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# USING VALUATION RATIOS TO PREDICT RETIREMENT PORTFOLIO PERFORMANCE

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**Abstract**

**Retirees face great risk when planning for retirement. They can prematurely run out of funds due to the volatile equities and bond markets. The ability to accurately measure the future risk of a portfolio will tremendously benefit retirees in securing their financial future.**

**This thesis aims to use valuation ratios, such as Shiller P/Es and dividend yields, to forecast the ending balance of retirement portfolios over a 30 year horizon. Historical data was utilized to generate models that could predict when a retiree would prematurely run out of funds,  and a range of models were developed for a wide array of portfolio allocations and withdrawal habits.**

**Valuation ratios were found to have predictive capabilities with retirement portfolio balance.  Utilization of valuation ratios could benefit retirees with retirement planning by hinting at the performance potential of the markets.**

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## Introduction

Retiring in the midst of a financial crisis can be painful for any retiree, as it was during the Wall Street Crash of 1929, the 1973 Oil Crisis induced stock market crash, the dot-com bubble, and most recently the Global Financial Crisis. In a very short period of time a retiree can lose a substantial portion of their portfolio due to financial crises caused by a wide array of negative economic shocks. For example, a retiree in 2008 who was hoping to kick back, hit the links, and enjoy a quality of life secured by a lifetime of savings is worried what a 25%- 40% loss of their portfolio would spell for their way of life. In 2009 Robert Shipley a 68-year-old retired dreaming of spending retirement at a golf-course, and now he spends his days at the Niagara Falls Country Club not as a patron but as a golf-cart mechanic (Gandel, 2009). Due to the substantial loss he experienced in 2008, Shivley has to work part time to augment his income--- something he thought he would never have to do after a lifetime of working. Unfortunately, due to a move toward market driven retirement funds, Shivley's misfortune is far more common today than it was a generation ago.

A middle aged person and, especially, a young-saver will be able to make up for their portfolio loss with annual contributions and over time the market shall recover. On the other hand, a retiree who cannot make any additional contributions, but also has to regularly withdraw from their retirement fund can mean either running out of funds prematurely or permanently diminishing their quality of life. To hedge against these negative shocks, the general investment consensus suggests that investors closest to retirement should hold safer assets such as bonds and treasuries (ensuring security but very low returns). However, 1 in 4 investors between ages 56-65 had more than 90% of their account balances in equities at year-end 2007, and more than 2 in 5 had more than 70 percent (VanDerhei, 2009). Furthermore, it is important to note older investors with less exposure to equities (thought to be less vulnerable to negative shocks) still tend to have larger account balances than younger investors, and, therefore, have a lot more to lose in aggregate (VanDerhei). In essence, a financial crisis hits those closest to retirement the hardest.

Due to the current economic climate, many retirees and near-retirement individuals are opting to delay retirement, get a job, or cut back substantially on their spending. Naturally, predicting long term stock market performance would tremendously empower retires to plan efficiently. But, the prevailing notion in finance suggests that the market is randomly driven and predicting stock market returns is not possible. This thesis will present evidence against this notion and demonstrate that certain valuation ratios have significant predictive capabilities, especially concerning the ending balance of retirement portfolios.

Despite the widespread subscription to the random walk theory, economists and financial engineers have long sought to predict the stock price of a certain stock (or even an index) for short term gains and goals. Those who have successfully developed models to predict long term stock market performance have not applied them to model retirement portfolio performance. Usefully, Shiller P/E's and Dividend Yields have been shown to have predictive capabilities with broad market index performance (Campbell & Shiller, 1988). By using historical data and these variables, this thesis aims to predict the ending portfolio balance after 30 years of retirement. By using these variables, senior citizens and retirees can hope to simulate their ending balance in thirty years based on the current economic conditions and their personal withdrawal rate. This predictive capability could drastically change the behavior of senior citizens in the United States.

## Background

The main goal of maintaining a retirement portfolio is to smooth consumption. Based on past income and lifestyle, a retiree would like to maintain a similar quality of life after retirement. To sustain such a lifestyle, a retiree needs to have a substantial pool of assets (ranging from stocks, bonds and cash) to withdraw from for a 30 year retirement window. Hopefully, from an early age the retiree has annually invested in a mutual fund, a 401(k) plan, Individual Retirement Account (IRA) or is provided an employee benefit package or pension. These saving mechanisms, along with Medicare and Social Security, are intended to allow senior-citizens a similar style of life they enjoyed prior to retirement.

The aim is to save during the peak employment ages of 25 to 65 that the retiree has enough money to withdraw for 30 years and maintain a standard of living. Most of these accounts are heavily vested in the stock market and the remainder is locked into safer assets. So saving early means that these contributions have a longer time to grow (with the stock or bond markets) and the government provides numerous tax incentives for individuals who chose to save for retirement.

It can be easily argued that the major link Main Street has with Wall Street is the effort to save for retirement. Much of the money that flows into Wall Street is sourced from institutional investors, pension funds, and mutual funds. In some way shape or form this flow of income directly, indirectly and constantly has an impact on the average retirement portfolio. The financial industry is a massive one—earnings comprising 7-8% of the US GDP (Phillipon). Numerous investment strategies are implemented, but the most widely accepted would be the Capital Asset Pricing Model (CAPM). The model states that much of the risk (deviation) associated with individual assets in a portfolio can be eliminated by diversifying the portfolio.

The objective of the model is to maximize the Sharpe Ratio— ((Expected Portfolio Return-Risk Free Rate) /Beta of the portfolio). The Beta measures the sensitivity of the expected excess portfolio returns versus expected excess market returns. In other words, how does the asset move with the market. The Sharpe ratio is a measure of return per unit of risk and by maximizing this ratio one gains the most while risking the least (least volatility). The final component of this model is the Capital Allocation Line, which is a line that connects the risk-free rate (going T-Bill or other treasuries rate) and the portfolio on the Efficient Portfolio Frontier that maximizes the Sharpe Ratio (always a tangent to the efficient frontier).

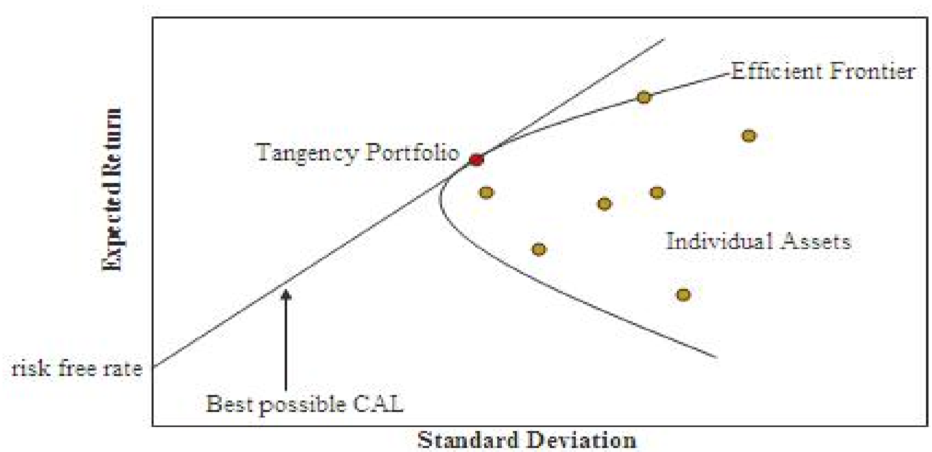


**Chart 1- CAPM- Markowitz Frontier - (Wikipedia, 2005)**

CAPM implies that there are only two things you can and should invest in: a diversified efficient portfolio that maximizes the Sharpe ratio and treasuries (risk free rate). Depending on what kind of risk and return one wants to take they can move along the CAL, but will always gain the greatest return while being exposed to the least risk. There are several other caveats like the borrowing rate etc. but the CAPM is in some way, shape or form is used by most mutual funds and institutional investors.

This thesis will use the S&P 500 as the optimal diversified portfolio because it is sufficiently diversified that it eliminates all idiosyncratic risk( risks associated to individual stocks) and only is effected by market risk (un-diversifiable risk that effects all assets). The other merits of using the S&P 500 as the optimal diversified portfolio will be discussed in the Model section of the paper. 10-year U.S. T-Notes are used as the safe asset in the portfolio allocation. This thesis does not aim to construct a balance of risk-free and optimal diversified portfolio to realize a certain return or volatility, but to see how a selection of common ratios of the two would perform over the retirement horizon; more on the merits of the selection are discussed in the literature review of the thesis.

## **Literature Review**

Some of the most prolific work done with predicting stock returns has been conducted by Robert Shiller. Over a span of almost a decade, Price-to-Earnings ratios and Dividend Yields have proven to possess substantial capability to predict future performance (Campbell & Shiller, 1998). Shiller, in fact, has developed his own form of P/E ratio (Shiller P/E) that averages the last ten years of monthly S&P 500 P/E's and provides a forward looking measure. Furthermore, vector-autoregressive method has been developed to weigh the potential of key historical averages of real earnings to forecast present values of future real dividends (unique way of determining if assets are over or underpriced) (Campbell & Shiller).

Valuating ratios are valid variables when forecasting future performance, "Because they relate stock prices to careful evaluations of the fundamental value of corporations," (Campbell & Shiller, 1998). Furthermore, they assert that dividends are set by corporations with an understanding that they need to maintain the dividends at a reasonable rate with future prospects. Most importantly, when Shiller and Campbell conducted their research and publication, based on the distance of valuation ratios from historical averages they both warned against the bearish future of the stock market (amongst the midst of the dot-com bubble).

Presently, valuation ratios, especially P/E's and Dividend Yields, are monitored by analysts to forecast a company or a portfolio's future performance potential—despite the fact that valuation ratios have very little predictive ability for individual firms.  Also, much more research has been conducted by other parties and companies all in an effort to develop the perfect crystal ball.  An area of financial services that seldom utilizes these findings is the sector of retirement planning.

Similar to the appeal of developing the perfect crystal ball, there is great appeal in finding the perfect withdrawal rate for retirees.  An inappropriate withdrawal rate either causes a retiree to run out money or lower their standard of living unnecessary. Retirees need to constantly monitor their portfolio and adjust their withdrawal rate as such that they maximize their consumption over their retirement horizon (Weston, 2012). Additionally, individual circumstances are important to consider; for example, younger retirees able to partake in leisurely activities, while older retirees are burdened with deteriorating health and higher healthcare costs (Weston, 2012). There are no steadfast rules but consumption is based on individual means and circumstances. It is an ultimate balancing act; one which has been studied (Cooley, Hubbard, and Walz, 1998). By conducting Monte-Carlo simulations they experimented with numerous withdrawal rates ranging from 3% to 12% of the starting portfolio, different composition of stocks and bonds, and inflation adjusted rates. The research found that some bonds in a portfolio help with certainty but a stock heavy portfolio can better capture upside (and downside) potential. Therefore, retirees with stock heavy portfolios can maintain higher withdrawal rates. Interestingly, the researchers also concluded that a withdrawal rate of 4% under any composition is very safe and almost always guarantees a successful portfolio (Cooley, Hubbard, and Walz, 1998).

On the other hand, different means of securing income during retirement have been explored as well (Horneff, Maurer, Mitchell and Dus, 2006). Since most retires have a substantial amount of savings, they can turn that into an annuity (via an insurance company) and receive consistent payments over a set period of time. Many retirees choose not to annuitize their savings because they cannot capture any upside in the equities market, cannot bequeath their wealth in case of early death, and they pay a premium to receive the annuity. Therefore the best option, based on the retiree's portfolio, age, and risk aversion, can be a combination of an annuity and an individual Retirement Account (IRA) (Horneff, Maurer, Mitchell and Dus, 2006).

## **Model and Data**

The model and data were developed to reconstruct how a portfolio of $1,000,000 would perform for thirty years with an annual withdrawal rates of 3%,4% or 5% with a compositions of 100% stocks, 70% stocks/30% bonds, and 50% stocks/50% bonds. The ending balance of a thirty year stint was calculated for every year since 1871. For example, using historical data the model would calculate how much money would be left over in the portfolio in 1900 after annual withdrawals beginning in 1871.

The simplest components of the model are the real return on 10 year T-Bills, real S&P 500 market return, S&P 500 dividend yield, and Shiller price-to-earnings ratios. The S&P is one of the broadest, oldest, and heavily invested indexes for which the previously mentioned components are available. All data utilized was compiled by the office of Dr. Robert Shiller for his recent book *Irrational Exuberance* and is made publicly available on his Yale Economics Department webpage. The source and methodology are outlined on the webpage as well. Also, Dr. Shiller's data is collected monthly, but for the purposes of the thesis the data points were annualized because retirement portfolios are adjusted and withdrawn from on an annual basis. Lastly, all appropriate variables have been adjusted to be in real terms, rather than the nominal form that the data was reported in. The conversion to real terms allows us to analyze the data without inflation bias and keeps the withdrawal rate consistent as well.

<u>Real S&P 500 Market Return</u>

The real market return is composed of the real capital gains and real dividend yields. In order to calculate these two variables the nominal stock price and nominal dividends needed to be converted to real stock prices and real dividends. By multiplying the corresponding (for example 1871) year's nominal S&P price or S&P dividend times the ratio of 2012's CPI over the corresponding year's CPI gives us the real stock price and the real dividends.

Equ. Real Price= Nominal S&P 500 Price X-year*(2012's CPI/ X-year CPI)

From here, the Real Capital gain is simply the difference between next year's S&P price and the corresponding year's price all divided by the corresponding year's price.

Equ. Real Capital Gain=$(P_1-P_0)/P_0$

0The real dividend Yield is calculated similarly, except the two-year dividends are averaged and divided by the corresponding S&P real price. The two dividends are averaged to compensate for the fact that dividends that are not always paid at the beginning of each year.

Equ. Real Dividend Yield= $((D_1+D_0)/2)/P_0$

Real Bond Returns

A nominal bond return adjusted for inflation also yields a real bond return. Shiller provide 10-year Treasury Yields for every month since 1871. The change in yield from year to year was used to estimate the return from holding a 10-year Treasury for one year. Excel was utilized to calculate the present value of a bond by using next year's bond rate as the prevailing interest rate, nine payments as the number of payments that would be left at the end of next year (payments were annualized for simplicity), annual bond payments of the corresponding year's interest rate, and with a future value of 100. The present value is the value the bond will sell for at the end of one year of holding the asset. The initial sum of 100 was subtracted but one annual interest payment was added to the bond return because the payment was made while the bond was held.

ExcelEqu. PV= (current interest rate, payments remaining, interest payment, future value)

Equ. Nominal Bond Return= $(-PV\ (G_1,\ 9{,}100*G_0,\ 100))-100+G_0*100$

The inflation rate is simply the ratio of next year's CPI divided by the current year's CPI, all subtracted by 1.

Equ. Inflation Rate= $(CPI_1/CPI_0)-1$

Dividing the nominal bond return by the inflation rate, the real bond return can be derived.

Equ. Real Bond Returns=(1+Nom Bond Ret/1+Inflation Rate)-1

Ending Balance Calculations

Real S&P 500 market returns and real 10 year T-Notes returns were used to simulated how each portfolio would act during a 30 year retirement window. Every portfolio starts out with the arbitrary sum of $1,000,000 and an annual sum of 3%,4% or 5% of the initial portfolio is withdrawn at the end of each year. The balance is rolled over each year and is also grown by the real S&P 500 market return and if applicable by the real 10 year T-Note returns. The net sum is unimportant because the value of money changes over time, but what matters is the net percentage gained or lost. In order to expedite the repetitive process of multiplying the returns to the ending balance each year, withdrawing a set sum each year, and adjusting the portfolio annually, Visual Basic for Excel code was used to loop the process. It's also important to note that VBA was implemented to extract data from the Shiller data on an annualized basis (every January data set) instead of manually arranging the data.

Once the ending balances are compiled they are plotted against the beginning year's P/E's and dividend yields to test the hypothesis of whether theses valuation ratios have predictive capabilities with retirement portfolio performance.

## Results and Findings

The following linear model was utilized for all predictions and findings:

Equ 1. 30-year Ending Balance= $\beta_0+\beta_1$*Beginning Year Shiller P/E

Equ 2. 30-year Ending Balance= $\beta_0+\beta_1$*Beginning Year Dividend Yield

Below are the starting year P/E's and Dividend Yields, as predicted by the simple linear regression that would lead to zero balances.

| Zero Balance P/E | 100% Stocks 0% Bonds | 70% Stocks 30% Bonds | 50% Stocks 50 % Bonds |
|---|---|---|---|
| 3 % Withdrawal | 25.42 | 26.51 | 27.26 |
| 4 % Withdrawal | 22.44 | 22.48 | 22.04 |
| 5 % Withdrawal | 19.56 | 18.62 | 17.16 |
| Zero Balance Dividend Yield | 100% Stocks 0% Bonds | 70% Stocks 30% Bonds | 50% Stocks 50 % Bonds |
| 3 % Withdrawal | .01382 | .00950 | .00789 |
| 4 % Withdrawal | .02307 | .02246 | .02396 |
| 5 % Withdrawal | .03219 | .03458 | .03840 |

**Table 1- Zero Balance Predictions- Shiller P/E and Dividend Yields**

Based on these P/E's, Dividend Yields, and portfolio allocation a retiree can predict if she will run out of money prematurely. To avoid running out of funds, the retiree can reallocate their portfolio and/or consider annuitizing a portion if not all of their savings, because the equities market does not ensure positive growth for the retirement horizon. The following tables outline the predictive capabilities of both Shiller P/E's and the Dividend Yields. The predictive capabilities are measured by $R^2$ statistics resulting from a simple regression line of best fit with the ending balance as the dependent variables and the valuation ratios as the independent values

| R-Squared Measures- P/E | 100% Stocks 0% Bonds | 70% Stocks 30% Bonds | 50% Stocks 50 % Bonds |
|---|---|---|---|
| 3 % Withdrawal | .4326 | .5796 | .5119 |
| 4 % Withdrawal | .5204 | .6580 | .5791 |
| 5 % Withdrawal | .5903 | .6818 | .5854 |

**Table 2- $R^2$ Measures- P/E**

| R-Squared Measures- Dividend Yield | 100% Stocks 0% Bonds | 70% Stocks 30% Bonds | 50% Stocks 50 % Bonds |
|---|---|---|---|
| 3 % Withdrawal | .3874 | .3853 | .2825 |
| 4 % Withdrawal | .4528 | .4502 | .3457 |
| 5 % Withdrawal | .5032 | .4968 | .3992 |

**Table 3- $R^2$ Measures- Dividend Yield**

The $R^2$ values, first and foremost, demonstrated that valuation ratios have predictive capability with retirement portfolio performance from the lowest estimator of 38.74% for dividend yields to the highest of 68.18% for Shiller P/E's. Furthermore, the predictive capabilities increase for all parameters as the withdrawal rates increase. Such results can be attributed to the fact that larger withdrawals are a greater burden for any portfolio and the ending balance is more closely linked to how the portfolio grows with the market. With a lower withdrawal rate, and a lower burden on the portfolio, the ending balance is a result of frugal spending and the portfolio intensely growing with the market. In other words, the more one withdraws the more the portfolio is depended on the performance on the market to determine the ending balance.

The movement of the predictive capability of the dividend yield is consistent across all parameters. As discussed earlier the predictive capabilities increase as the withdrawals rates increase, but they also increase as the portfolio's equities weight increases. The positive correlation can be credited to the fact that valuation principles are sourced from the equities market and will predict only the performance of the equities portion of the portfolio.

Surprisingly, the predictive capabilities of Shiller P/Es for the 70/30 portfolio are relatively high---higher than the pure equities portfolio. As with the dividend yields, one would expect the predictive capability to decrease as the equities weight increases but to the contrary, the 70/30 portfolio is tracked best by the valuation ratios. The main reason the 70/30 portfolio responds so well to the valuation ratios could be that the shocks (both positive and negative) are damped by the minority inclusion of the bonds. As found in previous studies, the inclusion of some bonds allows for stability but reduces exposure to market volatility. Similarly, the outlier portfolios are damped or eliminated by the inclusion of some bonds. Such influence of stability is apparent with the dividend yield $R^2$ ratios as well, because there is only a slight difference between pure equities portfolios versus the 70/30 portfolios. The predictive ability of valuation ratios falls precipitously with 50/50 portfolios but are relative strong with 70/30 portfolios.

Predictive capability can be further verified by studying the statistical significance of the slope coefficients of the ending balance linear regression. Statistically significance is established by statistical hypothesis testing. The null hypothesis; the slope coefficient is statistically insignificant (equal to zero), is tested by calculating the Student T-Statistic for the sample data. Based on a normal T-distribution chart, the T-Statistic will determine the probability that the slope coefficient it zero and, therefore, insignificant. The larger the absolute value of the T-Statistic the larger the probability that the true mean of the slope coefficient is not equal to zero. The following chart summarized the statistical significance of the slope coefficients predicted by the linear regressions.

| P/E Slope Coefficient<br>T-Statistic | 100% Stocks<br>0% Bonds | 70% Stocks<br>30% Bonds | 50% Stocks<br>50 % Bonds |
|---|---|---|---|
| 3 % Withdrawal | -8.64 | -11.62 | -10.14 |
| 4 % Withdrawal | -10.31 | -13.73 | -11.61 |
| 5 % Withdrawal | -11.88 | -14.49 | -11.763 |

**Table 4- T-Statistic- 95% Confidence Level**

| Div.Yield Slope Coef.<br>T-Statistic | 100% Stocks<br>0% Bonds | 70% Stocks<br>30% Bonds | 50% Stocks<br>50 % Bonds |
|---|---|---|---|
| 3 % Withdrawal | 8.27 | 8.22 | 6.52 |
| 4 % Withdrawal | 9.45 | 9.40 | 7.55 |
| 5 % Withdrawal | 10.46 | 10.33 | 8.47 |

**Table 5- T-Statistic- 95% Confidence Level**

All null hypotheses were rejected even at a 99% confidence interval. Statistical hypothesis testing has shown that all valuation ratios are statistically significant in predicting ending balances for retirees. As expected, the significance increases as the withdrawal rate and weight of equities increases. Moreover, the anomaly with predictive capability of the valuation rations with 70/30 portfolios is captured again by the increase in statistical significance. T-statistics and the $R^2$ are both congruent and support the predictive capability of valuation ratios.

Recent Portfolio Performance

The model utilizes 30 years of data, and as such, the last ending balance was calculated for 1980. A more recent application of valuation principles to portfolio performance further supports the hypothesis. If someone with a million dollar portfolio of 70% equities and 30% bonds retired in 2000, amid record high Shiller P/E’s and low dividend yields, and withdrew at 4%, by 2010 the retiree would have less than $500,000 to consume for 20 more years. Even with a conservative strategy, the retiree will be in trouble and the valuation ratios have foreshadowed the outcome. By noting the Shiller P/E of 43.7 and a dividend yield of 1.1%, an informed retiree could have annuitized a portion, if not all, of their portfolio to avoid the predicament most traditional retirees would have found themselves in.

| Year-4% Withdrawal (70/30)-Distribution- | Shiller P/E | Divdend Yield | 2010 Balance |
|---|---|---|---|
| 1982 | 7.39 | .057 | $5,923,812.70 |
| 1990 | 17.05 | .033 | $2,392,293.42 |
| 1998 | 32.86 | .016 | $818,966.98 |
| 2000 | 43.77 | .012 | $581,355.68 |

**Table 6- Recent "In-Progress" Portfolio 2010 Ending Balance**

The 1998 and 2000 Portfolio may need to reevaluate their portfolio; based on the beginning year P/E's and div yields, this is no surprise. Valuation ratios may not be able to predict the exact portfolio balance, but they are precursors to the trends that will prevail in the near further. The directionality of trends could tremendously help retirees plan for their future.

## Implications

Despite the fact that 73 million Americans (approx. 50% of working population) have a 401(k), retirement funds are a recent phenomenon (VanDerhei). In the 1980's, Fortune 500 companies started to replace expensive pension plans for defined-contribution 401(k) systems. Experts believe that since the 401(k) has replaced the company pension and social security as the cornerstone of American retirement saving, retirees today risk having a lower quality of life than their parents. They are exposed to this risk because the longer one holds a 401(k) the more market-exposed it becomes (VanDerhei). Retirees have very few resources to predict how their portfolio will do, but based on the valuation ratios, they can have some idea of what to expect and plan accordingly.

Utilization of valuation principles has a place in every retiree's portfolios and investment strategies because most of them are fledgling accounts. According to the Society of Professional Asset-Managers and Record Keepers, the average 401(k) has a balance of $45,519 and 46% of all 401(k) have less than $10,000 (Gandel). In other words, most accounts have not been around long enough to accumulate enough wealth for retirement (Gandel). As Baby Boomers, the largest group of American retirees, begin to enter retirement, large swaths of Americans will become dependent on the proverbial Wall Street roll of the dice to determine how they live. This risk can be mitigated by adjusting investment strategy based on the valuation principle models discussed in the paper.

If the Shiller P/E's are close to the thresholds discussed in the paper the retiree should look to annuitize at least a portion of their savings and, perhaps, even look into safer assets. If the Shiller P/E's are low and the dividend Yields are high then one should invest heavily in equities and choose a high withdrawal rate.

Most importantly, the data also contradicts the random walk hypothesis and places emphasis on existing valuation principles and methods. More research needs to be conducted with different predictive objectives, indices, bonds, and timeframe. The additional research may further strengthen and refine the predictive capabilities of valuation ratios or elucidate the limitations of valuation ratios. At the very least, financiers and economists need to begin paying attention to valuation ratios. A balanced belief in both the random walk theory and the predictive capabilities of valuation ratios could serve investors well.

## Limitations

This thesis has a narrow scope and application. The equities studied represent only the S&P 500 and the treasuries used are only the 10 year T-notes. Investors have hundreds of different equities, indices, corporate/government bonds, international equities, international bonds, derivatives and exotic investments etc. in their portfolio. It is important to note that the valuation ratios in this thesis predict broad market index performance and such predictive capabilities may or may not be present in a personal portfolio of selected equities.

By design the model itself accounts for the data multiple times. Basically, the market and bond performance for a single year is used 30 times to calculate the ending balances of portfolios starting in 30 different years. A market shock is not captured by just one portfolio but every portfolio active during that time period. Such lack of independence is inherent when using historical data and may skew the data.

## Conclusion

The American work ethic is truly unique and a pillar of American economic success. Many work hard to ensure a high standard of living for their families and themselves. 401(k)s, IRAs, 529 plan and other financial products have become pivotal in financial security for the average American. Unfortunately, the volatile nature of the market, coupled with the general lack of knowledge of finance, places the dream of financial security and independence in jeopardy.

Educated retirees make informed decisions on how to allocate their portfolio and what withdrawal rate to apply. But, this thesis has aimed to provide a few tools to predict the future of the equities market. By closely monitoring valuation ratios, such as the Shiller P/E and dividend yields, a retiree can choose to capture the gains of the market or annuitize to protect against poor future performance. Valuation ratios, most definitely, have predictive capability because they aim to capture the fundamental current and prospective worth of a firm. Further research and refinement could elucidate the abilities of valuation ratios. But, one thing is for certain, after a lifetime of working and saving, retirees have earned their piece of mind. Such peace of mind is impossible to guarantee and, at times, cannot be afforded to them, but a pursuit to secure this right is well worthwhile.

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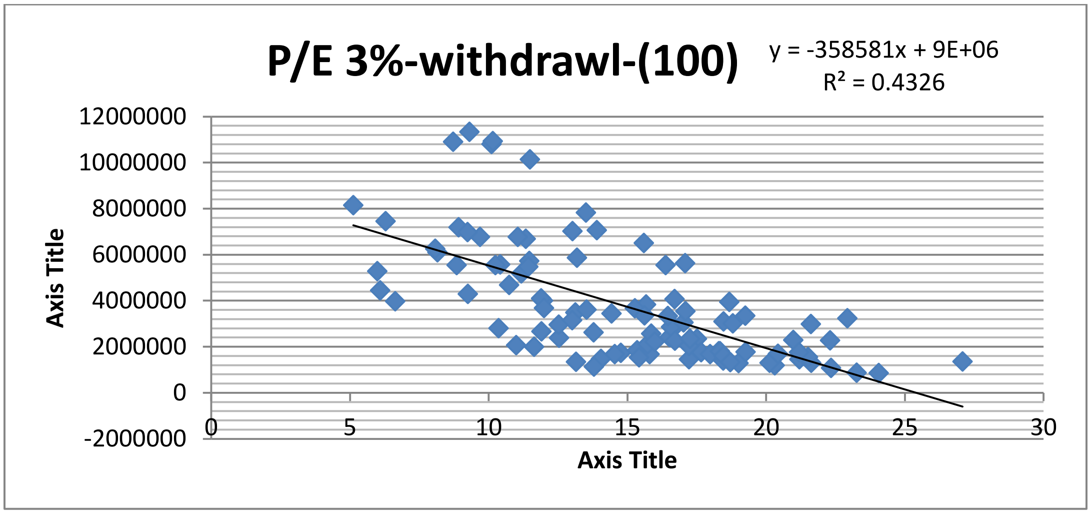
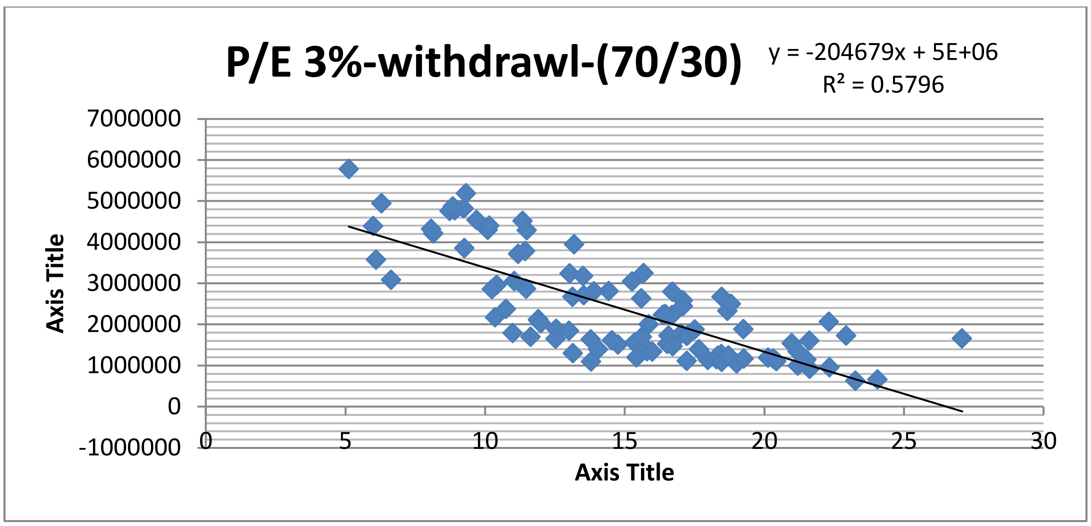
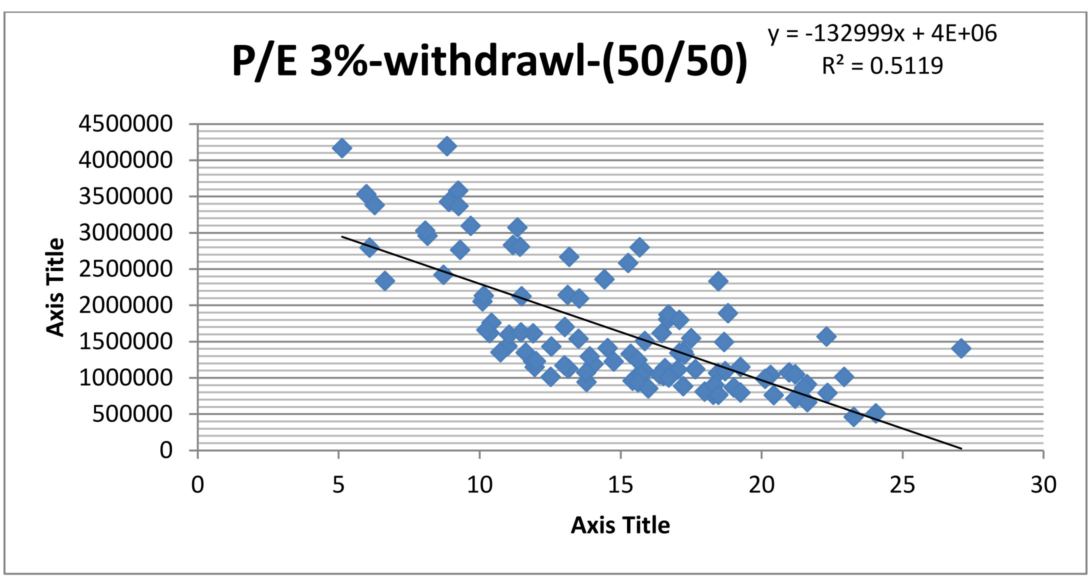
## Appendix i- Sample VBA Code

```
Sub EndingBalance45Bond()
For j = 0 To 109
bal = 1000000
withdr = 40000
For i = 4 To 33
bal = (bal - withdr) * (0.5 * (1 + Cells(i + j, 3)) + (0.5 * (1 + Cells(i + j, 2))))
Next i
Cells(j + 4, 13) = bal
Next j
End Sub

Sub EndingBalance55Bond()
For j = 0 To 109
bal = 1000000
withdr = 50000
For i = 4 To 33
bal = (bal - withdr) * (0.5 * (1 + Cells(i + j, 3)) + (0.5 * (1 + Cells(i + j, 2))))
Next i
Cells(j + 4, 14) = bal
Next j
End Sub

Sub EndingBalance35Bond()
For j = 0 To 109
bal = 1000000
withdr = 30000
For i = 4 To 33
bal = (bal - withdr) * (0.5 * (1 + Cells(i + j, 3)) + (0.5 * (1 + Cells(i + j, 2))))
Next i
Cells(j + 4, 15) = bal
Next j
End Sub
```

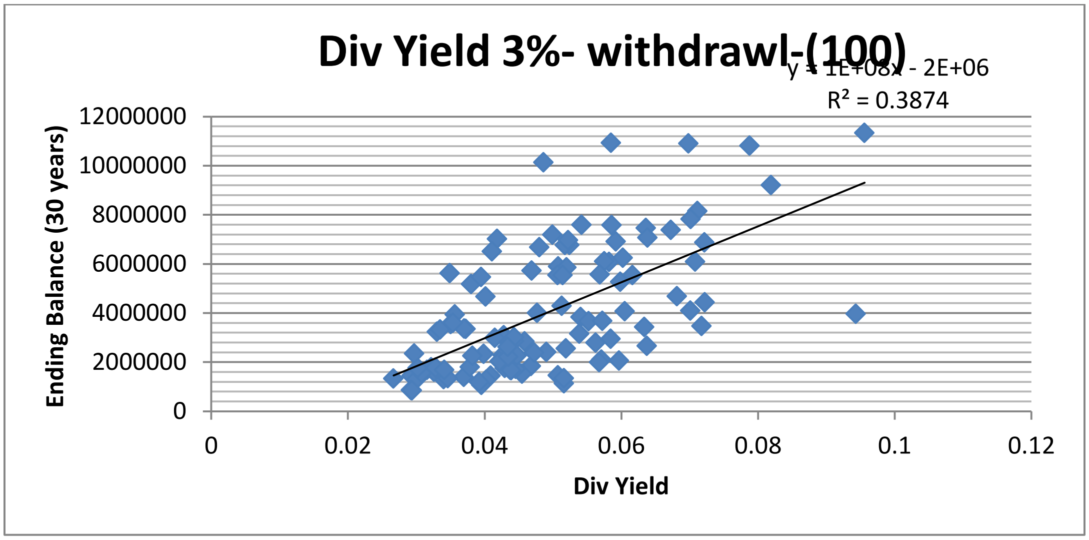
**Appendix ii- 3 % Withdrawal Rates Graphs-P/Es**

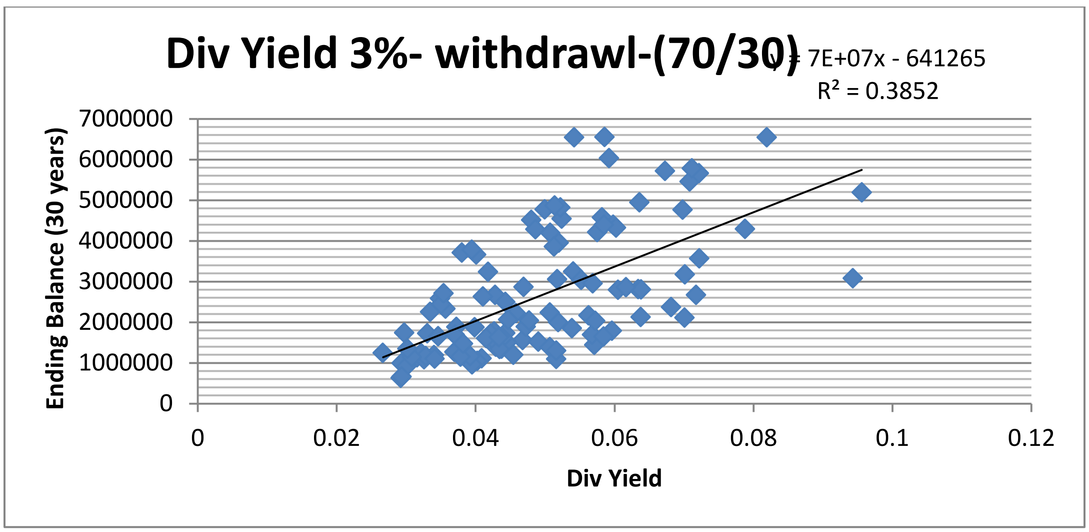


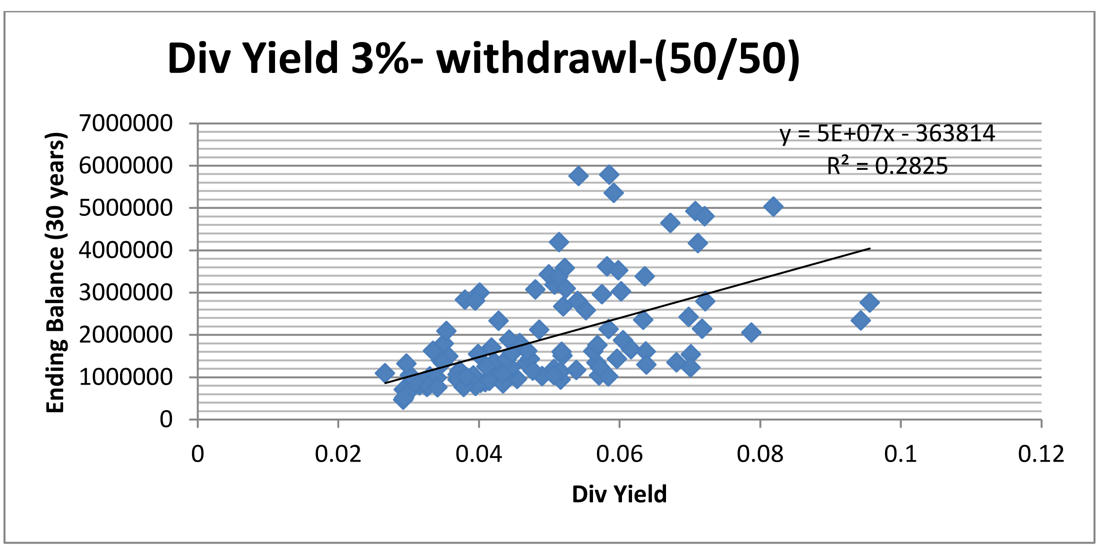



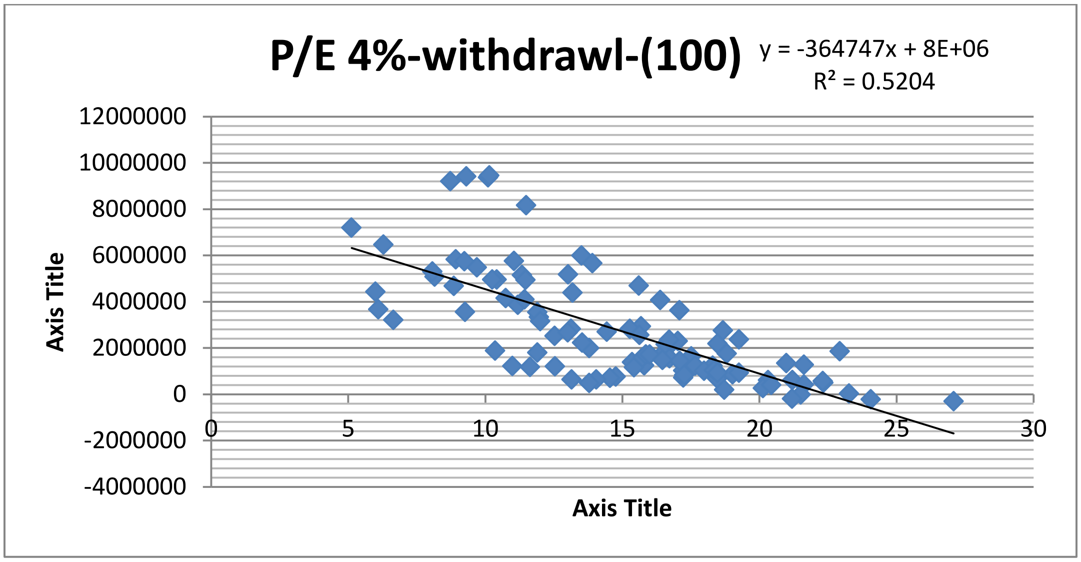
## Appendix iii- 3 % Withdrawal Rates Graphs- Dividend Yields

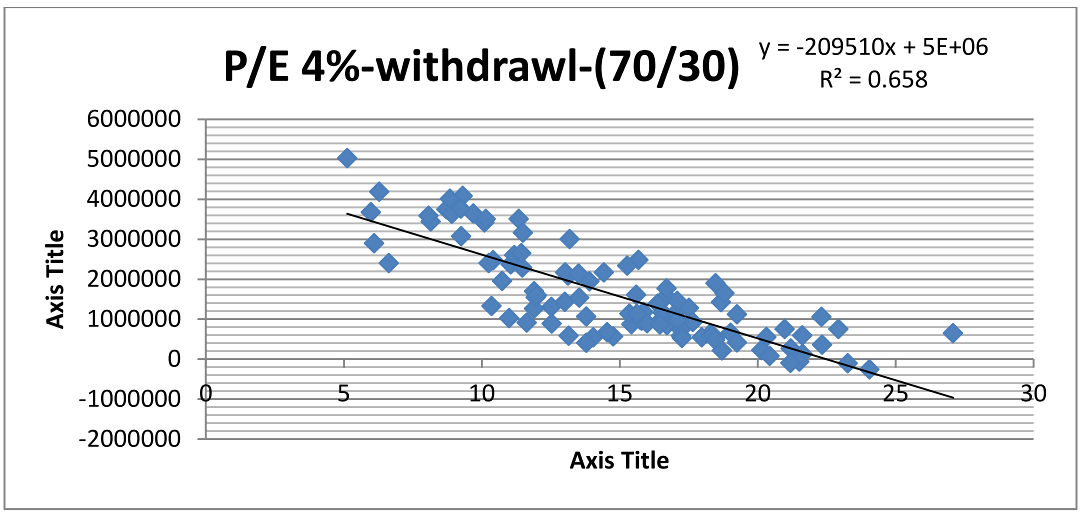


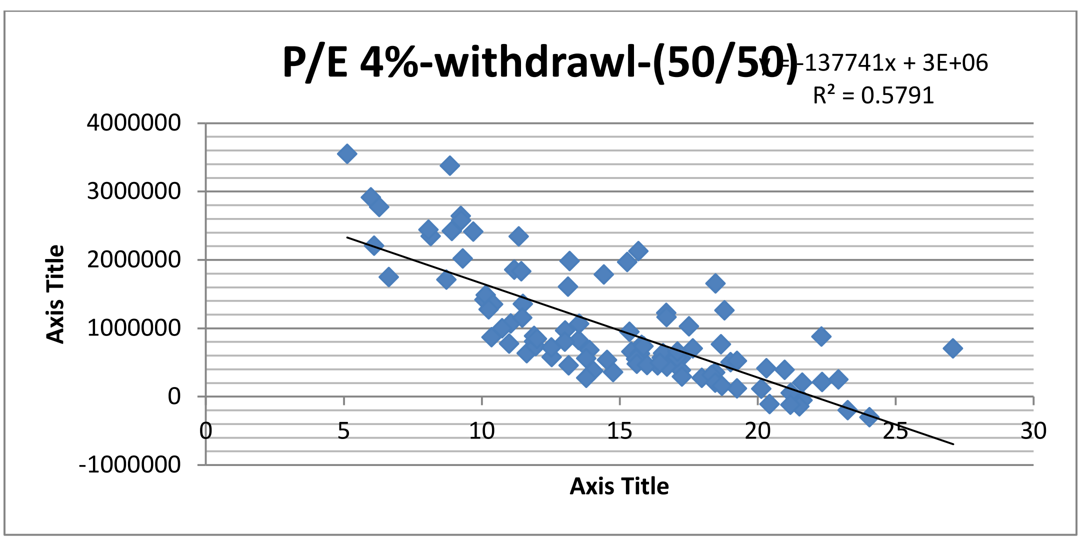



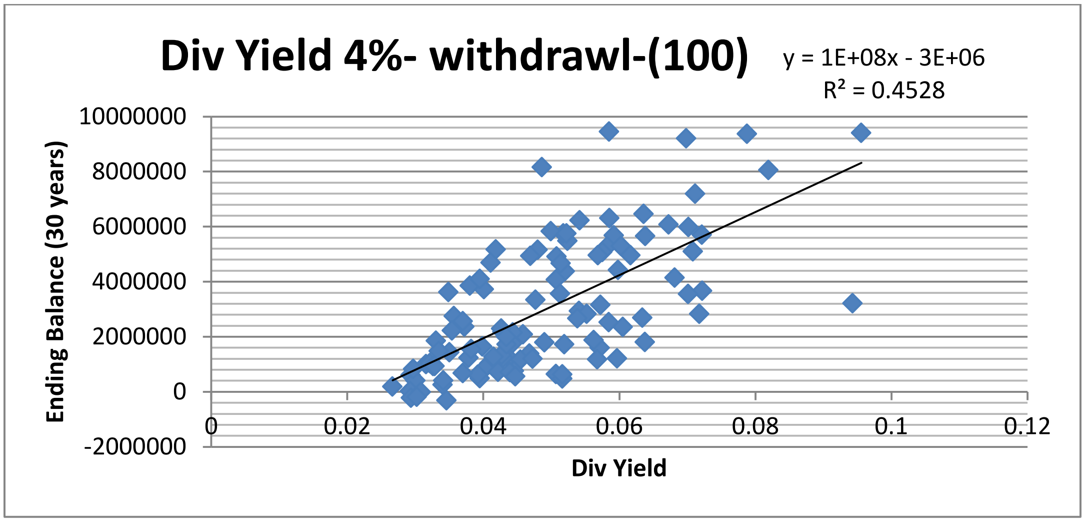
## Appendix iv- 4 % Withdrawal Rates Graphs-P/Es

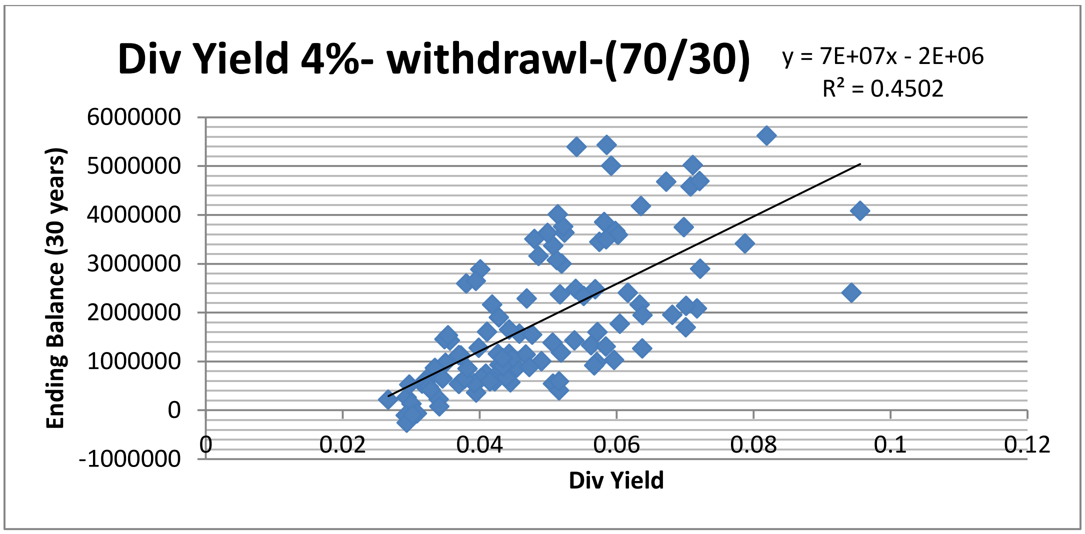


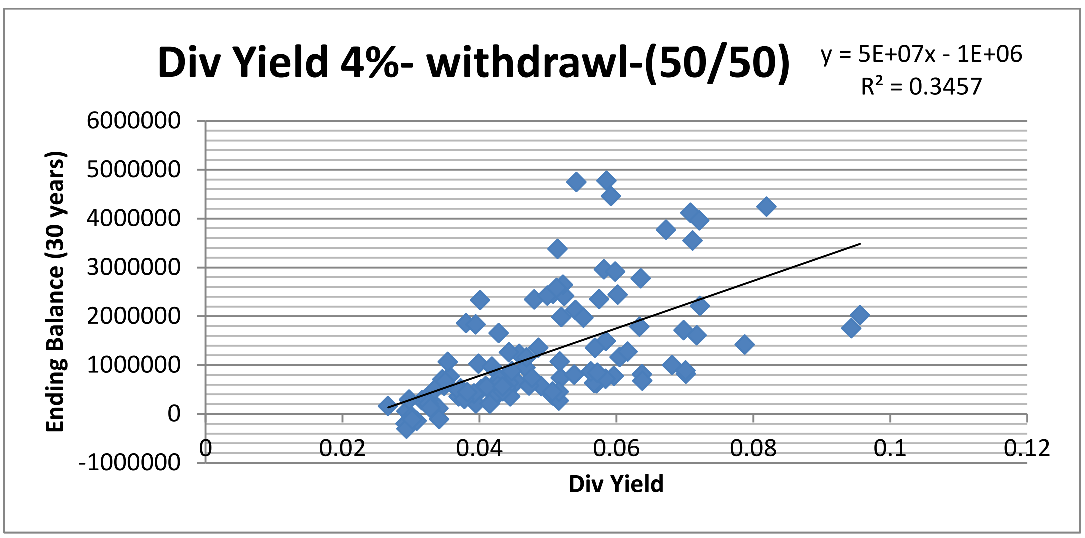



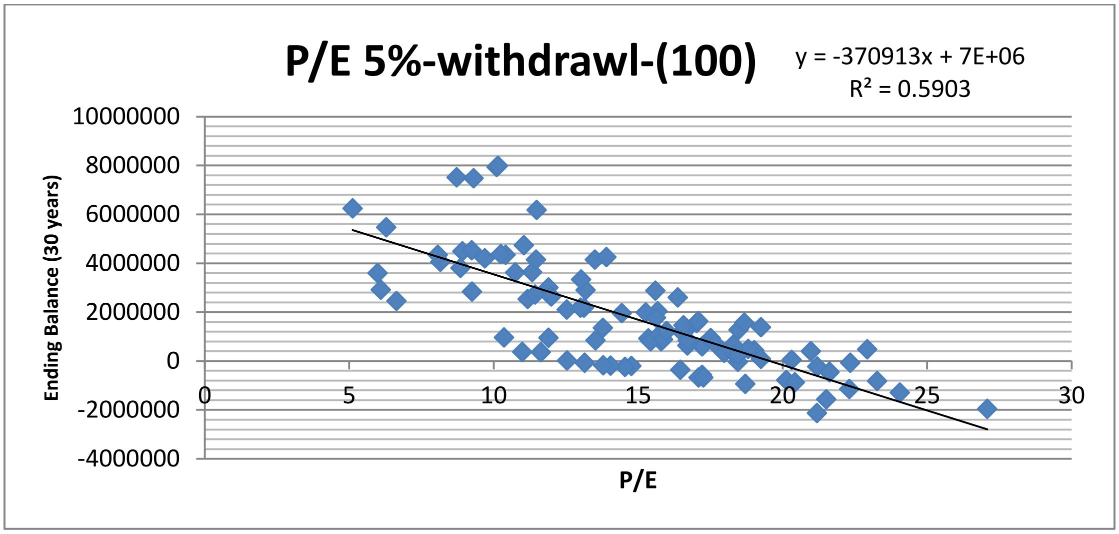
## Appendix v-4 % Withdrawal Rates Graphs-Dividend Yields

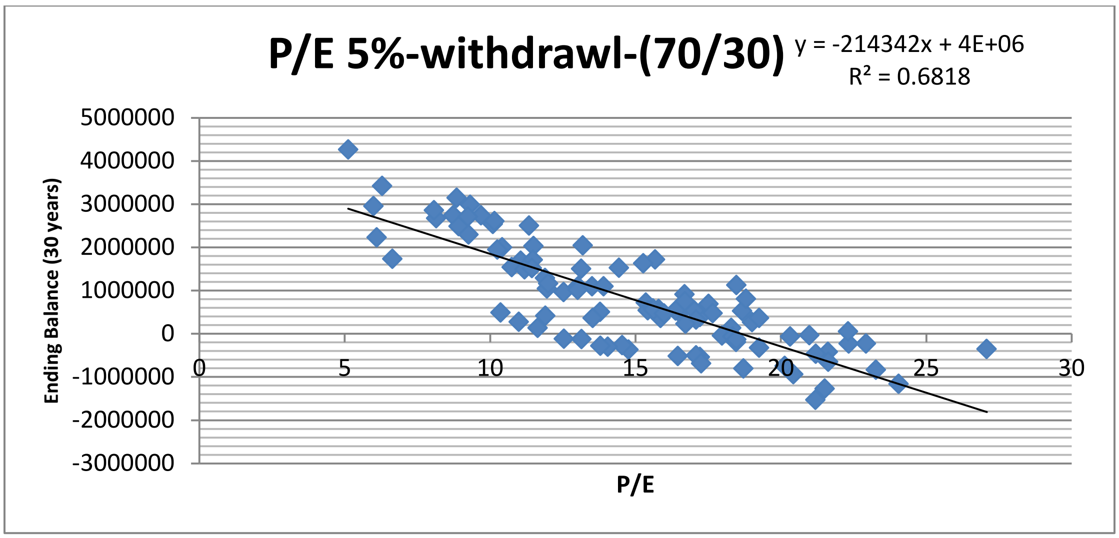


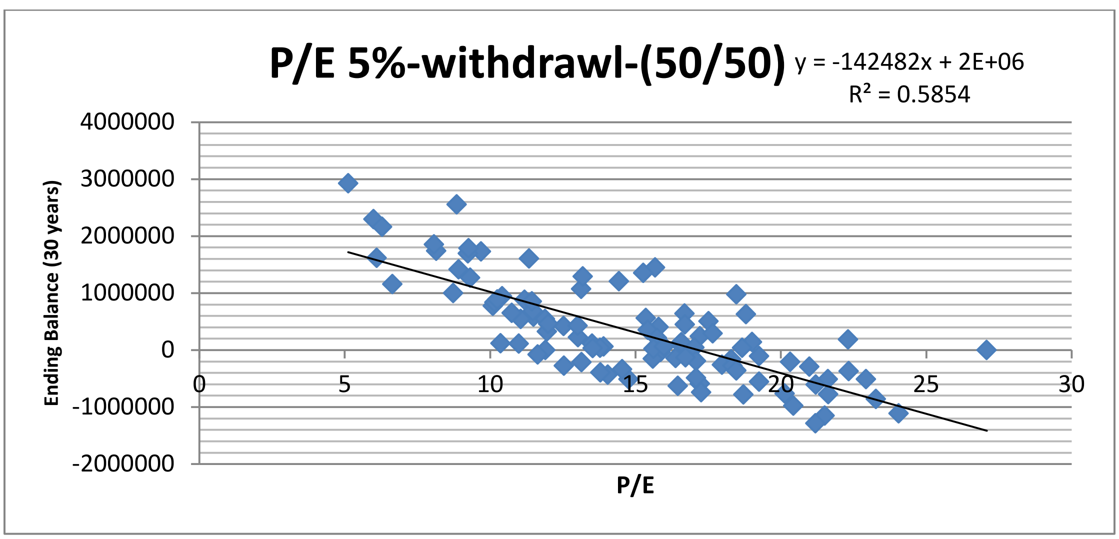



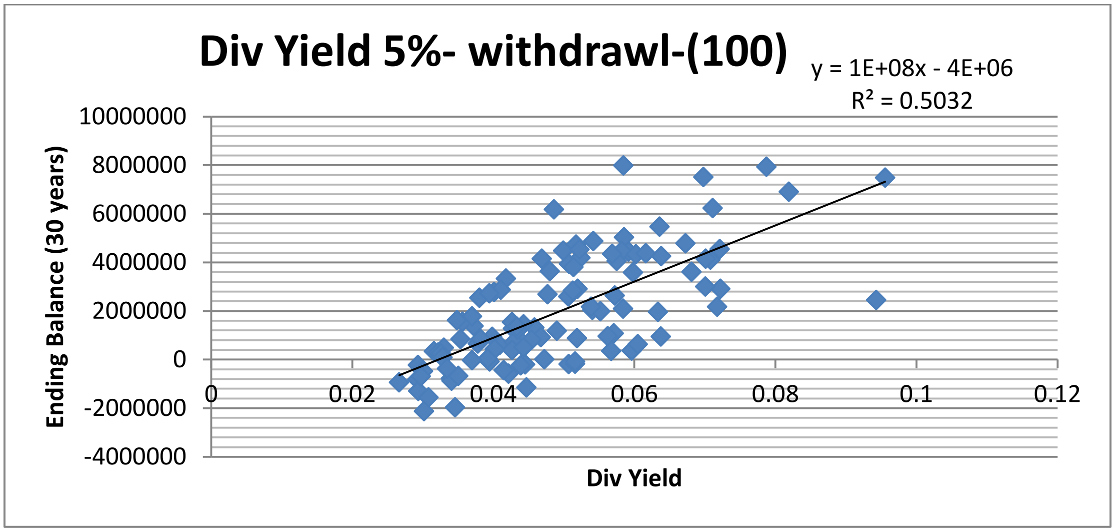
## Appendix vi- 5 % Withdrawal Rates Graphs-P/Es

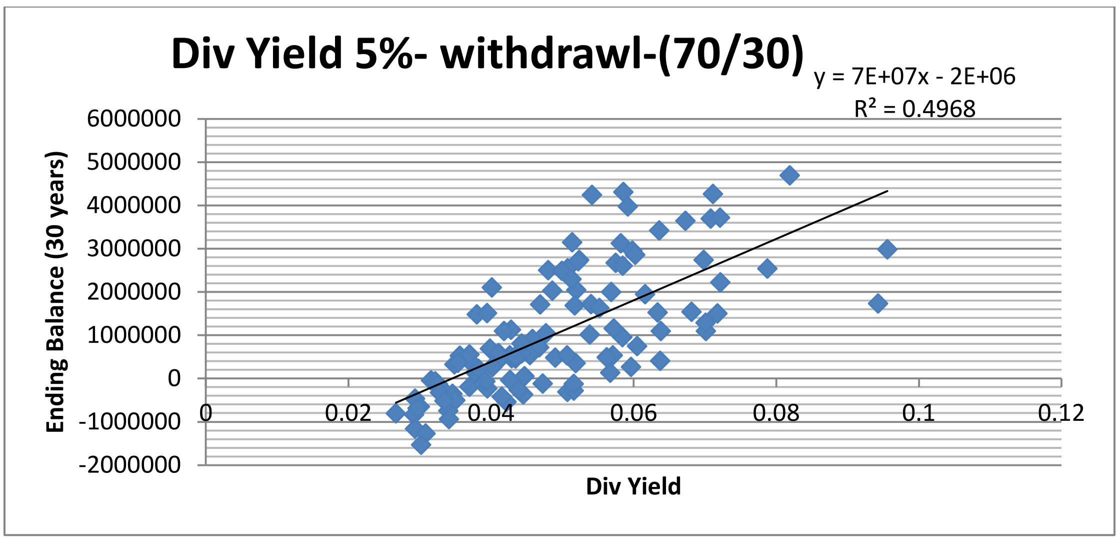


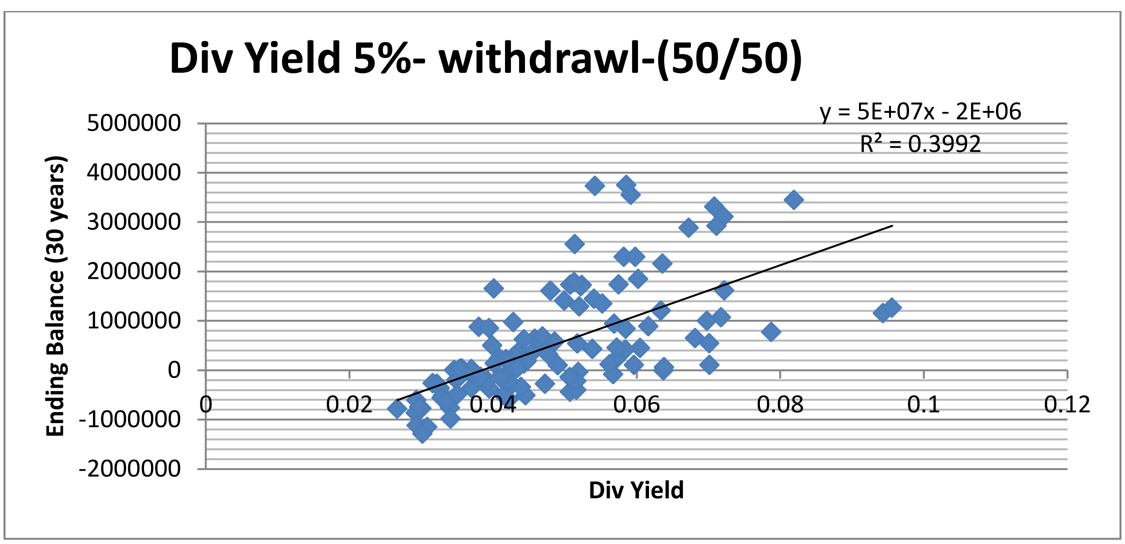



**Appendix vii= 5 % Withdrawal Rates Graphs-Dividend Yields**



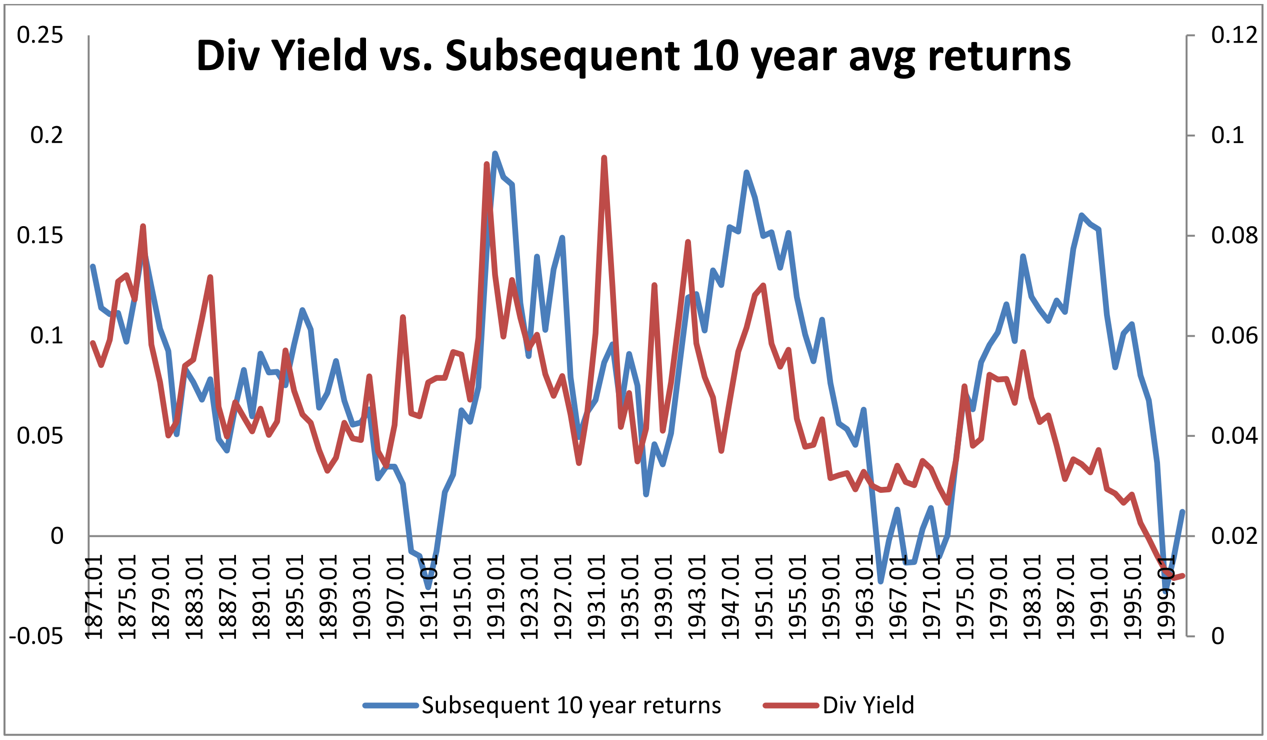



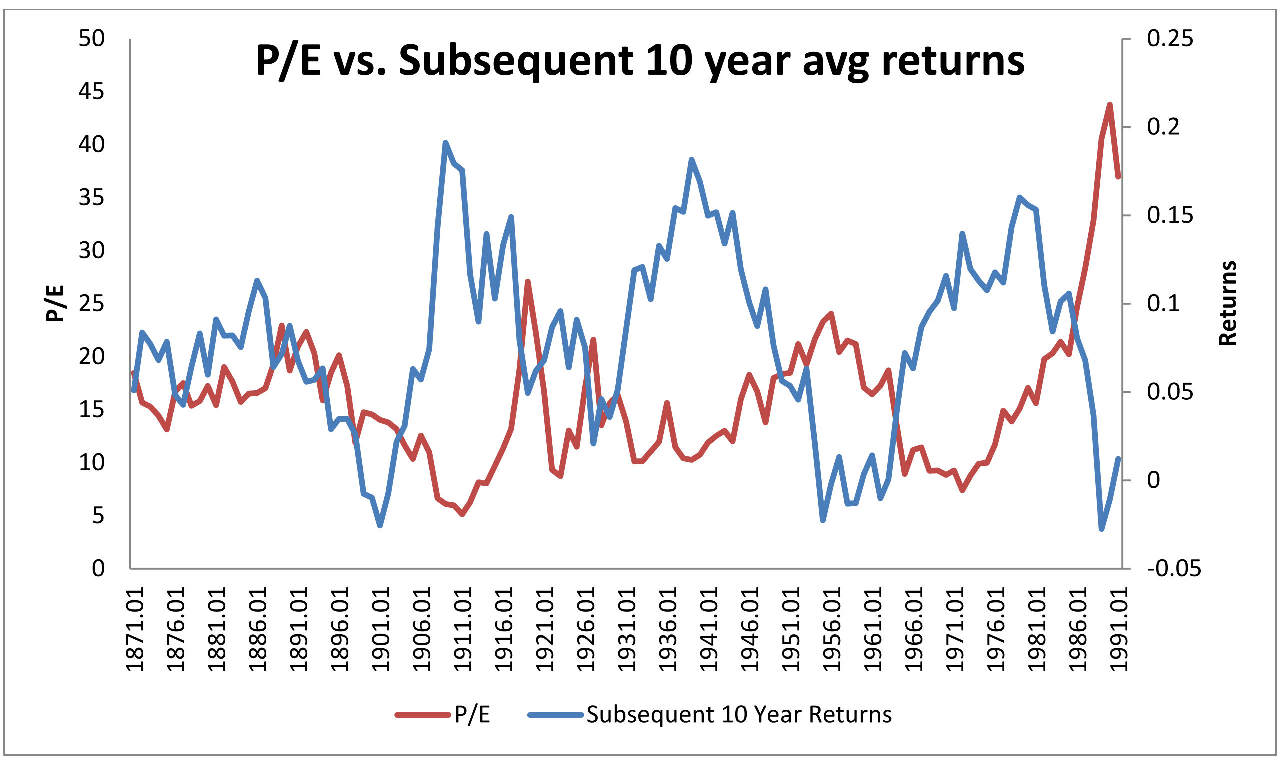



# Appendix viii- Sample of Data Set

| | 10-Year | Real | Subsequent | | | 100% Stocks | | | 70% Stocks, 30% Bonds | | | 50% Stocks, 50% Bonds | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Interest Rate GS10 | Market Return | Returns 10 year | Div Yield | P/E | Ending Balance(4%) | Ending Balance (5%) | Ending Balance (3%) | Ending Balance(4%) | Ending Balance (5%) | Ending Balance (3%) | Ending Balance(4%) | Ending Balance (5%) | Ending Balance (3%) |
| 1871.01 | 0.0346 | 0.13699 | 0.1345573 | 0.058559 | | 6307507.869 | 5035372.051 | 7579643.686 | 5429727.686 | 4308795.184 | 6550660.189 | 4766533.374 | 3752212.916 | 5780853.831 |
| 1872.01 | 0.0155 | 0.085311 | 0.11391375 | 0.054177 | | 6232648.935 | 4871822.214 | 7593475.657 | 5392152.049 | 4241202.238 | 6543101.86 | 4743884.591 | 3730554.816 | 5757214.365 |
| 1873.01 | 0.1125 | 0.017646 | 0.11074792 | 0.059198 | | 5678023.086 | 4437907.136 | 6918139.037 | 5003568.865 | 3972266.065 | 6034871.664 | 4452071.673 | 3553397.144 | 5350746.201 |
| 1874.01 | 0.1636 | 0.120274 | 0.11137466 | 0.070815 | | 5103589.75 | 4110726.262 | 6096453.238 | 4578573.954 | 3695616.621 | 5461531.287 | 4116142.446 | 3312536.937 | 4919747.955 |
| 1875.01 | 0.1521 | 0.113277 | 0.09706931 | 0.072137 | | 5710141.132 | 4540338.243 | 6879944.021 | 4687975.216 | 3714394.258 | 5661556.173 | 3955064.944 | 3108408.504 | 4801721.384 |
| 1876.01 | 0.0469 | -0.14183 | 0.11927064 | 0.067265 | | 6082003.032 | 4780707.242 | 7383298.823 | 4677122.646 | 3637317.773 | 5716927.519 | 3764082.071 | 2883681.386 | 4644482.756 |
| 1877.01 | 0.2479 | 0.157614 | 0.14528402 | 0.081915 | | 8057399.148 | 6902211.172 | 9212587.125 | 5618821.156 | 4689598.589 | 6548043.723 | 4239274.367 | 3447728.537 | 5030820.196 |
| 1878.01 | 0.1732 | 0.288969 | 0.12457026 | 0.058215 | | 5272742.203 | 4467362.391 | 6078122.015 | 3850050.638 | 3125844.347 | 4574256.93 | 2954567.757 | 2292629.352 | 3616506.162 |
| 1879.01 | -0.1242 | 0.234217 | 0.10365721 | 0.050754 | | 4917982.827 | 3938684.866 | 5897280.788 | 3370246.216 | 2541786.108 | 4198706.323 | 2456795.997 | 1731784.124 | 3181807.869 |
| 1880.01 | 0.1288 | 0.333108 | 0.09246646 | 0.040117 | | 3731518.785 | 2785768.657 | 4677268.913 | 2883286.839 | 2101542.037 | 3665031.641 | 2325122.054 | 1651366.949 | 2998877.159 |
| 1881.01 | -0.0349 | -0.06945 | 0.05091942 | 0.042811 | 18.47395 | 2182603.536 | 1273601.992 | 3091605.081 | 1898310.903 | 1126336.958 | 2670284.848 | 1652649.655 | 974508.2 | 2330791.109 |
| 1882.01 | 0.0552 | 0.053652 | 0.08368984 | 0.054054 | 15.67876 | 2938768.333 | 2038370.762 | 3839165.904 | 2481623.625 | 1715322.913 | 3247924.338 | 2123273.701 | 1448379.468 | 2798167.934 |
| 1883.01 | 0.1226 | 0.023913 | 0.0769887 | 0.055215 | 15.27026 | 2827354.818 | 1982357.9 | 3672351.737 | 2335647.28 | 1627887.594 | 3043406.967 | 1966046.453 | 1348626.106 | 2583466.799 |
| 1884.01 | 0.1638 | -0.02278 | 0.06805129 | 0.063378 | 14.43282 | 2697283.117 | 1957408.147 | 3437158.088 | 2164914.854 | 1521106.374 | 2808723.333 | 1780625.272 | 1204067.572 | 2357182.972 |
| 1885.01 | 0.0841 | 0.33529 | 0.07839225 | 0.071745 | 13.12982 | 2828298.643 | 2178013.826 | 3478583.459 | 2084859.97 | 1500161.833 | 2669558.108 | 1605051.383 | 1069346.209 | 2140756.558 |
| 1886.01 | 0.0223 | 0.118301 | 0.04841424 | 0.045827 | 16.69232 | 2082585.454 | 1314064.209 | 2851106.699 | 1565222.543 | 907117.8467 | 2223327.239 | 1222062.43 | 639069.2423 | 1805055.619 |
| 1887.01 | -0.0227 | -0.04952 | 0.04276853 | 0.039875 | 17.51222 | 1640638.427 | 940446.3923 | 2340830.461 | 1278410.012 | 684737.3193 | 1872082.705 | 1023321.428 | 500346.6286 | 1546296.228 |
| 1888.01 | 0.1036 | 0.079838 | 0.06430378 | 0.046761 | 15.35866 | 1385979.54 | 926831.6769 | 1845127.404 | 1138248.582 | 719759.4684 | 1556737.696 | 943002.0759 | 556569.2368 | 1329434.915 |
| 1889.01 | 0.0886 | 0.122309 | 0.0830326 | 0.04374 | 15.80229 | 1241437.95 | 802813.4312 | 1680062.469 | 956330.2138 | 567893.7947 | 1344766.633 | 751950.6966 | 399823.257 | 1104078.136 |
| 1890.01 | -0.0058 | -0.08236 | 0.05975704 | 0.040892 | 17.22007 | 1022289.594 | 592045.807 | 1452533.382 | 747314.7581 | 381894.6115 | 1112734.905 | 560398.2229 | 238186.754 | 882609.6918 |
| 1891.01 | 0.1051 | 0.258259 | 0.09111227 | 0.045455 | 15.42898 | 1170558.023 | 809472.3345 | 1531643.712 | 869298.5519 | 540848.7879 | 1197748.316 | 656639.7053 | 353533.1259 | 959746.2846 |
| 1892.01 | -0.0494 | -0.01336 | 0.08177802 | 0.040236 | 19.01639 | 856769.2371 | 433640.6777 | 1279897.797 | 658612.8189 | 268326.8991 | 1048898.739 | 499659.1831 | 135567.6099 | 863750.7564 |
| 1893.01 | 0.2004 | -0.06546 | 0.08200145 | 0.042923 | 17.65664 | 1233521.581 | 706038.3441 | 1761004.818 | 929498.102 | 468516.7222 | 1390479.482 | 703071.0006 | 288482.13 | 1117659.871 |
| 1894.01 | 0.1012 | 0.08063 | 0.07535669 | 0.057106 | 15.73987 | 1594480.792 | 1079771.147 | 2109190.437 | 985718.8691 | 531249.7907 | 1440187.948 | 625413.681 | 213173.4928 | 1037653.869 |
| 1895.01 | 0.0094 | 0.03551 | 0.09554563 | 0.049012 | 16.52444 | 1799501.584 | 1184334.096 | 2414669.073 | 999723.8406 | 476543.856 | 1522903.825 | 563723.83 | 101166.9793 | 1026280.681 |
| 1896.01 | 0.0822 | 0.061844 | 0.1129431 | 0.044309 | 16.57622 | 2157514.654 | 1452905.654 | 2862123.653 | 1151906.728 | 573449.7155 | 1730363.74 | 631521.3696 | 132342.0908 | 1130700.648 |
| 1897.01 | 0.0082 | 0.165829 | 0.10315097 | 0.042654 | 17.02652 | 2301821.294 | 1546735.586 | 3056907.001 | 1154804.701 | 533910.7942 | 1775698.608 | 578026.2468 | 41316.2549 | 1114736.239 |
| 1898.01 | 0.0380 | 0.267127 | 0.06412732 | 0.037234 | 19.249 | 2368295.742 | 1386793.68 | 3349797.804 | 1118817.626 | 358450.5638 | 1879184.688 | 520048.325 | -109772.517 | 1149869.167 |
| 1899.01 | -0.1214 | -0.11045 | 0.07148476 | 0.033026 | 22.93281 | 1856821.815 | 480951.1302 | 3232692.5 | 748240.5455 | -231669.3837 | 1728150.475 | 249712.2616 | -514030.398 | 1013454.921 |
| 1900.01 | 0.0609 | 0.23119 | 0.08750237 | 0.035656 | 18.67428 | 2753274.981 | 1558916.41 | 3947633.551 | 1426759.875 | 525928.716 | 2327591.033 | 763509.6979 | 33938.22657 | 1493081.169 |
| 1901.01 | 0.0001 | 0.164917 | 0.06760801 | 0.042673 | 20.97858 | 1340791.018 | 394890.3535 | 2286691.683 | 753369.4573 | -37000.49821 | 1543739.413 | 390399.1304 | -292858.921 | 1073657.181 |
| 1902.01 | -0.0673 | -0.01112 | 0.05571457 | 0.039507 | 22.34029 | 496023.233 | -79044.45813 | 1071090.924 | 362971.768 | -231635.9353 | 957579.4713 | 208311.6552 | -373003.813 | 789627.1237 |
| 1903.01 | 0.0725 | -0.13191 | 0.05682739 | 0.039208 | 20.31813 | 615617.6762 | 43375.73599 | 1187859.617 | 549018.439 | -70460.22901 | 1168497.107 | 411867.2411 | -212966.039 | 1036700.521 |
| 1904.01 | 0.0048 | 0.28252 | 0.06332797 | 0.051901 | 15.86183 | 1720427.442 | 880532.9438 | 2560321.941 | 1178157.042 | 357252.2771 | 1999061.808 | 733997.2207 | -35951.8986 | 1503946.34 |
| 1905.01 | 0.0386 | 0.209485 | 0.02887063 | 0.036975 | 18.45985 | 683825.2913 | -30869.51218 | 1398520.095 | 537407.1546 | -196893.024 | 1271707.333 | 352843.65 | -359456.781 | 1065144.081 |
| 1906.01 | -0.0275 | -0.03608 | 0.03474286 | 0.034022 | 20.1324 | 260090.6387 | -782524.2776 | 1302705.555 | 220924.4975 | -748343.6475 | 1190192.642 | 111034.528 | -764434.497 | 986503.5532 |
| 1907.01 | 0.0442 | -0.22441 | 0.03466914 | 0.042186 | 17.21891 | 728382.8485 | -575801.4198 | 2032567.117 | 587294.6601 | -544381.5384 | 1718970.859 | 383641.9524 | -591304.941 | 1358588.845 |
| 1908.01 | 0.0136 | 0.340701 | 0.02607405 | 0.063752 | 11.90297 | 1805296.034 | 949332.8932 | 2661259.176 | 1266601.274 | 409174.6342 | 2124027.915 | 803570.264 | -2514.13775 | 1609654.666 |
| 1909.01 | -0.0723 | 0.04973 | -0.00760644 | 0.044514 | 14.76442 | 763006.8576 | -198603.3259 | 1724617.041 | 569475.9028 | -369322.8464 | 1508274.652 | 356550.6119 | -511709.07 | 1224810.293 |
| 1910.01 | 0.1085 | 0.032247 | -0.00981381 | 0.043899 | 14.54789 | 713611.1796 | -244940.3651 | 1672162.724 | 670972.2949 | -268934.578 | 1610879.168 | 533680.8605 | -339405.769 | 1406767.49 |
| 1911.01 | 0.0484 | 0.045982 | -0.02556854 | 0.050701 | 14.04922 | 640803.8285 | -188275.1804 | 1469882.837 | 540554.8536 | -308258.0986 | 1389367.806 | 375725.7543 | -436230.113 | 1187681.622 |
| 1912.01 | -0.0605 | 3.47E-06 | -0.00749828 | 0.051623 | 13.79495 | 481428.4886 | -176383.1329 | 1139240.11 | 405036.7348 | -283015.9426 | 1093089.412 | 270093.3736 | -398474.15 | 938660.897 |
| 1913.01 | 0.0446 | -0.0669 | 0.02190202 | 0.051613 | 13.14809 | 633319.8157 | -79186.91712 | 1345826.549 | 587399.9687 | -124863.2294 | 1299663.167 | 455075.8826 | -216830.412 | 1126982.177 |
| 1914.01 | 0.0255 | -0.06205 | 0.03070733 | 0.05675 | 11.63609 | 1177367.523 | 353224.3962 | 2001510.65 | 914135.4156 | 131815.755 | 1696455.076 | 631831.0806 | -81397.1062 | 1345059.267 |
| 1915.01 | 0.0260 | 0.268207 | 0.06292605 | 0.056257 | 10.35983 | 1879050.775 | 959052.2287 | 2799049.321 | 1327039.08 | 485737.3126 | 2168340.848 | 866160.8475 | 117261.3548 | 1615060.34 |
| 1916.01 | -0.0869 | -0.03681 | 0.05705462 | 0.047245 | 12.54356 | 1199663.985 | 15371.26903 | 2383956.701 | 885965.4478 | -121686.7416 | 1893617.637 | 575128.9657 | -278345.446 | 1428603.377 |
| 1917.01 | -0.1495 | -0.31036 | 0.07430851 | 0.059645 | 10.99236 | 1217949.371 | 366819.3071 | 2069079.434 | 1027160.748 | 268596.553 | 1785724.942 | 771357.2394 | 108002.2516 | 1434712.227 |
| 1918.01 | -0.1084 | 0.003896 | 0.14322213 | 0.094313 | 6.640646 | 3212949.77 | 2452514.987 | 3973384.554 | 2403959.55 | 1728893.645 | 3079025.455 | 1746299.487 | 1156095.55 | 2336503.424 |
| 1919.01 | -0.1352 | 0.027656 | 0.19100517 | 0.072191 | 6.098468 | 3673732.734 | 2908596.948 | 4438868.521 | 2897077.911 | 2222992.839 | 3571162.983 | 2204851.308 | 1616981.518 | 2792721.098 |
| 1920.01 | 0.0576 | -0.1253 | 0.17925443 | 0.05983 | 5.989668 | 4430811.155 | 3588198.371 | 5273423.938 | 3671223.816 | 2951017.744 | 4391429.888 | 2911634.539 | 2294562.898 | 3528706.181 |
| 1921.01 | 0.2466 | 0.226685 | 0.17556283 | 0.071139 | 5.122184 | 7195481.694 | 6237879.121 | 8153084.266 | 5021138.185 | 4260828.597 | 5781447.773 | 3544644.281 | 2924208.832 | 4165079.73 |
| 1922.01 | 0.0448 | 0.294006 | 0.11646186 | 0.063589 | 6.287087 | 6461145.89 | 5464666.224 | 7457625.555 | 4182866.607 | 3420047.646 | 4945685.569 | 2770122.553 | 2160871.969 | 3379373.137 |
| 1923.01 | 0.0350 | 0.021151 | 0.08977833 | 0.057494 | 8.1542 | 5078152.063 | 4052364.989 | 6103939.137 | 3442725.579 | 2672605.909 | 4212845.249 | 2346201.131 | 1736926.694 | 2955475.568 |
| 1924.01 | 0.0556 | 0.260133 | 0.13948909 | 0.060215 | 8.072249 | 5297108.822 | 4338315.49 | 6255902.154 | 3587772.125 | 2855496.546 | 4320047.704 | 2437991.027 | 1849365.272 | 3026616.782 |
| 1925.01 | 0.0169 | 0.209493 | 0.10291383 | 0.052382 | 9.692619 | 5482586.376 | 4195308.043 | 6769864.71 | 3637797.828 | 2734841.739 | 4540753.917 | 2409882.218 | 1724500.971 | 3095263.466 |
| 1926.01 | 0.0872 | 0.135724 | 0.13322849 | 0.048024 | 11.34097 | 5154656.304 | 3629958.524 | 6679354.084 | 3507767.827 | 2502528.868 | 4513006.786 | 2339272.289 | 1605297.528 | 3073247.05 |
| 1927.01 | 0.0461 | 0.378777 | 0.14899972 | 0.051993 | 13.18593 | 4382714.484 | 2905699.918 | 5859729.05 | 2997669.418 | 2044260.379 | 3951078.457 | 1977698.097 | 1287754.418 | 2667641.776 |
| 1928.01 | 0.0247 | 0.481727 | 0.07934072 | 0.044307 | 18.80613 | 1756313.115 | 494980.3167 | 3017645.912 | 1649740.127 | 803021.8764 | 2496458.377 | 1256485.929 | 624339.9561 | 1888631.902 |
| 1929.01 | 0.0598 | -0.08985 | 0.04934966 | 0.034594 | 27.0832 | -306755.6329 | -1962649.582 | 1349138.316 | 649310.4775 | -356888.2695 | 1655509.225 | 701012.6823 | -1376.80454 | 1403402.169 |
| 1930.01 | 0.1067 | -0.16222 | 0.06190425 | 0.044717 | 22.31072 | 563842.9265 | -1142756.302 | 2270442.155 | 1056185.419 | 48654.55511 | 2063716.282 | 873984.714 | 181633.1273 | 1566336.301 |
| 1931.01 | 0.1205 | -0.36432 | 0.06794314 | 0.060494 | 16.70548 | 2351493.503 | 634998.0635 | 4067988.942 | 1771041.988 | 746588.7781 | 2795495.197 | 1159187.961 | 446869.3002 | 1871506.622 |
| 1932.01 | 0.1808 | 0.027171 | 0.08665271 | 0.095578 | 9.312406 | 9409377.419 | 7478206.124 | 11340548.72 | 4084289.806 | 2980417.379 | 5188162.232 | 2015479.928 | 1266574.089 | 2764385.766 |
| 1933.01 | 0.0240 | 0.518258 | 0.09584444 | 0.069817 | 8.728046 | 9210814.257 | 7512998.544 | 10908629.97 | 3747772.56 | 2734131.069 | 4761414.051 | 1708100.236 | 997568.3039 | 2418632.169 |
| 1934.01 | 0.0261 | -0.10562 | 0.06386378 | 0.041822 | 13.02512 | 5173391.426 | 3332020.52 | 7014762.332 | 2164882.228 | 1094615.173 | 3235149.282 | 961575.2629 | 223601.3925 | 1699549.133 |
| 1935.01 | 0.0239 | 0.512639 | 0.09096917 | 0.048596 | 11.49591 | 8161413.572 | 6181779.41 | 10141047.74 | 3156885.058 | 2027368.271 | 4286401.845 | 1350126.526 | 578489.6991 | 2121763.353 |
| 1936.01 | 0.0023 | 0.293437 | 0.07514461 | 0.034884 | 17.08736 | 3624447.513 | 1624928.782 | 5623966.244 | 1453620.164 | 323833.1664 | 2583407.161 | 572645.3212 | -196241.079 | 1341531.722 |
| 1937.01 | 0.0290 | -0.31781 | 0.02079538 | 0.041501 | 21.61874 | 1277568.081 | -434749.4058 | 2989885.567 | 592093.9063 | -419981.8252 | 1604169.638 | 199970.5656 | -511860.309 | 911801.4401 |
| 1938.01 | 0.0565 | 0.181816 | 0.04589236 | 0.070144 | 13.51146 | 5988947.796 | 4151467.419 | 7826428.173 | 2134046.665 | 1092617.518 | 3175475.813 | 821995.252 | 108147.9077 | 1535842.596 |
| 1939.01 | 0.0432 | 0.035695 | 0.0357979 | 0.041067 | 15.59963 | 4691518.661 | 2876397.693 | 6506639.628 | 1605587.214 | 582997.434 | 2628176.993 | 547352.1553 | -152296.941 | 1247001.252 |
| 1940.01 | 0.0286 | -0.10183 | 0.05127635 | 0.050677 | 16.37848 | 4074094.373 | 2601171.722 | 5547017.024 | 1383830.414 | 532151.933 | 2235508.895 | 452131.0784 | -142374.936 | 1046637.092 |
| 1941.01 | -0.1210 | -0.17723 | 0.08508452 | 0.063823 | 13.90416 | 5658764.783 | 4251578.099 | 7065951.468 | 1946807.529 | 1093197.736 | 2800417.322 | 677282.8853 | 60709.88537 | 1293855.885 |
| 1942.01 | -0.0489 | 0.119089 | 0.11903618 | 0.078761 | 10.10169 | 9373092.35 | 7935086.365 | 10811098.33 | 3416031.502 | 2536266.713 | 4295796.291 | 1412703.384 | 772799.7164 | 2052607.053 |
| 1943.01 | -0.0055 | 0.198452 | 0.12084981 | 0.058474 | 10.15053 | 9454475.005 | 7982413.371 | 10926536.64 | 3500994.465 | 2605555.277 | 4396433.653 | 1483916.217 | 835729.0386 | 2132103.394 |
| 1944.01 | 0.0104 | 0.165435 | 0.10257453 | 0.051758 | 11.05241 | 5752912.907 | 4732087.025 | 6773738.789 | 2370284.215 | 1685635.265 | 3054933.165 | 1067294.372 | 539410.6206 | 1595178.122 |
| 1945.01 | 0.0154 | 0.354394 | 0.13273437 | 0.04769 | 11.96046 | 3343112.983 | 2681273.154 | 4004952.812 | 1543927.679 | 1045039.978 | 2042815.38 | 734941.1233 | 320542.0363 | 1149340.21 |
| 1946.01 | -0.1390 | -0.25006 | 0.12531745 | 0.036996 | 15.62316 | 2567692.079 | 1772218.348 | 3363165.811 | 1125138.402 | 553210.9356 | 1697065.868 | 478406.8213 | 19251.95039 | 937561.6922 |
| 1947.01 | -0.0862 | -0.06684 | 0.15417991 | 0.046899 | 11.4693 | 4941486.803 | 4150834.079 | 5732139.528 | 2289347.948 | 1710383.032 | 2868312.865 | 1152094.991 | 680763.6014 | 1623426.381 |
| 1948.01 | 0.0219 | 0.080871 | 0.15199392 | 0.056867 | 10.41934 | 4962232.951 | 4347216.351 | 5577249.551 | 2476115.834 | 1995028.154 | 2957203.515 | 1347293.331 | 938227.8152 | 1756358.846 |
| 1949.01 | 0.0440 | 0.190479 | 0.18151764 | 0.061632 | 10.24829 | 4958402.293 | 4372814.257 | 5543990.329 | 2402112.667 | 1945234.174 | 2858991.161 | 1273619.649 | 886568.6132 | 1660670.684 |
| 1950.01 | -0.0717 | 0.236254 | 0.16895078 | 0.068128 | 10.74573 | 4151944.787 | 3615189.229 | 4688700.344 | 1953524.046 | 1536865.792 | 2370182.3 | 998662.372 | 647971.871 | 1349352.873 |
| 1951.01 | -0.0252 | 0.162287 | 0.14981791 | 0.070093 | 11.89576 | 3549052.788 | 3005750.848 | 4092354.729 | 1697017.168 | 1283666.05 | 2110368.285 | 885848.1406 | 543892.881 | 1227803.4 |

## Appendix ix- Subsequent 10 Year Average Returns



# Academic Vita

## Mohit Kudaravalli

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Permanent Address: 1104 Woodlawn Drive, Pittsburgh PA 15317

EDUCATION

**The Pennsylvania State University, Schreyer Honors College**
**Smeal College of Business** University Park, PA
Bachelor of Science in **Finance** May 2012
Honors Thesis: **Predicting Retirement Fund Performance**
**The Pennsylvania State University**, **College of Liberal Arts and Science**
Bachelor of Science in **Economics** May 2012
**University of Maastricht** Maastricht, Netherlands
Study Abroad**- Economics of European Integration** Summer 2011

EXPERIENCE

**Johnson & Johnson- McNeil Consumer & Specialty Pharmaceutical** Ft. Washington, PA
*Sarbanes-Oxley Compliance Co-op* June- December 2010

- Exclusive tester of a broad spectrum of internal controls across 16 SOX cycles ranging from Application Security and Segregation of Duties (APSOD) to Tax.
- Interacting and collaborating with employees (co-ops to CEOs) from different functions and companies to facilitate the proper gathering and testing of internal controls.
- Closely partnering with Corporate Internal Audit (CIA) and external auditors (PWC) to ensure a complete, thorough, and compliant audit.
- Maintaining, creating and delegating access to the McNeil Finance SharePoint and SOX controls.
- Optimizing companywide document control matrixes.
- Training current employees and new hires on compliance standard operating procedures.
- Creating training materials/courses for department wide bi-annual training.

**Kenya Agricultural Utility System** State College, PA
*BA 301 H Water Drill –Business Team Lead* Jan- May 2010

- Developed a Business Plan to be applied in Kenya.
- Conducting research and surveys to facilitate proper product development and delivery.
- Collaborating internationally with students from Moi University (JKUAT) in Nairobi Kenya.
- Producing informative and persuasive literature for prospective entrepreneurs and customers.

ACTIVITIES

**Beta Theta Pi** *–Brother/Member of Risk-Management Representative* 2009-Present

- Learning Beta Theta Pi lore and tradition, supporting fellow brothers, and maintaining high academic standards.
- Completing community service and numerous fraternal requirements.
- Mitigating risk and liabilities by establishing/enforcing safety policies, and educating brothers on protocol.

**Inter-Fraternal Council Judicial Board-** *Board Member* 2011- Present

- Initiating sanctions and corrective actions for fraternities that have violated IFC rules and regulations.
- Closely liaising with university leaders and fraternities to facilitate a fair and reasonable course of action.

**International Student Council**– *Treasurer* Present

- Responsible for all ISC finances ranging from sales, application for university funding to procurement for events.
- Directing and researching costs for all branches of the organizations. Created a new system of tracking costs and funding received.

SKILLS

Software: Microsoft Excel, SharePoint, Word, and Publisher. SAP, Ariba Buyer, Ariba Views, and HTML.