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**DIVERSIFYING A PAKISTANI STOCK PORTFOLIO WITH REAL ESTATE CAN REDUCE RISK****AMMAR ASGHAR****LECTURER****UNIVERSITY INSTITUTE OF MANAGEMENT SCIENCES  
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PAKISTAN****ABSTRACT**

*A stock only portfolio due to its high liquidity can easily lose its Net Asset Value in response of any stimulus like Open Market Operation, political instability or due to law in order situation in the country. If another asset is added to the portfolio that acts in reverse manner to these stimuli (i-e negatively correlated) then the Net Asset Value of the portfolio can be hedged. This study attempts to find that an illiquid asset like real estate if added to a stock portfolio can curtail its volatility (in other words hedge the Net Asset Value) or not? The researchers use Markowitz Portfolio Theory to answer this question. A few studies have been carried out in U.K and U.S.A to answer the same question but in Pakistan such a study is an unprecedented effort. The researchers found a high correlation of 0.58 between Karachi stock exchange and real estate market and a well desired negative correlation of -0.018 between Islamabad stock exchange and real estate market. Based on these correlation values optimal portfolio weightages of these assets were found. The results showed that an investor (considering the least coefficient of variation) should invest only 100% in real estate and 0% in Karachi stock exchange or he/she should invest 97% in real estate or 3% in Islamabad stock exchange.*

**KEYWORDS**

Index, Markowitz portfolio theory, Pakistan, Portfolio, Return, Real Estate, Risk.

**INTRODUCTION**

**F**inancial system is the collection of markets, institutions, laws, regulations and techniques through which bonds, stocks and other securities are traded, interest rates are determined and financial services are produced and delivered throughout the world. The primary function of a financial system is to mobilize surplus funds from savers to borrowers so that the borrower can buy goods and services and make investments in new equipment and facilities so that economy can grow and increase the standards of living enjoyed by its citizens<sup>1</sup>.

The institutions in the system that mobilize the funds are of two types. One of them is known as "Financial Broker" like stock exchange broker. These brokers in the form of brokerage firms direct the funds from savers to borrowers and for that purpose charge a brokerage fee. The other type is "Financial Intermediary". These financial intermediaries in the form of companies or firms take funds from the savers and give them their own security document, like share or deposit certificate, entitling the savers a right to their earnings. These funds are then placed in different assets to get earnings (investment). These assets might be shares of other public limited companies, bonds of other companies, real estate etc. the examples of financial intermediaries include predominantly, banks and mutual funds.

Amongst all the financial institutions discussed above only Mutual Funds go for diversifying their investment portfolios (basket of assets in which funds are being invested) with different assets like shares of other companies, interest earning assets (t-bills, TFCs, CFS), spread transactions<sup>2</sup>, real estate etc. The other counterparts specialize in one sort of assets. Banks specialize in interest earning assets like t-bills, bonds, TFCs, CFS<sup>3</sup>, etc. Financial brokers on the other hand tend to specialize in brokerage business and earn a brokerage fee.

In Pakistan there are 67 Mutual Funds. Depending upon their kind they invest in different sort of assets. Income funds invest in interest based assets like CFS, TDRs, TFCs, money market placements etc. examples of such funds in Pakistan include Atlas Income Fund, KASB Liquid Fund, IGI Income Fund, Pakistan Income Fund etc. Stock Market Mutual Funds invest in assets related to stock market like Shares and CFS. Examples are Atlas Stock Market Fund, Pakistan Stock Market Fund etc. some Mutual Funds are hybrid funds. They invest in both stock market and interest earning assets. Example of such a fund is Arif Habib Asset Management Company's "Pakistan Capital Market Fund". Some mutual funds invest only in Shariah compliant securities like Modarba certificate, Musharka certificates. Their examples include Atlas Islamic Fund and Pakistan international element Islamic fund. Still there is another type of Mutual Funds that invest exclusively in Real Estate. These are known as Real Estate Investment Trust (REIT). At the moment in Pakistan there is no REIT.

If we note the compositions of the portfolios above we find that these portfolios are vulnerable to interest rate risk (change in the Net Asset Value of a Portfolio due to change in the interest rate). If the interest rate in the economy go up then the prices of Bonds, TFCs, TDRs, T-bills, and Shares go down. The reason is that the bank deposits now give more interest than these interest based assets and shares and holders of these assets are ready to sell these assets so that the proceeds can be deposited in banks resulting an increased supply of these assets in the market which causes a downward pressure on the price of the assets. Efficient markets providing liquidity, like stock exchange, facilitates this process and there is nothing stopping this price decline. So an Income Fund or a Stock Market Fund or a Hybrid Fund is bound to book a capital loss i-e a decrease in the NAV (Net Asset Value). One question arises over here that why do we want to hedge the NAV of a portfolio. The answer is that a mutual fund's NAV determines the unit price of the fund<sup>4</sup>. Decrease in the NAV decreases the unit price as well. This means decrease in the shareholder's wealth which is against the primary purpose of financial management i-e "to increase the share holder's wealth". If we add such an asset to these portfolios which cannot behave as quickly as the other assets to such stimuli as interest or other then we will be able to put a drag on the NAV of the portfolio. Putting it in another way, we are interested in adding an asset to the portfolio whose price change has a negative or very little correlation with the price changes of the other assets in the portfolio.

<sup>1</sup> Money and Capital Markets by Peter Rose, 8<sup>th</sup> Edition.

<sup>2</sup> Spread Transaction is earning a spread in the price of shares resulting from the timing difference between ready and future settlement, buying in the ready settlement market and selling in the future settlement market.

<sup>3</sup> CFS stands for continuous financing system. This financing system is modernized version of Badla financing system with provisions to curtail stock price manipulations. By the virtue of this system speculators finance their speculations in stock market to earn capital gain and the financier (bank or Stock Broker) earns the interest on the loaned amount.

<sup>4</sup> Unit/share price of Mutual Fund = NAV/ total number of shares or units of the fund outstanding.

This is what Markowitz said in 1950 in his Nobel Prize winning "Portfolio Theory". According to Markowitz Portfolio Theory the risk (here, deviation of NAV of portfolio from expected average NAV) of a portfolio depends upon the covariance of the returns (here, capital gain/increase in the NAV of portfolio) of the assets in the portfolio. If correlation between the capital returns of the assets in the portfolio is positive then there is high degree of risk because at any time the capital returns from both of the asset can be positive or negative resulting in high deviations of NAV from the expected average NAV. If correlation between the capital returns of the assets in the portfolio is negative then capital gain by one asset is offset by capital loss by the other asset and there will be less deviation from the expected average NAV of portfolio which means less risk. So if the covariance terms are likely to be negative then it may be possible to get rid of the risk almost wholly by resorting to diversification.

**This paper attempts to see the benefits of diversification (risk reduction phenomenon) due to correlation effect if private real estate is added to a portfolio of stock.** The reason for adding a private real estate<sup>5</sup> to a portfolio of stock is that at the moment there are no efficient markets for private real estate making private real estate an illiquid asset. So private real estate cannot react as quickly to interest rate changes or other stimuli as the other assets like Shares can. So adding a real estate to the portfolio of shares would put a drag on the NAV of the portfolio. Public real estate on the other hand acts like stock because being traded at the stock exchange gives it a lot of liquidity.

Different studies have been carried out in other countries (other than Pakistan) to find the correlation of real estate market with stock market and to find out the optimal allocation of real estate in a portfolio. **Paladino, Michael, Mayo, Herbert (1995)**<sup>1</sup> found the correlation between the returns of stock and the returns of private real estate market, and the returns of stock market and public real estate market. For this purpose the benchmark of stock market, private real estate market and public real estate market performance was considered to be S&P-500 index, NCREIF index, NAREIT (National Association of Real Estate Investment Trust) index respectively. They found a very low correlation between Private real estate and stock market returns i-e 0.052 and very high correlation between public real estate and stock market return i-e 0.72. Based on these results and in the light of Markowitz Portfolio theory they concluded that because of low correlation with stock market Private real estate gives more benefits of diversification than Public real estate. Later on a study by **Sander's (1998)**<sup>ii</sup> aimed at finding the allocation of private real estate in a mixed asset portfolio in the absence of public real estate revealed that private real estate enters the mixed asset portfolio of stock and bonds at all risk levels with the allocation between 10% and 40%. An extensive study by **Muller, Andrew, Muller and Glenn (2003)**<sup>2</sup> attempted to analyze the inclusion of both Public and Private Real Estate in a mixed asset portfolio using Mean/Variance Markowitz Efficient Frontier Methodology. Their findings indicate that Public and Private Real Estate returns have low correlation between each other and the inclusion of both in a mixed asset portfolio of stock and bond produces more efficient frontier than inclusion of just one or the other or neither. After adjusting for the appraisal-bias in the NCREIF index they suggested 100% allocation to Private Real Estate at the lowest risk level and a portfolio composition of 96% Public Real estate and 4% stock (1.5% S&P-500 and 2.5% Russell-2000) at the mid point in the mean/variance curve. In another study **Georgiev, Gupta, Kunkel (2003)**<sup>3</sup> explored the benefits of Private and Public real estate investments in a mixed asset portfolio of stock and bonds and other asset classes such as hedge funds and commodities. Their analysis included the correlation analysis of assets. The correlation of Private Real Estate (represented by NCREIF) with stock (represented by S&P-500) was found to be -0.02. **Adair, McGreal, Webb (2006)**<sup>4</sup> used data from 1975 through 2003 to construct a mean/variance optimal portfolio for U.K. the portfolio so constructed was a mixed asset portfolio consisting mainly of three assets i-e Real Estate (including both Private and Public), Common Stock, and Gilt (Government Bonds). Different alternative portfolios were suggested based on both current and capital gains separately. Their findings in context of capital gains were that the allocation of funds to the real estate should be 65.5%, 47% and 0% to portfolios of low, medium and high risk profile respectively.

As far as Pakistan is concerned, till now there have been no attempts by the researchers to find out the correlation between real estate returns and stock market returns.

## OBJECTIVES OF THE RESEARCH

1. The first objective of the research is to find out the correlation between the returns (here, only capital returns considered) of stock market and real estate market. Lesser the correlation more the benefits of diversification with such assets.
2. The optimum weightage of real estate and stock in a portfolio that would result in minimum variance.
3. Compare the performance of the best optimal portfolio with the contemporary stock portfolios using different performance measures like Standard Deviation, Beta, and Sharp ratio.

The study is planned as follows. The second section presents the model, data and estimation technique. The third section analyses results. The fourth section provides the conclusion.

## FRAME WORK OF ANALYSIS, DATA AND ESTIMATION

### THE MODEL (MARKOWITZ PORTFOLIO THEORY)

The research is based on Markowitz Portfolio theory. This Portfolio theory, originally proposed by Harry Markowitz in 1950s, was also the first former attempt to quantify the risk of a portfolio and develop a methodology for determining the optimal portfolio. Prior to the development of portfolio theory, investors dealt with the concepts of return and risk somewhat usually, intuitively smart investors knew the benefits of diversification which is reflected in the traditional adage "do not put all your eggs in one basket". Harry Markowitz was the first person to show quantitatively why and how diversification reduces risk. In recognition of his seminal contributions in this field he was awarded the Nobel Prize in Economics in 1952. He proposed the following formulas for finding the return and risk of portfolio.

### PORTFOLIO EXPECTED RETURN

The expected return on a portfolio is simply the weighted average of the expected returns on the individual securities in the portfolio.

$$E(R_p) = \sum_i w_i E(R_i) \quad [1]$$

Where  $E(R_p)$  = expected returns on the portfolio  
 $w_i$  = weight of the security i in the portfolio  
 $E(R_i)$  = expected return on security i  
 $n$  = number of securities in the portfolio

### PORTFOLIO RISK

Markowitz gave the following equation to measure the risk of portfolio;

$$\sigma_p^2 = w_A^2 \sigma_A^2 + w_B^2 \sigma_B^2 + 2w_A w_B \rho_{AB} \sigma_A \sigma_B \quad [2]$$

<sup>5</sup> Private real estate is the property like residential and commercial areas that are not traded on stock exchange as compared to publicly traded real estate which is traded on the stock exchange in the form of shares of REIT.



Where  $\sigma_p^2$  = variance of portfolio return

$w_A^2 w_B^2$  = square of weight of the two securities in the portfolio

$\sigma_A^2 \sigma_B^2$  = variance of returns of the two securities

$\rho_{AB} \sigma_A \sigma_B$  = covariance of returns of the two securities

$\rho_{AB}$  = coefficient of correlation between the returns of two securities

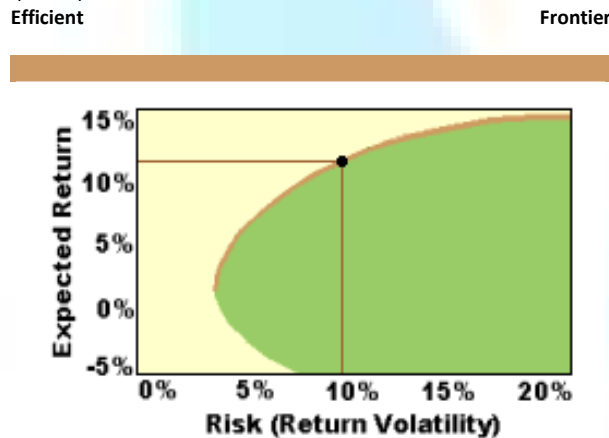
Harry Markowitz was the person to quantify the risk of a portfolio and develop a methodology for determining the optimal portfolio. The Efficient Frontier represents all the dominant portfolios in risk/return space. The efficient frontier was first defined by Harry Markowitz in his groundbreaking (1952) paper that launched portfolio theory. That theory considers a universe of risky investments and explores what might be an optimal portfolio based upon those possible investments.

Consider an interval of time. It starts today. It can be any length, but a one-year interval is typically assumed. Today's values for all the risky investments in the universe are known. Their accumulated values (reflecting price changes, coupon payments, dividends, stock splits, etc.) at the end of the horizon are random. As random quantities, we may assign those expected returns and volatilities. We may also assign a correlation to each pair of returns. We can use these inputs to calculate the expected return and volatility of any portfolio that can be constructed using the instruments that comprise the universe.

The notion of "optimal" portfolio can be defined in one of two ways:

1. For any level of volatility, consider all the portfolios which have that volatility. From among them all, select the one which has the highest expected return.
2. For any expected return, consider all the portfolios which have that expected return. From among them all, select the one which has the lowest volatility.

Each definition produces a set of optimal portfolios. Definition (1) produces an optimal portfolio for each possible level of risk. Definition (2) produces an optimal portfolio for each expected return. Actually, the two definitions are equivalent. The set of optimal portfolios obtained using one definition is exactly the same set which is obtained from the other. That set of optimal portfolios is called the efficient frontier.



The green region corresponds to the achievable risk-return space. For every point in that region, there will be at least one portfolio that can be constructed and has the risk and return corresponding to that point. The efficient frontier is the gold curve that runs along the top of the achievable region. Portfolios on the efficient frontier are optimal in both the sense that they offer maximal expected return for some given level of risk and minimal risk for some given level of expected return.

**STATISTICAL TEST FOR CORRELATION**

A statistical test to conclude, if the correlation between the returns of real estate and stock market is significant or not, is two tailed t-test. Where "t" is a normal random variable and is given by

$$t = r * (N - 2 / 1 - r^2)^{1/2} \quad [3]$$

Where

N = size of sample and in our case, 14 for KSE and 11 for ISE

r = coefficient of correlation

N-2 = degree of freedom and in our case 12 for KSE and 9 for ISE

Here for this statistical test the level of significance is assumed to be 0.10 i-e 10%. The critical values of "t" at 13 and 10 degree of freedom and 0.10 level of significance are 1.782 and 1.833 respectively.

**DATA**

The basis of our calculation is an "index" showing change in the prices of assets. KSE-100 index and ISE-10 index has been taken as a benchmark to calculate the stock market returns. The historical index values of KSE-100 index and ISE-10 index are being taken from the respective exchanges. At the moment in Pakistan there is no real estate index as there are in USA like NPI (NCREIF Property Index that represents a value-weighted aggregate of private U.S real estate properties) and NAREIT index (the index for publicly traded real estate investment trusts in USA). So we had to calculate the index ourselves.

Data about the property prices in order to compute real estate index has been gathered from different property dealers who have been working since 1990 in their respective areas. The property dealers were asked to fill a questionnaire with price of a certain area, with in a certain region, for different years. Based on these prices for different years (since 1992-2007) for different areas that lie in different regions, a price weighted index of real estate has been developed. Nine real estate properties are used to calculate the index therefore we name it RE-9 index. All of these nine real estate properties are in Rawalpindi and in Islamabad.

**ESTIMATION TECHNIQUE**

The first objective of the study is to calculate the coefficient of correlation (r) between real estate and stock market returns so calculation of returns of real estate and stock is a prerequisite to the accomplishment of the objective. To calculate the returns, the **index of real estate** is to be calculated first. So a price

weighted real estate index is made which is an unprecedented effort in Pakistan. Based on the index, percentage returns (percentage capital gain) of real estate are calculated. These percentage returns are then correlated with stock market returns to find "r". Stock market returns are also percentage capital gains based on KSE-100 index and ISE-10 index. To find "r" between real estate and KSE returns the tenure is 14 years from 1993 to 2006 and for "r" between real estate and ISE return the tenure is 11 years from 1997 to 2007.

In pursuit of the second objective the risk and return, as per the formulae proposed by the Markowitz, of the Real Estate-Stock portfolio are calculated for different percentages of the two assets in portfolio. A portfolio weightage that gives maximum return for minimum risk is considered to be optimal portfolio weightage.

**RESULTS AND FINDINGS**

As discussed in the introduction the research study has three objectives therefore the results and discussion section also has three parts.

First one deals with the finding pertaining to the correlation between the stock market and the real estate market. The second one describes the optimal portfolio allocation between real estate and stock that would maximize return for a given level of risk. The third one compares the performance of this optimal portfolio with the contemporary stock portfolios using different measures.

**CORRELATION ANALYSIS**

The exhibit-1 shows the Real Estate index calculated as per the procedure explained in the Methodology section. Exhibit-2 shows the three indices that is KSE-100 index, ISE-10 index and real estate index plotted on the same graph.

Based on these indices and the procedure explained in methodology the correlation between returns of Karachi Stock Exchange and Real Estate market works out to be 0.58 (t=2.498, statistically significant) and between the returns of Islamabad Stock Exchange and Real Estate market works out to be -0.018 (t= - 0.054, statistically insignificant). The correlation between ISE returns and Real Estate market return is quite in line with the findings of **Paladino, Michael, Mayo, Herbert (1995)** and **Georgiev, Gupta, Kunkel (2003)** but the correlation between the returns of KSE and Real Estate market is too high as compared to the previous researches carried out in other parts of world. Such high correlation between a liquid Stock market and an illiquid Real Estate market seems illogical and unlikely. What could be the reason?

The answer to this question can be sought in light of 9/11 incident. Exhibit-3 shows the returns from KSE and Real Estate market. If we see the era before 2001, we observe little fluctuation of Real Estate capitalization and quite a volatile capitalization of stock market. Also, if we see numerically, the correlation (r) between the returns in this period (1992-2000) is only -0.053 which is in line with findings of **Paladino, Michael, Mayo, Herbert (1995)** i-e r = 0.052 (not adjusted for appraisal bias) and **Georgiev, Gupta, Kunkel (2003)** i-e r = - 0.04 (after adjusting for appraisal bias) and r = - 0.02 (before adjusting for appraisal bias). After 9-11 many wealthy investors and businessmen of Pakistani origin living in the west perceived subsequent events and policies as a possible threat to their financial futures and feared the daunting prospect of having their assets frozen. Therefore, there was a large influx of capital back to Pakistan<sup>6</sup>. Pakistan witnessed an upsurge in home remittances from \$983 million in 2000 to historic \$4.2 billion in fiscal year 2003-2003<sup>7</sup>. Also president Musharraf declared his support against terrorism after 9/11 resulting in \$2 billion grant during 2001-2003 and FDI of \$82 million during July, 2004 and February, 2005. The post 9/11 analysis of exhibit-2 and exhibit-3 shows that all these funds found their way into Stock market (and KSE being the largest one<sup>8</sup>) and Real Estate market as both gained in capitalization after year 2001. So a low correlation of returns (-0.053) in before 9/11 and high correlation of returns in after 9/11 period resulted in overall good correlation of 0.58.

**OPTIMAL PORTFOLIO ANALYSIS**

To find the optimal portfolio we must draw the Markowitz Efficient Frontier. It is drawn by taking Risk (Variance of return) of portfolio at x-axis and return of portfolio at y-axis. Each point on the graph represents a different percentage allocation to the real estate and stock. Exhibit-5 shows the possible portfolio options for ISE stock and real estate. The head of the arrow points at the Minimum Variance Portfolio or more accurately the minimum standard deviation portfolio because the x-axis represents the standard deviation. At any point below MVP the investor would be assuming more risk for less return but at any point above MVP the investor would be assuming more risk for more return therefore the points above MVP represent the optimal portfolio options or Markowitz Portfolio Frontier. So no investor would like to invest in any portfolio below MVP. Exhibit-6 shows the Markowitz Efficient Frontier for ISE stock and real estate.

The following tables summarize the portfolio allocation between stock and real estate for different risk levels. The results are not comparable with the previous researches carried out in other countries because in them private real estate was considered in a mixed asset portfolio consisting of assets other than stock as well. Therefore the allocation of real estate in their portfolios was dependent upon the correlation of real estate with assets in portfolio other than stock as well.

**TABLE - 1: PORTFOLIO ALLOCATION BETWEEN KSE AND REAL ESTATE FOR DIFFERENT RISK LEVELS**

RISK PROFILE	%AGE OF REAL ESTAE	%AGE OF KSE LISTED STOCK	RETURN OF PORTFOLIO	RISK OF PORTFOLIO	COEFFICIENT OF VARIATION (i-e RISK/RETURN)
HIGH	0%	100%	24.9495%	42.4180%	1.7002
MEDIUM (AVERAGE OF HIGH AND LOW RISK)	41%	59%	22.8634%	29.3929%	1.2856
LOW (MVP)	100%	0%	16.1432	19.8614%	0.8128
BEST PORTFOLIO ALLOCATION (Least coefficient of variation)	100%	0%	16.1432	19.8614%	0.8128

**TABLE - 2: PORTFOLIO ALLOCATION BETWEEN ISE AND REAL ESTATE FOR DIFFERENT RISK LEVELS**

RISK PROFILE	%AGE OF REAL ESTAE	%AGE OF ISE LISTED STOCK	RETURN OF PORTFOLIO	RISK OF PORTFOLIO	COEFFICIENT OF VARIATION (i-e RISK/RETURN)
HIGH	100%	0%	20.0035%	18.9111%	0.9454
MEDIUM (AVERAGE OF HIGH AND LOW RISK)	95%	5%	19.0948%	18.0387%	0.9447
LOW (MVP)	81%	19%	16.5504%	16.9418%	1.0236
BEST PORTFOLIO ALLOCATION (Least coefficient of variation)	97%	3%	19.4583%	18.3608%	0.9436

**COMPARISON OF THE PORTFOLIO WITH CONTEMPORARY STOCK PORTFOLIOS**

This part of the section compares the performance of stock-real estate portfolio with contemporary stock portfolios that have not been diversified by using real estate. For this purpose we have selected three parameters:

- Standard deviation of the best (minimum coefficient of variation) portfolio
- Beta of the best (minimum coefficient of variation) portfolio

<sup>6</sup> Clark, Masood, Tunaru, "Political Events Affecting the Pakistan Stock Exchange: An Analysis of the Past and Forecasting the Future" Cass Business School, City University, London

<sup>7</sup> www.strategicforesight.com/sfgnews\_133.htm

<sup>8</sup> As on march 2007, 655 companies were listed on KSE as compared to 240 on ISE (Source: Economic Survey 2006-2007)

- Sharp ratio of the best (minimum coefficient of variation) portfolio

**Beta of a portfolio** is actually the correlation of the portfolio with the stock market and it is a measure of systematic risk. Systematic risk is the variation of expected returns due to factors that affect each sector of the stock and not one or two. The stock market beta is “1” because correlation of stock market with itself is “1”. If the portfolio beta is greater than “1” then it means that the factors bring more changes in the expected return of portfolio as compared to that of stock market and vice versa. In Pakistan Karachi Stock Exchange is considered as a benchmark of performance of stock or equity market. Mathematically it can be written as:

$$\text{Beta} = (\text{STD of portfolio} / \text{STD of stock market}) * (r)_{(\text{between portfolio and stock market return})}$$

**Sharp ratio of a portfolio** is excess return (over risk free return) to standard deviation of the portfolio. Mathematically it can be written as:

$$\text{Sharp ratio} = (\text{AVG return on portfolio} - \text{AVG return on a risk free investment}) / \text{STD of portfolio}$$

To calculate the sharp ratio, PACRA<sup>9</sup> and all mutual funds use 3-month Treasury Bills rate as risk free investment and the ratio is calculated by using the average value for the last three years. For the purpose of comparison we follow the same convention and find the sharp ratio of our portfolios based the average values of last three years.

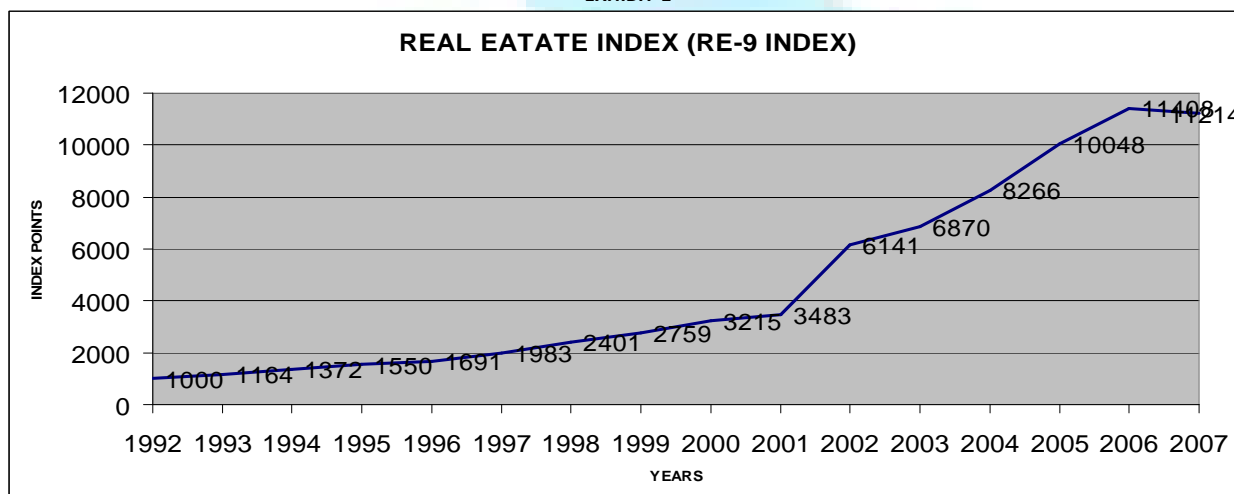
The table-3 on the other page compares the performance measures of different stock market funds with our least coefficient of variation stock-real estate portfolio.

So from the table on the next page we see that our portfolio outperforms all other mutual funds. Its very low beta value i-e 0.22 makes it less volatile than the benchmark market, Karachi stock Exchange. It is evident that the rest of the mutual funds have high degree of correlation with KSE as the minimum Beta value among them is 0.62. Also the sharp ratio suggests that KSE-Real estate portfolio gives more excess return (over risk free return) than any other fund in the comparison. ISE-Real Estate fund gives a low sharp ratio because this calculation involves the return of year 2007 which is a year of slump for the property market. So due to more deviation of returns the sharp ratio is low for this portfolio.

**TABLE - 3: COMPARISON OF MINIMUM COEFFICIENT OF COVARIANCE PORTFOLIOS WITH CONTEMPORARY STOCK INVESTMENT FUNDS**

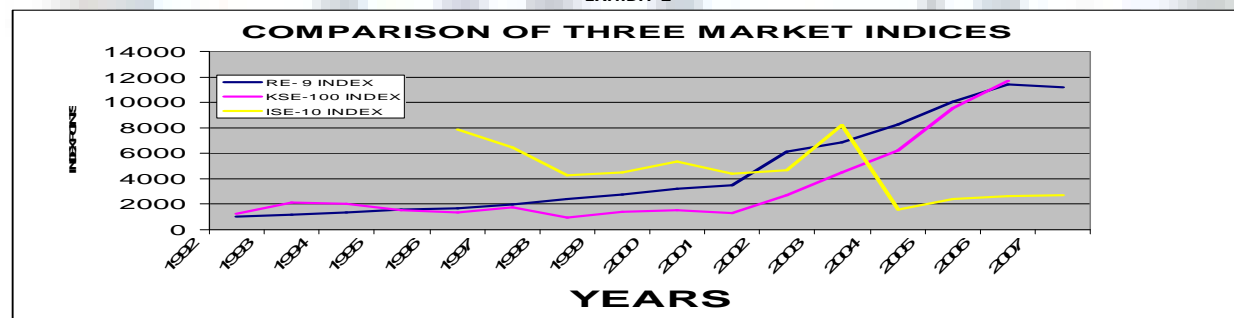
PARAMETERS	BENCH MARK KSE-100	KSE-REAL ESTATE PORTFOLIO (0%KSE- 100%RE)	ISE-REAL ESTATE PORTFOLIO (3%ISE-97%RE)	PAKISTAN STOCK MARKET FUND (July 2007 fund manager report)	PAKISTAN INTERNATIONAL ELEMENT ISLAMIC FUND (July 2007 fund manager report)	PAKISTAN CAPITAL MARKET FUND (July 2007 fund manager report)	KASB STOCK MARKET FUND (August 2007 fund manager report)
STANDARD DEVIATION (%)	42.42	16.14	18.36	18.72	17.24	17.87	1.0
BETA (correlation with KSE)	1	0.22	DATA CONSTRAINT	0.69	0.62	0.63	0.87
SHARP RATIO	0.60 (Yr 2005-2007)	3.32 (Yr 2004-2006)	0.34 (Yr 2005-2007)	1.11 (Yr 2005-2007)	0.35 (Yr 2005-2007)	1.16 (Yr 2005-2007)	0.015 (Yr 2005-2007)

**EXHIBIT-1**



The graph above shows the change in the index of real estate (RE-9 index). From 1992-2001 there is a persistent and almost constant rise in the prices of the real estate properties. In 2002 the index went up like a rocket due to 9/11 incident as a lot of Pakistanis in America repatriated their money from America to Pakistan and invested them in real estate. Resultantly the prices of the real estate went up.

**EXHIBIT-2**



The above graph shows KSE-100 index, ISE-10 index and RE-9 index (made by the writers of this paper).

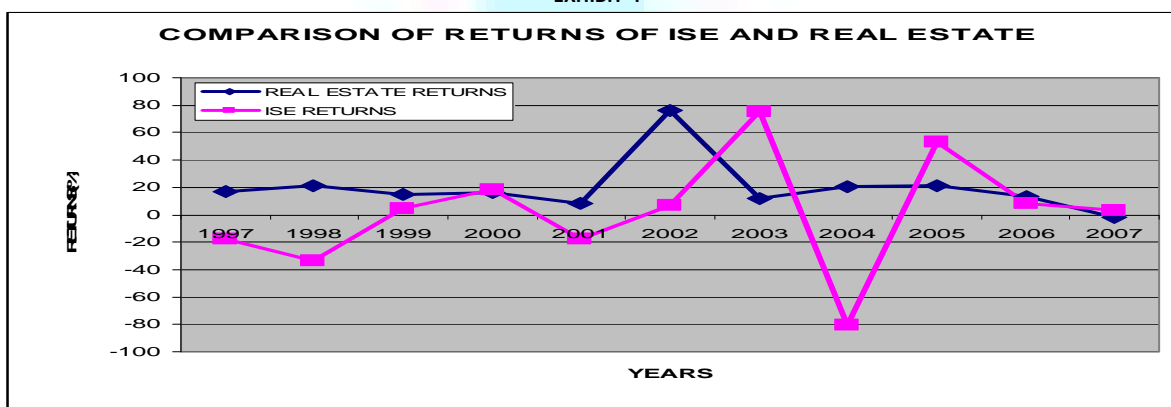
<sup>9</sup> PACRA stands for (Pakistan Credit Rating Agency Limited). PACRA is to evaluate the capacity and willingness of a corporate entity to honor its debt obligations. PACRA ratings reflect an independent, professional and impartial assessment of the credit risk associated with a particular debt instrument or a corporate entity (such as a Bank, Mutual Fund). By providing a measurement of risk, PACRA's ratings facilitate investors in making prudent investment decisions after determining the acceptable rate of return at the given risk level.

EXHIBIT-3



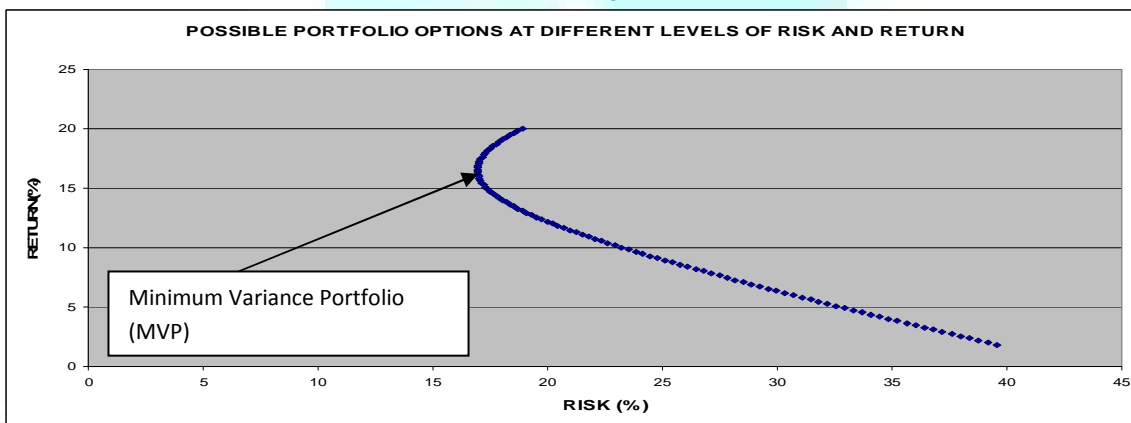
The above graph shows the up and down movement of returns of real estate market and Karachi Stock Exchange.

EXHIBIT-4



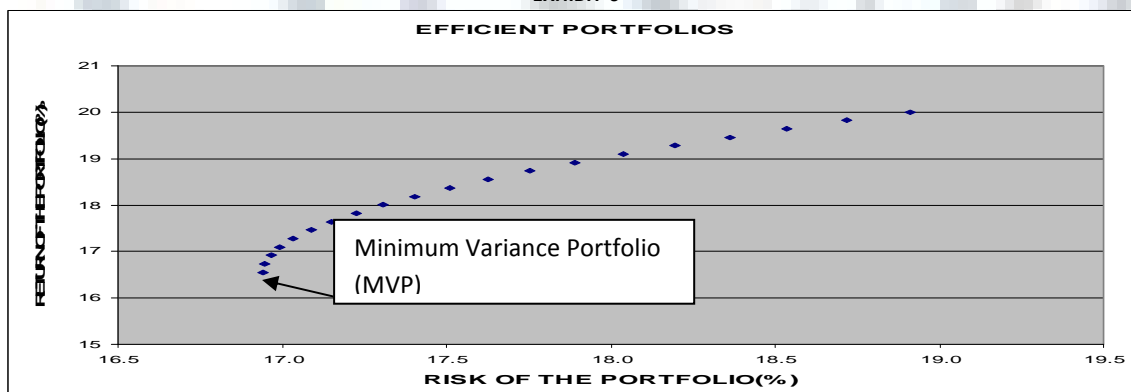
The above graph shows the up and down movement of returns of real estate market and Islamabad Stock.

EXHIBIT-5



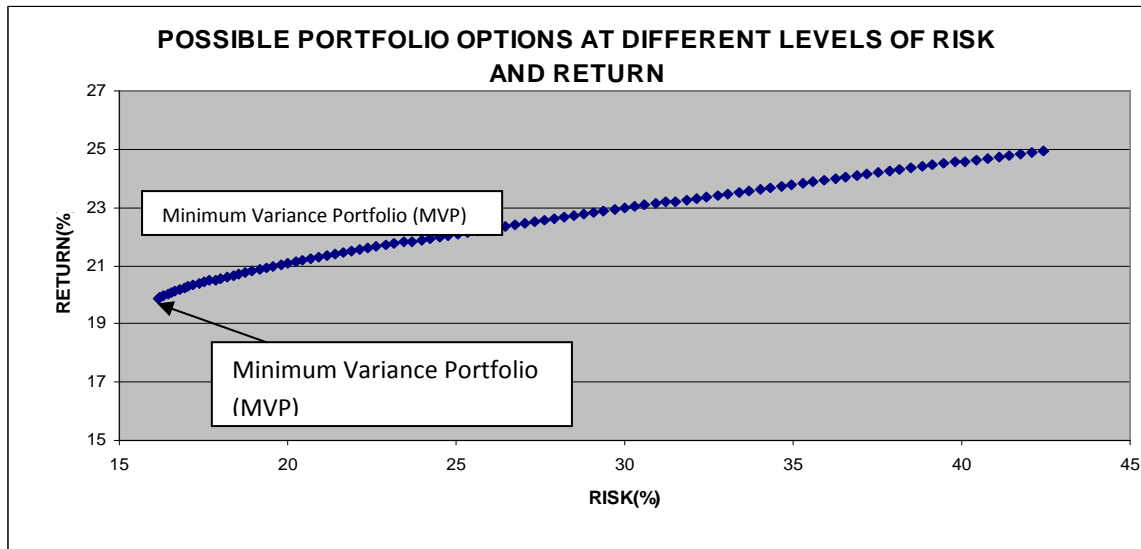
Possible portfolio options for different levels of risk and return.

EXHIBIT-6



Markowitz Efficient Frontier for ISE and real estate.

EXHIBIT-7



Markowitz Efficient Frontier for KSE and real estate as the correlation between the two is high i-e 0.58 therefore the Markowitz Efficient Frontier and graph of possible portfolio option is the same.

### CONCLUSION

The research very convincingly meets its objectives. It shows that there exists no correlation between stock market and real estate market. The high positive correlation between KSE and real estate ( $r=0.58$ ) is due to high influx of home remittances after 9/11. If we exclude the period after 9/11, the correlation works out to be almost zero ( $r=-0.053$ ). In the light of these finding we are safe to say that adding real estate to a stock portfolio reduces the volatility of the overall portfolio. In other words Real estate in the portfolio puts a drag on the Net Asset Value of the whole portfolio due to its low correlation with the other asset in the portfolio. Coefficient of variation analysis of the Markowitz Efficient Frontier suggests that **100% real estate and 0%KSE** portfolio or **97% real estate and 3%KSE** portfolio provides the best return against the risk assumed. The former also outshines many Stock Mutual Funds (not being diversified by real estate) as indicated by its low beta value i-e **0.22** and high sharp ratio i-e **3.32**.

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