |
| 10.25% G.S. 2012                 |             |             | 7.60%       | 7.15%       | 4.68%       | 5.50%       |                       |
| 12.30% G.S. 2016                 |             |             | 7.74%       | 7.52%       | 6.93%       | 7.34%       |                       |
| 10.70% G.S. 2020                 |             |             | 7.88%       | 7.59%       | 7.32%       | 7.68%       |                       |
| <b><u>COMMODITY:</u></b>         |             |             |             |             |             |             |                       |
| MCX AGRI - S                     | 16.26%      | 15.41%      | 3.69%       | -16.46%     | 36.58%      | 18.38%      | -10.47%               |
| MCX AGRI - F                     | 15.15%      | 16.40%      | -3.03%      | -4.45%      | 30.48%      | 14.96%      | -19.94%               |
| MCX COMDEX - S                   | 24.91%      | 13.08%      | 9.41%       | -32.45%     | 43.88%      | 14.02%      | 11.27%                |
| MCX COMDEX - F                   | 27.81%      | 14.29%      | 6.45%       | -21.56%     | 33.87%      | 14.62%      | 9.81%                 |
| MCX ENERGY - S                   | 22.73%      | -1.17%      | 20.07%      | -50.85%     | 50.77%      | 2.24%       | 20.15%                |
| MCX ENERGY - F                   | 28.41%      | 0.73%       | 15.56%      | -35.15%     | 35.53%      | 4.71%       | 20.35%                |
| MCX METAL - S                    | 34.37%      | 25.84%      | 1.21%       | -21.37%     | 40.91%      | 21.49%      | 12.00%                |
| MCX METAL - F                    | 37.25%      | 26.84%      | 0.04%       | -14.53%     | 33.68%      | 22.11%      | 11.31%                |
| Aluminum-S                       | 64.82%      | 16.98%      | -25.09%     | -22.76%     | 31.24%      | 5.47%       | 16.91%                |
| Aluminum-F                       | 121.24%     | 15.17%      | -25.27%     | -22.31%     | 31.13%      | 5.47%       | 16.52%                |
| Copper-S                         | 46.27%      | 27.00%      | -2.32%      | -55.64%     | 75.87%      | 18.87%      | -20.18%               |
| Copper-F                         | 35.68%      | 27.84%      | -5.83%      | -45.17%     | 66.54%      | 19.95%      | 0.00%                 |
| Crude Oil-S                      | 24.87%      | -1.65%      | 28.67%      | -60.83%     | 58.53%      | 6.55%       | 29.59%                |
| Crude Oil-F                      | 28.36%      | -0.42%      | 26.30%      | -51.63%     | 51.19%      | 7.53%       | 0.00%                 |
| Gold-S                           | 26.21%      | 15.91%      | 11.81%      | 20.21%      | 18.52%      | 17.42%      | 16.97%                |
| Gold-F                           | 15.59%      | 15.73%      | 11.02%      | 20.49%      | 16.58%      | 17.66%      | 0.00%                 |
| Natural Gas-S                    | 0.00%       | -41.25%     | 1.57%       | 0.09%       | -5.35%      | -26.21%     | -11.07%               |
| Natural Gas-F                    | 0.00%       | 7.74%       | 3.85%       | -7.36%      | -3.46%      | -22.11%     | 0.00%                 |
| Silver-S                         | 34.54%      | 30.68%      | 1.19%       | -6.46%      | 34.91%      | 44.92%      | 0.00%                 |
| Silver-F                         | 19.67%      | 31.01%      | 0.16%       | -4.77%      | 30.94%      | 44.46%      | 0.00%                 |
| <b><u>EQUITY:</u></b>            |             |             |             |             |             |             |                       |
| NIFTY-S                          | 30.87%      | 33.53%      | 43.85%      | -74.16%     | 58.02%      | 16.38%      | 0.00%                 |
| NIFTYJ-S                         | 21.77%      | 24.87%      | 56.61%      | -102.48%    | 84.75%      | 16.26%      | 0.00%                 |
| S&P500-S                         | 30.81%      | 29.26%      | 48.75%      | -86.07%     | 65.26%      | 13.11%      | 0.00%                 |
| BANKNIFTY-S                      | 25.86%      | 28.16%      | 49.76%      | -69.01%     | 60.78%      | 26.48%      | 0.00%                 |
| ENERGY-S                         | 26.69%      | 18.34%      | 67.94%      | -66.75%     | 48.98%      | 3.35%       | 0.00%                 |
| MIDCAP-S                         | 29.92%      | 25.47%      | 57.29%      | -91.59%     | 70.78%      | 17.39%      | 0.00%                 |
| INFOSYSTCH-S                     | 35.82%      | -29.03%     | -23.73%     | -46.92%     | 87.11%      | 27.81%      | -51.91%               |
| IOC-S                            | 8.17%       | -21.32%     | 57.11%      | -63.40%     | -34.07%     | 11.18%      | -10.31%               |
| ONGC-S                           | 35.77%      | -29.84%     | 35.18%      | -62.75%     | 58.50%      | 8.87%       | -373.15%              |
| RELIANCE-S                       | 50.86%      | 35.65%      | 82.29%      | -86.33%     | -12.61%     | -2.94%      | -26.08%               |
| SAIL-S                           | -14.69%     | 49.84%      | 116.64%     | -132.18%    | 117.02%     | -27.87%     | -63.93%               |
| SBIN-S                           | 33.00%      | 31.60%      | 64.63%      | -61.96%     | 58.19%      | 21.28%      | -49.47%               |
| TELCO-S                          | 25.61%      | 32.09%      | -19.46%     | -155.99%    | 164.58%     | 49.85%      | -43.56%               |
| TISCO-S                          | -1.34%      | 23.84%      | 66.52%      | -148.39%    | 107.53%     | 9.59%       | -35.36%               |

**Table 2: Average Volatility of Different Assets in Various Asset Classes**

| <b>Annualized Average Volatility</b> |             |             |             |             |             |             |                       |
|--------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-----------------------|
|                                      | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011<br/>(May)</b> |
| <b>BONDS:</b>                        |             |             |             |             |             |             |                       |
| CCIL-B-TRI                           | 3.70%       | 2.30%       | 2.37%       | 2.84%       | 6.15%       | 6.58%       | 1.92%                 |
| CCIL-B-PRI                           | 3.95%       | 2.61%       | 2.85%       | 3.55%       | 8.03%       | 8.47%       | 2.53%                 |
| CCIL-L-TRI                           | 5.38%       | 2.92%       | 2.77%       | 3.27%       | 9.32%       | 9.09%       | 2.33%                 |
| CCIL-L-PRI                           | 5.75%       | 3.27%       | 3.31%       | 3.97%       | 12.13%      | 11.00%      | 2.93%                 |
| 8.00% G.S. 2011                      |             |             |             |             |             |             |                       |
| 9.00% G.S. 2013                      |             |             | 0.21%       | 1.74%       | 0.48%       | 0.49%       |                       |
| 10.25% G.S. 2012                     |             |             | 0.22%       | 1.82%       | 0.45%       | 0.56%       |                       |
| 12.30% G.S. 2016                     |             |             | 0.21%       | 1.37%       | 0.45%       | 0.14%       |                       |
| 10.70% G.S. 2020                     |             |             | 0.20%       | 1.23%       | 0.48%       | 0.15%       |                       |
| <b>COMMODITY:</b>                    |             |             |             |             |             |             |                       |
| MCX AGRI - S                         | 9.78%       | 10.52%      | 6.81%       | 18.63%      | 16.27%      | 8.37%       | 9.17%                 |
| MCX AGRI - F                         | 13.04%      | 12.21%      | 8.99%       | 21.26%      | 33.39%      | 11.66%      | 26.28%                |
| MCX COMDEX - S                       | 15.66%      | 17.65%      | 12.89%      | 24.37%      | 23.14%      | 12.86%      | 14.93%                |
| MCX COMDEX - F                       | 57.65%      | 18.55%      | 12.03%      | 25.57%      | 18.27%      | 11.28%      | 14.91%                |
| MCX ENERGY - S                       | 125.12%     | 27.32%      | 24.76%      | 40.72%      | 51.10%      | 23.34%      | 24.96%                |
| MCX ENERGY - F                       | 83.18%      | 25.22%      | 20.63%      | 36.88%      | 33.06%      | 17.38%      | 23.23%                |
| MCX METAL - S                        | 14.79%      | 28.37%      | 14.61%      | 26.80%      | 17.52%      | 14.34%      | 16.04%                |
| MCX METAL - F                        | 29.44%      | 31.69%      | 14.92%      | 25.16%      | 16.72%      | 13.26%      | 14.61%                |
| Aluminum-S                           | 383.91%     | 25.99%      | 19.50%      | 29.45%      | 30.36%      | 21.90%      | 14.71%                |
| Aluminum-F                           | 54.19%      | 33.35%      | 16.59%      | 25.54%      | 26.07%      | 20.14%      | 14.72%                |
| Copper-S                             | 32.09%      | 203.87%     | 29.96%      | 40.44%      | 38.96%      | 25.63%      | 20.91%                |
| Copper-F                             | 28.58%      | 32.57%      | 26.52%      | 36.62%      | 30.22%      | 20.46%      | 0.00%                 |
| Crude Oil-S                          | 33.48%      | 26.89%      | 25.95%      | 44.10%      | 51.09%      | 23.69%      | 31.65%                |
| Crude Oil-F                          | 26.16%      | 23.87%      | 22.29%      | 40.31%      | 44.98%      | 21.09%      | 0.00%                 |
| Gold-S                               | 11.91%      | 19.61%      | 12.97%      | 26.27%      | 15.20%      | 12.32%      | 10.98%                |
| Gold-F                               | 9.42%       | 20.43%      | 12.47%      | 24.14%      | 17.77%      | 11.79%      | 0.00%                 |
| Natural Gas-S                        | 0.00%       | 49.79%      | 45.85%      | 43.76%      | 64.17%      | 42.24%      | 31.64%                |
| Natural Gas-F                        | 0.00%       | 64.82%      | 40.67%      | 39.71%      | 57.75%      | 40.08%      | 0.00%                 |
| Silver-S                             | 17.94%      | 34.75%      | 19.30%      | 31.57%      | 21.82%      | 21.32%      | 0.00%                 |
| Silver-F                             | 15.23%      | 39.46%      | 20.67%      | 33.19%      | 26.63%      | 21.58%      | 0.00%                 |
| <b>EQUITY:</b>                       |             |             |             |             |             |             |                       |
| NIFTY-S                              | 17.61%      | 26.09%      | 25.32%      | 44.40%      | 33.88%      | 16.19%      | 0.00%                 |
| NIFTYJ-S                             | 19.51%      | 31.26%      | 27.05%      | 49.81%      | 35.29%      | 16.94%      | 0.00%                 |
| S&P500-S                             | 16.75%      | 25.74%      | 23.89%      | 43.32%      | 31.87%      | 15.24%      | 0.00%                 |
| BANKNIFTY-S                          | 24.99%      | 29.74%      | 33.63%      | 55.14%      | 43.54%      | 21.82%      | 0.00%                 |
| ENERGY-S                             | 17.65%      | 25.79%      | 26.81%      | 47.83%      | 32.66%      | 16.14%      | 0.00%                 |
| MIDCAP-S                             | 17.69%      | 27.63%      | 23.27%      | 40.32%      | 29.75%      | 15.94%      | 0.00%                 |
| INFOSYSTCH-S                         | 26.03%      | 76.53%      | 31.16%      | 48.50%      | 37.78%      | 21.11%      | 27.66%                |
| IOC-S                                | 24.43%      | 40.50%      | 40.81%      | 54.81%      | 82.64%      | 31.39%      | 30.42%                |
| ONGC-S                               | 25.13%      | 51.30%      | 36.33%      | 52.15%      | 41.58%      | 23.59%      | 227.90%               |
| RELIANCE-S                           | 24.52%      | 45.00%      | 31.96%      | 60.06%      | 88.33%      | 24.44%      | 24.80%                |
| SAIL-S                               | 38.69%      | 56.15%      | 50.56%      | 73.19%      | 59.82%      | 33.01%      | 30.60%                |
| SBIN-S                               | 28.67%      | 31.92%      | 40.69%      | 57.88%      | 48.93%      | 28.17%      | 33.28%                |
| TELCO-S                              | 31.60%      | 40.08%      | 33.82%      | 63.70%      | 66.21%      | 37.16%      | 42.82%                |
| TISCO-S                              | 28.84%      | 48.02%      | 45.60%      | 73.71%      | 68.05%      | 34.98%      | 27.92%                |

**Table 3: Annual Performance of Different Assets in Various Asset Classes**

| <b>Annualized Sharpe Ratio</b> |             |             |             |             |             |             |
|--------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> |
| <b><u>BONDS:</u></b>           |             |             |             |             |             |             |
| CCIL-B-TRI                     | -2.07       | -0.79       | -1.60       | -0.60       | 2.55        | -1.62       |
| CCIL-B-PRI                     | -3.56       | -3.23       | -3.98       | -2.41       | 1.56        | -2.33       |
| CCIL-L-TRI                     | -1.74       | -0.68       | -0.92       | -0.60       | 2.17        | -1.82       |
| CCIL-L-PRI                     | -2.67       | -2.41       | -2.99       | -2.16       | 1.09        | -2.31       |
| 8.00% G.S. 2011                |             |             |             |             |             |             |
| 9.00% G.S. 2013                |             |             | 1.35        | 0.07        | 3.05        | 1.42        |
| 10.25% G.S. 2012               |             |             | 0.96        | 0.02        | 1.01        | 0.01        |
| 12.30% G.S. 2016               |             |             | 1.62        | 0.29        | 5.97        | 13.16       |
| 10.70% G.S. 2020               |             |             | 2.46        | 0.38        | 6.45        | 14.48       |
| <b><u>COMMODITY:</u></b>       |             |             |             |             |             |             |
| MCX AGRI - S                   | 1.06        | 0.81        | -0.54       | -1.27       | 1.99        | 1.54        |
| MCX AGRI - F                   | 0.71        | 0.78        | -1.16       | -0.54       | 0.79        | 0.81        |
| MCX COMDEX - S                 | 1.21        | 0.35        | 0.16        | -1.62       | 1.71        | 0.66        |
| MCX COMDEX - F                 | 0.38        | 0.40        | -0.08       | -1.12       | 1.62        | 0.81        |
| MCX ENERGY - S                 | 0.13        | -0.29       | 0.51        | -1.42       | 0.91        | -0.14       |
| MCX ENERGY - F                 | 0.27        | -0.24       | 0.40        | -1.15       | 0.95        | -0.05       |
| MCX METAL - S                  | 1.92        | 0.67        | -0.42       | -1.06       | 2.09        | 1.12        |
| MCX METAL - F                  | 1.06        | 0.63        | -0.49       | -0.86       | 1.76        | 1.25        |
| Aluminum-S                     | 0.15        | 0.39        | -1.67       | -1.01       | 0.89        | 0.00        |
| Aluminum-F                     | 2.13        | 0.25        | -1.97       | -1.15       | 1.03        | 0.00        |
| Copper-S                       | 1.26        | 0.10        | -0.32       | -1.55       | 1.84        | 0.52        |
| Copper-F                       | 1.04        | 0.64        | -0.50       | -1.43       | 2.06        | 0.71        |
| Crude Oil-S                    | 0.57        | -0.32       | 0.82        | -1.54       | 1.06        | 0.04        |
| Crude Oil-F                    | 0.86        | -0.31       | 0.85        | -1.46       | 1.04        | 0.10        |
| Gold-S                         | 1.70        | 0.46        | 0.34        | 0.50        | 0.94        | 0.97        |
| Gold-F                         | 1.03        | 0.43        | 0.29        | 0.55        | 0.70        | 1.03        |
| Natural Gas-S                  |             | -0.97       | -0.13       | -0.16       | -0.15       | -0.75       |
| Natural Gas-F                  |             | 0.01        | -0.09       | -0.36       | -0.13       | -0.69       |
| Silver-S                       | 1.60        | 0.68        | -0.32       | -0.43       | 1.41        | 1.85        |
| Silver-F                       | 0.90        | 0.61        | -0.35       | -0.36       | 1.00        | 1.81        |
| <b><u>EQUITY:</u></b>          |             |             |             |             |             |             |
| NIFTY-S                        | 1.42        | 1.02        | 1.44        | -1.83       | 1.59        | 0.67        |
| NIFTYJ-S                       | 0.81        | 0.58        | 1.82        | -2.20       | 2.28        | 0.64        |
| S&P500-S                       | 1.49        | 0.87        | 1.73        | -2.15       | 1.91        | 0.50        |
| BANKNIFTY-S                    | 0.80        | 0.72        | 1.26        | -1.38       | 1.30        | 0.96        |
| ENERGY-S                       | 1.18        | 0.44        | 2.26        | -1.54       | 1.37        | -0.13       |
| MIDCAP-S                       | 1.36        | 0.67        | 2.14        | -2.45       | 2.24        | 0.75        |
| INFOSYSTCH-S                   | 1.15        | -0.47       | -1.00       | -1.11       | 2.19        | 1.06        |
| IOC-S                          | 0.09        | -0.70       | 1.22        | -1.29       | -0.46       | 0.18        |
| ONGC-S                         | 1.19        | -0.72       | 0.76        | -1.34       | 1.31        | 0.14        |
| RELIANCE-S                     | 1.83        | 0.64        | 2.34        | -1.56       | -0.19       | -0.35       |
| SAIL-S                         | -0.53       | 0.77        | 2.16        | -1.90       | 1.89        | -1.01       |
| SBIN-S                         | 0.95        | 0.77        | 1.41        | -1.19       | 1.10        | 0.56        |
| TELCO-S                        | 0.62        | 0.63        | -0.79       | -2.56       | 2.42        | 1.19        |
| TISCO-S                        | -0.25       | 0.35        | 1.30        | -2.11       | 1.52        | 0.12        |

**Table 4: Performance Evaluation of Different Commodity Based Equities**

|                                       | 2005     | 2006    | 2007    | 2008     | 2009    | 2010    |
|---------------------------------------|----------|---------|---------|----------|---------|---------|
| <b>Annualized Average Return:</b>     |          |         |         |          |         |         |
| Hindalco Industries Ltd.              | -321.14% | 20.44%  | 20.08%  | -146.07% | 119.33% | 43.06%  |
| National Aluminium Co. Ltd.           | 63.85%   | -3.00%  | 85.97%  | -100.15% | 82.75%  | -6.13%  |
| Hindustan Oil Exploration Co.Ltd.     | 26.17%   | -60.31% | 57.23%  | -92.66%  | 157.79% | -23.05% |
| Oil & Natural Gas Corpn. Ltd.         | 52.78%   | -31.34% | 34.40%  | -62.58%  | 59.48%  | 8.98%   |
| Jindal Steel & Power Ltd.             | 75.03%   | 38.17%  | 191.60% | -289.62% | -27.10% | 1.24%   |
| Steel Authority Of India Ltd.         | 3.52%    | 52.35%  | 115.50% | -132.17% | 118.98% | -28.21% |
| Tata Steel Ltd.                       | 14.49%   | 25.04%  | 66.35%  | -149.78% | 109.33% | 9.71%   |
| <b>Annualized Average Volatility:</b> |          |         |         |          |         |         |
| Hindalco Industries Ltd.              | 281.62%  | 45.24%  | 42.69%  | 76.04%   | 62.56%  | 39.25%  |
| National Aluminium Co. Ltd.           | 30.03%   | 46.29%  | 48.06%  | 77.67%   | 47.09%  | 30.63%  |
| Hindustan Oil Exploration Co.Ltd.     | 46.57%   | 58.62%  | 64.90%  | 86.10%   | 73.71%  | 50.45%  |
| Oil & Natural Gas Corpn. Ltd.         | 25.62%   | 52.26%  | 36.40%  | 52.82%   | 41.97%  | 23.82%  |
| Jindal Steel & Power Ltd.             | 30.02%   | 50.85%  | 61.85%  | 210.58%  | 190.28% | 27.08%  |
| Steel Authority Of India Ltd.         | 38.92%   | 57.07%  | 50.65%  | 73.96%   | 60.49%  | 33.12%  |
| Tata Steel Ltd.                       | 28.50%   | 48.98%  | 45.70%  | 74.42%   | 68.83%  | 35.19%  |
| <b>Annualized Sharpe Ratio:</b>       |          |         |         |          |         |         |
| Hindalco Industries Ltd.              | -1.16    | 0.30    | 0.30    | -2.01    | 1.84    | 0.96    |
| National Aluminium Co. Ltd.           | 1.93     | -0.21   | 1.63    | -1.38    | 1.67    | -0.38   |
| Hindustan Oil Exploration Co.Ltd.     | 0.44     | -1.15   | 0.77    | -1.16    | 2.08    | -0.57   |
| Oil & Natural Gas Corpn. Ltd.         | 1.83     | -0.73   | 0.74    | -1.32    | 1.32    | 0.15    |
| Jindal Steel & Power Ltd.             | 2.30     | 0.62    | 2.98    | -1.41    | -0.16   | -0.16   |
| Steel Authority Of India Ltd.         | -0.06    | 0.80    | 2.13    | -1.88    | 1.90    | -1.02   |
| Tata Steel Ltd.                       | 0.30     | 0.37    | 1.29    | -2.11    | 1.53    | 0.12    |

**Table 5: Correlations between Selected Commodities and Related Commodity based Equities**

| <b>Commodity vs. Equity</b>                        | <b>Whole Period</b> | <b>2005</b>    | <b>2006</b> | <b>2007</b>   | <b>2008</b>   | <b>2009</b> | <b>2010</b>   |
|----------------------------------------------------|---------------------|----------------|-------------|---------------|---------------|-------------|---------------|
| Alluminium(S)-National Aluminium Co. Ltd.          | 15.61%              | <b>-10.77%</b> | 36.58%      | 14.43%        | 10.74%        | 11.54%      | 11.93%        |
| Alluminium(F)-National Aluminium Co. Ltd.          | 11.13%              | 3.01%          | 28.43%      | <b>-0.86%</b> | 7.02%         | 3.13%       | 20.78%        |
| Copper (S) - Hindalco Industries Ltd.              | 3.64%               | <b>-1.14%</b>  | 3.01%       | 17.70%        | 14.59%        | 24.76%      | 10.76%        |
| Copper (F) - Hindalco Industries Ltd.              | 5.75%               | <b>-18.44%</b> | 17.60%      | 9.26%         | 21.88%        | 25.72%      | 29.99%        |
| Crude Oil (S) - Hindustan Oil Exploration Co. Ltd. | 13.18%              | <b>-11.40%</b> | 15.34%      | 4.99%         | 20.73%        | 14.70%      | 12.23%        |
| Crude Oil (F) - Hindustan Oil Exploration Co. Ltd. | 11.07%              | 10.15%         | 18.89%      | <b>-4.80%</b> | 17.29%        | 7.40%       | 11.53%        |
| Crude Oil (S) - ONGC                               | 10.10%              | <b>-2.41%</b>  | 6.52%       | 1.56%         | 10.06%        | 18.17%      | 15.70%        |
| Crude Oil (F) - ONGC                               | 15.21%              | 3.91%          | 12.21%      | 9.26%         | 12.82%        | 25.38%      | 18.07%        |
| Natural Gas (S) - ONGC                             | 3.03%               | NA             | 15.85%      | 8.74%         | <b>-5.11%</b> | 1.34%       | 5.25%         |
| Natural Gas (F) - ONGC                             | 2.23%               | NA             | 11.20%      | <b>-9.19%</b> | 6.47%         | 0.84%       | <b>-1.95%</b> |



**Table 6: Correlations among Individual Commodity Futures and Other Asset Classes during 2010**

|                  | ALUMINIUM<br>- F | COPPER -<br>F | CRUDE<br>OIL - F | GOLD<br>- F | NATURAL<br>GAS - F | SILVER<br>- F |
|------------------|------------------|---------------|------------------|-------------|--------------------|---------------|
| NIFTY-S          | 26%              | 25%           | 30%              | -10%        | -3%                | 16%           |
| ENERGY-S         | 21%              | 24%           | 26%              | -8%         | -3%                | 14%           |
| INFOSYSTCH-S     | 18%              | 13%           | 19%              | -9%         | 4%                 | 9%            |
| IOC-S            | 16%              | 12%           | 13%              | 0%          | -6%                | 0%            |
| RELIANCE-S       | 13%              | 18%           | 18%              | -8%         | 3%                 | 14%           |
| SAIL-S           | 18%              | 18%           | 23%              | -14%        | -14%               | 9%            |
| TISCO-S          | 27%              | 27%           | 26%              | -13%        | -5%                | 10%           |
| ALUMINIUM-F      | 100%             | 73%           | 42%              | -2%         | 3%                 | 28%           |
| COPPER-F         | 73%              | 100%          | 45%              | 7%          | 1%                 | 37%           |
| CRUDEOIL-F       | 42%              | 45%           | 100%             | 1%          | -13%               | 26%           |
| GOLD-F           | -2%              | 7%            | 1%               | 100%        | 9%                 | 59%           |
| NATURALGAS-F     | 3%               | 1%            | -13%             | 9%          | 100%               | 6%            |
| SILVER-F         | 28%              | 37%           | 26%              | 59%         | 6%                 | 100%          |
| MCXAGRI-F        | 11%              | 6%            | 16%              | -8%         | 2%                 | -3%           |
| MCXCOMDEX-F      | 48%              | 57%           | 58%              | 30%         | 11%                | 54%           |
| MCXENERGY-F      | 34%              | 39%           | 72%              | 7%          | 12%                | 27%           |
| MCXMETAL-F       | 47%              | 60%           | 26%              | 49%         | 7%                 | 67%           |
| USDINR-S         | <b>-16%</b>      | <b>-14%</b>   | <b>-13%</b>      | 19%         | 4%                 | <b>-5%</b>    |
| 8.00% G.S. 2011  | 5%               | <b>-2%</b>    | <b>-6%</b>       | 2%          | <b>-5%</b>         | 2%            |
| 9.00% G.S. 2013  | <b>-4%</b>       | <b>-9%</b>    | <b>-8%</b>       | <b>-3%</b>  | <b>-5%</b>         | <b>-2%</b>    |
| 10.25% G.S. 2012 | 2%               | <b>-3%</b>    | <b>-4%</b>       | 3%          | <b>-5%</b>         | 4%            |
| 12.30% G.S. 2016 | <b>-10%</b>      | <b>-8%</b>    | <b>-10%</b>      | 3%          | <b>-4%</b>         | <b>-4%</b>    |
| 10.70% G.S. 2020 | <b>-12%</b>      | <b>-10%</b>   | <b>-6%</b>       | 7%          | <b>-6%</b>         | <b>-5%</b>    |
| MCXAGRI-S        | 16%              | 18%           | 20%              | 0%          | 3%                 | 6%            |
| MCXCOMDEX-S      | 25%              | 20%           | 40%              | 1%          | -6%                | 15%           |
| MCXENERGY-S      | 15%              | 11%           | 38%              | -5%         | -5%                | 10%           |
| MCXMETAL-S       | 26%              | 20%           | 24%              | 8%          | -6%                | 14%           |

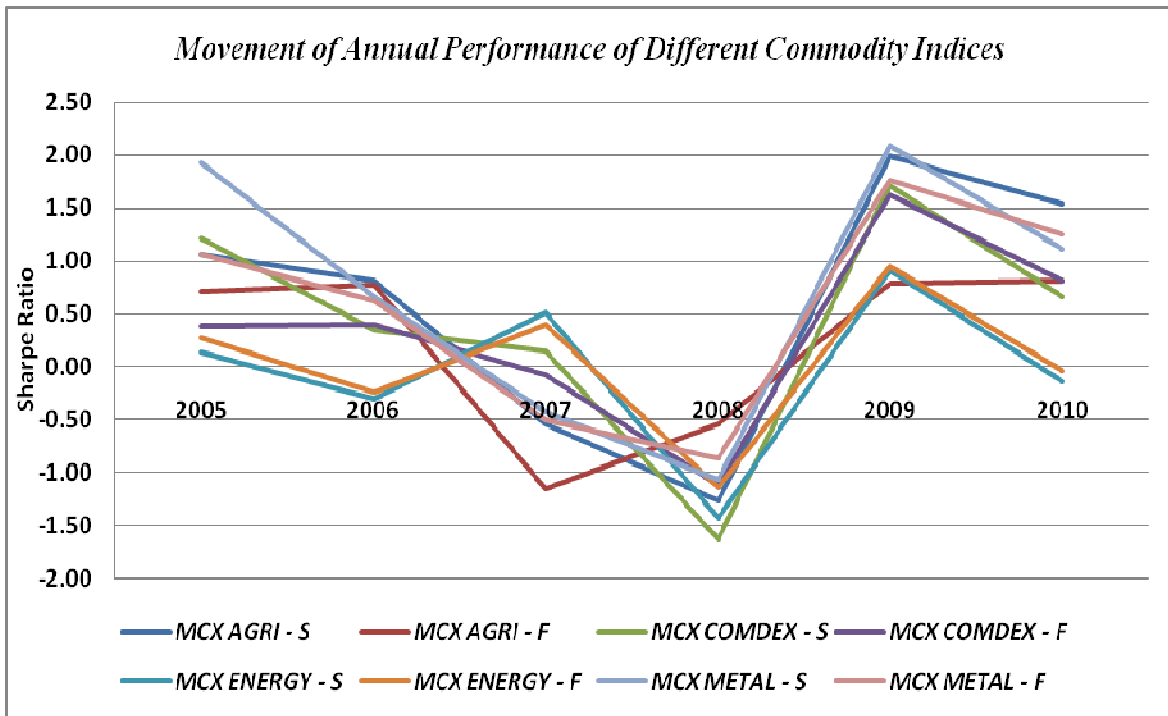
Table 7: Correlations among Commodity Indices (Spot &amp; Futures) and Other Asset Classes during the Year 2010

|                  | MCXAGRI<br>- F | MCXCOMDEX<br>- F | MCXENERGY<br>- F | MCXMETAL<br>- F | MCXAGRI<br>- S | MCXCOMDEX<br>- S | MCXENERGY<br>- S | MCXMETAL<br>- S |
|------------------|----------------|------------------|------------------|-----------------|----------------|------------------|------------------|-----------------|
| NIFTY-S          | 19%            | 20%              | 16%              | 12%             | 27%            | 38%              | 37%              | 21%             |
| ENERGY-S         | 17%            | 17%              | 14%              | 11%             | 25%            | 28%              | 25%              | 17%             |
| INFOSYSTCH-S     | 7%             | 12%              | 10%              | 8%              | 13%            | 23%              | 26%              | 10%             |
| IOC-S            | 15%            | 10%              | 8%               | 5%              | 14%            | 2%               | -4%              | 5%              |
| RELIANCE-S       | 17%            | 15%              | 11%              | 10%             | 15%            | 22%              | 19%              | 16%             |
| SAIL-S           | 18%            | 9%               | 8%               | 2%              | 17%            | 35%              | 33%              | 23%             |
| TISCO-S          | 13%            | 19%              | 17%              | 12%             | 29%            | 40%              | 33%              | 29%             |
| ALUMINIUM-F      | 11%            | 48%              | 34%              | 47%             | 16%            | 25%              | 15%              | 26%             |
| COPPER-F         | 6%             | 57%              | 39%              | 60%             | 18%            | 20%              | 11%              | 20%             |
| CRUDEOIL-F       | 16%            | 58%              | 72%              | 26%             | 20%            | 40%              | 38%              | 24%             |
| GOLD-F           | -8%            | 30%              | 7%               | 49%             | 0%             | 1%               | -5%              | 8%              |
| NATURALGAS-F     | 2%             | 11%              | 12%              | 7%              | 3%             | -6%              | -5%              | -6%             |
| SILVER-F         | -3%            | 54%              | 27%              | 67%             | 6%             | 15%              | 10%              | 14%             |
| MCXAGRI-F        | 100%           | 24%              | 13%              | 4%              | 42%            | 19%              | 17%              | 7%              |
| MCXCOMDEX-F      | 24%            | 100%             | 85%              | 84%             | 20%            | 29%              | 24%              | 21%             |
| MCXENERGY-F      | 13%            | 85%              | 100%             | 48%             | 16%            | 32%              | 30%              | 19%             |
| MCXMETAL-F       | 4%             | 84%              | 48%              | 100%            | 9%             | 14%              | 8%               | 16%             |
| USDINR-S         | -10%           | -6%              | -10%             | 2%              | -19%           | -36%             | -28%             | -31%            |
| 8.00% G.S. 2011  | -6%            | -5%              | -3%              | -3%             | 1%             | 3%               | -2%              | 8%              |
| 9.00% G.S. 2013  | 0%             | -8%              | -8%              | -6%             | -1%            | -6%              | -3%              | -8%             |
| 10.25% G.S. 2012 | -1%            | -4%              | -4%              | -3%             | 2%             | -2%              | 1%               | -5%             |
| 12.30% G.S. 2016 | -8%            | -7%              | -8%              | -2%             | -6%            | -17%             | -12%             | -16%            |
| 10.70% G.S. 2020 | -1%            | -6%              | -6%              | -4%             | 2%             | -12%             | -9%              | -12%            |
| MCXAGRI-S        | 42%            | 20%              | 16%              | 9%              | 100%           | 34%              | 18%              | 22%             |
| MCXCOMDEX-S      | 19%            | 29%              | 32%              | 14%             | 34%            | 100%             | 84%              | 78%             |
| MCXENERGY-S      | 17%            | 24%              | 30%              | 8%              | 18%            | 84%              | 100%             | 33%             |
| MCXMETAL-S       | 7%             | 21%              | 19%              | 16%             | 22%            | 78%              | 33%              | 100%            |

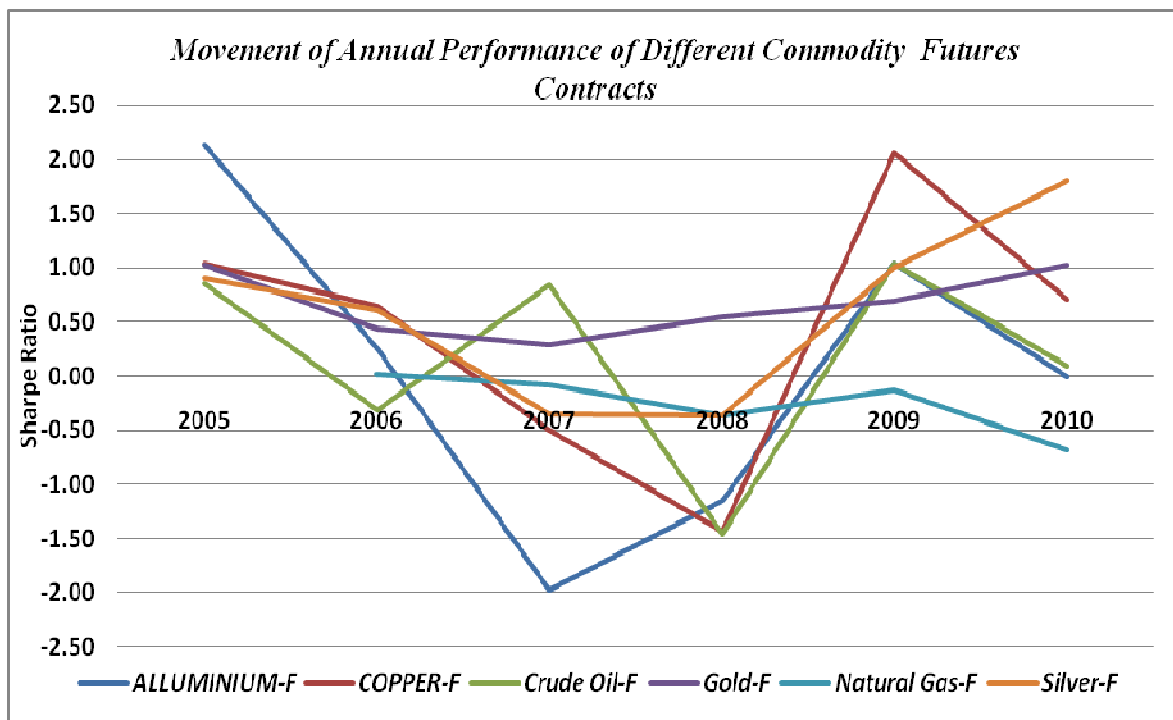
**Table 8: Yearly Transition of Correlation among Indices from Different Asset Classes**

|                              | <b>Whole Period</b> | <b>2006</b>   | <b>2007</b> | <b>2008</b>    | <b>2009</b>    | <b>2010</b>    |
|------------------------------|---------------------|---------------|-------------|----------------|----------------|----------------|
| NIFTY_NIFTYJ                 | 89.44%              | 86.68%        | 85.38%      | 91.65%         | 90.73%         | 86.15%         |
| NIFTY_CCIL-L-TRI             | 7.67%               | -4.07%        | 17.56%      | 2.39%          | 22.01%         | -19.08%        |
| NIFTY_MCX-AGRI               | 5.79%               | -0.82%        | 4.65%       | 9.83%          | -3.72%         | 27.80%         |
| NIFTY_MCX-COMDEX             | 18.91%              | 26.33%        | 25.88%      | 7.33%          | 22.70%         | 39.55%         |
| NIFTY_MCX-ENERGY             | 16.35%              | 18.54%        | 12.65%      | 7.88%          | 22.45%         | 39.27%         |
| NIFTYJ_CCIL-L-TRI            | 7.95%               | -3.99%        | 21.05%      | 1.35%          | 25.15%         | -14.11%        |
| NIFTYJ_MCX-AGRI              | 6.65%               | 2.04%         | -2.35%      | 13.67%         | -6.66%         | 29.74%         |
| NIFTYJ_MCX-COMDEX            | 16.09%              | 30.01%        | 20.31%      | 2.51%          | 20.05%         | 31.36%         |
| NIFTYJ_MCX-ENERGY            | 13.78%              | 21.03%        | 12.63%      | 4.67%          | 19.07%         | 28.00%         |
| <b>CCIL-L-TRI_MCX-AGRI</b>   | <b>-6.06%</b>       | 13.34%        | 6.73%       | <b>-4.23%</b>  | <b>-10.38%</b> | <b>-11.01%</b> |
| <b>CCIL-L-TRI_MCX-COMDEX</b> | <b>-14.91%</b>      | <b>-3.63%</b> | 7.71%       | <b>-31.20%</b> | <b>-4.37%</b>  | <b>-18.54%</b> |
| <b>CCIL-L-TRI_MCX-ENERGY</b> | <b>-12.36%</b>      | <b>-5.37%</b> | 4.42%       | <b>-30.02%</b> | <b>-1.27%</b>  | <b>-19.72%</b> |
| MCX-AGRI_MCX-COMDEX          | 22.51%              | 33.94%        | 17.63%      | 11.82%         | 25.24%         | 35.49%         |
| MCX-AGRI_MCX-ENERGY          | 9.03%               | 7.69%         | 3.80%       | 1.42%          | 13.56%         | 20.05%         |
| MCX-COMDEX_MCX-ENERGY        | 87.73%              | 77.71%        | 85.87%      | 90.66%         | 93.10%         | 84.49%         |

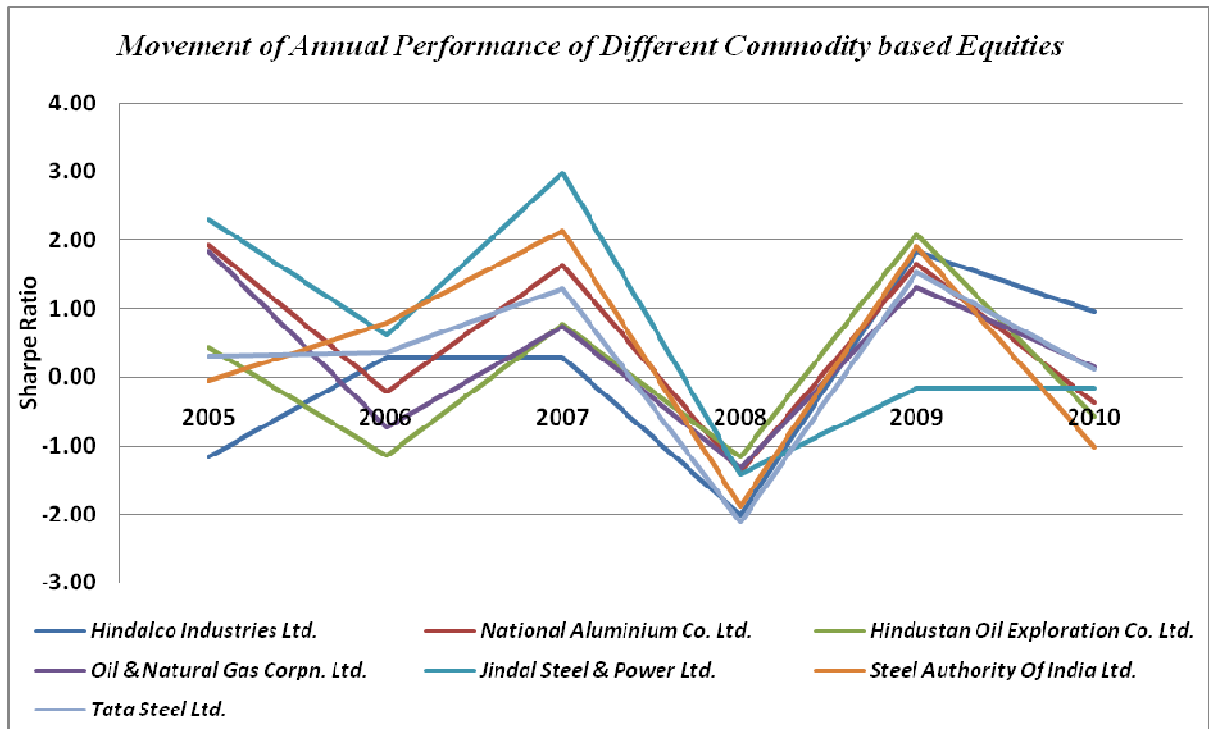
**Figure 1: Movement of Annual Performance of Commodity Indices**



**Figure 2: Movement of Annual Performance of Selected Commodities**



**Figure 3: Annual Performances of Commodity Based Equities**



**Figure 4: Comparing Performances of Commodity Based Equities and Actual Commodities**

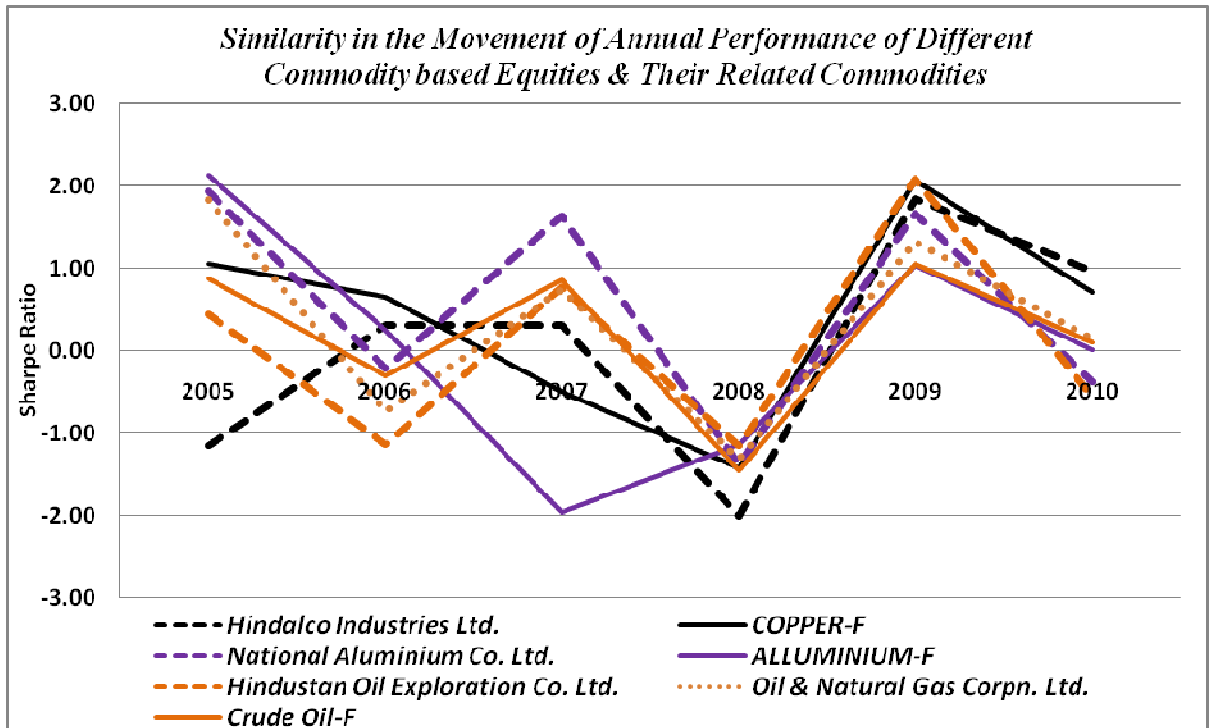


Figure 5: Annual Performances of Selected Assets under Different Asset Classes

