

Long-Run Returns for Retirement Portfolios: New Evidence.

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Introduction:

A USA Today article entitled “Investors Look Back on a Decade of *Grim* Stock Returns” (Wagonner, 2010) summed up investment returns for the first decade of the 21st century—grim. Our research shows the wealth relative for the DJIA was 0.92 for the period 2000-2009. The only other decade with a loss was from 1930-1939 with a wealth relative of 0.60. All other decades for the period of this study (1930-2010) had a positive return, a wealth relative greater than one. These grim results were nothing that most investors didn’t already ‘feel’. Certainly it was cause for numerous conversations amongst faculty at our university and I am confident at other universities as well. A more interesting question for us, with a retirement horizon of 5 to 10 years, is how this last decade affected retirement accounts and how these returns compare with prior decades. The purpose of this study will attempt to answer this question.

Literature Review, Methodology and Data:

The fundamental tenets of traditional retirement planning include disciplined and systematic savings over one’s working years and the deployment of those savings into investment vehicles that will expectedly grow with the underlying economy. In practice, retirement savers are often advised to emphasize domestic equities as a cornerstone of their investment portfolios. While it is a simple matter to observe historical returns on bullet investments held over any finite period, the relative returns accruing to a systematic savings and investment plan are less transparent. In this paper we examine the recent and longer-term performance histories of systematic savings and investment strategies that employ a broadly-based United States equities index.

Past studies have looked at this very question. (Levy, 1978), (Reichenstein, 1986), and (Butler K. C., 1991), used a single sum, not periodic contributions for various holding periods. They concluded that stocks outperform Treasury bills. (Butler & Domian, 1993) use Ibbotson’s real returns and sampling with replacement to form returns for various retirement holding periods from 1926 to 1990. They conclude that the stock market is the better choice for long-term retirement investing. A clever paper by (Hickman, Hunter, Byrd, Beck, & Terpening, 2001) uses a sample with replacement technique to examine the difference in returns between different retirement asset classes for the period. Unlike Butler and Dominan’s work their data isn’t inflation adjusted. They find huge penalties for not being in risky assets (common stocks) for long investment horizons. They do find marginal support for several switching strategies for investors with shorter investment horizons.

Decade long wealth relatives (decade ending price level/ decade beginning price level) were calculated for all decades, starting in 1930 (1930-1939) through 2001 (2000-2010). Wealth relatives for the period 1929/1928; for 2010; and the 1928 through 2010 were also calculated. The purpose of these calculations was to estimate bullet investments.

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Besides single sum wealth relatives we calculated wealth relatives for investors who make payments into a retirement plan yearly. Our hypothetical investor is assumed to be a wage earner who contributes a fixed proportion of salary, which is indexed for inflation, each year over a retirement savings period. The Consumer Price Index (CPI-U) serves as the retirement plan contribution inflator. The plan contributions are then invested in an equities market index fund with the Dow Jones Industrial Average (DJIA) serving as the investment proxy. For a five year savings period the calculation would be:

$$\begin{aligned}
 & \$1.00_{-5}(R_{-5t0-4})(R_{-4t0-3})(R_{-3t0-2})(R_{-2t0-1})(R_{-1t00}) \\
 & + \$1.00_{-5}(I_{-5t0-4})(R_{-4t0-3})(R_{-3t0-2})(R_{-2t0-1})(R_{-1t00}) \\
 & + \mathbf{\$1.00_{-5}(I_{-5t0-4})(I_{-4t0-3})(R_{-3t0-2})(R_{-2t0-1})(R_{-1t00})} \\
 & + \$1.00_{-5}(I_{-5t0-4})(I_{-4t0-3})(I_{-3t0-2})(R_{-2t0-1})(R_{-1t00}) \\
 & + \$1.00_{-5}(I_{-5t0-4})(I_{-4t0-3})(I_{-3t0-2})(I_{-2t0-1})(R_{-1t00})
 \end{aligned}$$

Where R is $1+r$, I is $1+i$, r is the return for the year in question and i is the inflation rate from the prior year. The subscripts for R and I represent the time period relative to the end of the holding period. The future value ‘Due’ situation is assumed—investing starts at the beginning of the period, and no cash-flow at the end of the holding period. One of the assumptions that differentiate this project from (Butler & Domian, 1993) is that the inflation adjustment for the invested amount is the prior year’s inflation. The reasoning is that pay increases are based on the last period’s inflation.

If \$1.00 is the initial annual contribution, this yearly installment will be indexed up or down as price levels change. The indexed installment will be invested at the then current equity market level and the resultant portfolio value will subsequently reflect both market performance and the saver’s wage level assuming the wages are indexed to inflation (with a lag of one year). Savings and investment periods of 5, 10, 15, 20, 25, 30, 35 and 40 years are evaluated for participants who start saving in 1930 and all following years. \$1.00 was used so that results will be for every dollar invested.

These results based on actual, not simulated, returns. The holding periods are started for EVERY year between 1930 through 2006. So every holding period overlaps the one next to it. For example, the 1930 forty year holding period overlaps the 1931 forty year holding period by 39 years. Likewise the 1931 forty year holding period overlaps the 1930 and 1932 forty year holding period by 39 years, etc. We recognize the fact that summary statistics will be biased, but we were interested in how a pensioner would have fared investing for retirement, assuming various holding periods and a salary contribution adjustment based on inflation. Thus the results will show this for all various holding periods beginning in 1930.

The data used were closing prices (to calculate yearly returns) for the DOW 30 and T-Bill returns. These data were obtained from yahoo finance and Ibbotson’s annual yearbooks. We also looked at a switching portfolio where the stock portfolio was shifted to T- bills 5 years before retirement. The purpose for this portfolio is to examine if there is merit in shifting from risky to safe assets as one approaches retirement.

Results:

Table 1 report wealth relatives by decade for the study period 1929 through 2010, calculated from the DJIA. These are monthly returns statistics. These statistics show that the first decade of the 21st century was the second worst decade for investing, surpassed only by the decade of the great worldwide depression. This fact will affect the holding period returns for the various retirement saving horizons starting in the 1960’s. There are some other periods throughout the years of this study that have negatively affect retirement results.

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Table 1

Summary Statistics for monthly returns by decade unless otherwise specified											
The wealth relative is the closing price divided by the opening price for the decade unless otherwise indicated											
	2010 - 1928	2010 2010	2000 - 2009	1990- 1999	1980- 1989	1970- 1979	1960- 1969	1950- 1959	1940- 1949	1930- 1939	Nov 1928- 1929
WR=	39.46	1.11	0.92	4.18	3.28	1.05	1.18	3.39	1.34	0.60	0.99
Mean	0.52%	0.99%	0.02%	1.28%	1.11%	0.14%	0.20%	1.08%	0.33%	0.09%	0.38%
Std Error	0.17%	0.014	0.41%	0.36%	0.43%	0.42%	0.33%	0.30%	0.38%	0.93%	2.67%
Median	0.85%	0.020	0.28%	1.61%	0.89%	0.10%	0.45%	1.29%	0.72%	0.90%	2.82%
St Dev	5.36%	4.96%	4.51%	3.98%	4.72%	4.60%	3.62%	3.29%	4.11%	10.16%	9.99%
Sample Var	0.00	0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Kurtosis	6.65	-1.019	0.83	2.00	5.26	1.15	0.09	-0.28	5.78	2.02	0.03
Skewness	-0.15	-0.334	-0.49	-0.73	-0.89	0.17	-0.24	-0.27	-1.49	0.29	-0.54
Range	0.66	0.154	0.25	0.25	0.37	0.28	0.19	0.17	0.29	0.66	0.37
Minimum	-30.70%	-7.92%	-14.06%	-15.13%	-23.22%	-14.04%	-8.49%	-7.38%	-21.70%	-30.70%	-20.36%
Maximum	35.76%	7.45%	10.60%	10.25%	13.82%	14.41%	10.09%	9.83%	7.39%	35.76%	16.35%
Sum	5.05	0.119	0.03	1.53	1.33	0.17	0.24	1.29	0.40	0.11	0.05
Count	986	12	120	120	120	120	120	120	120	120	14
%pos	57.91%	58.33%	53.33%	68.33%	55.83%	50.83%	56.67%	64.17%	58.33%	55.83%	57.14%

*The wealth relative is not a monthly calculation but simply the decade closing price divided by the decade opening price. The data in the rest of the table are summary statistics for monthly returns.

Table 2a gives the summary statistics of retirement period wealth relatives generated by increasing each year's nominal contribution rate by the CPI-U (lagged one year) and investing in the 'market' as defined by the Dow 30. There are no holding period horizons where you 'lose it all.' However when you get to the 10 year horizons you do wind up with less than if you had taken your contributions and put them in a safety deposit box. The years where this happens is if you started your contributions in 1960, 1964, 1965, 1968, 1969, 1972, 1999, and 2000. The same is true for the 5 year horizons. The years where this happens are 1930, 1936, 1937, 1938, 1964, 1965, 1969, 1970, 1973, 1977, 1998, 2004, and 2005.

Table 2a

Summary Statistics for various Retirement Saving Period Wealth Relatives from 1930-2010								
It is assumed that the yearly savings is increased by the CPI-U and the yearly return on the market								
	Retirement Saving Periods							
	40	35	30	25	20	15	10	5
Mean	701.14	467.87	293.57	166.76	86.55	41.66	18.56	6.70
Std Error	74.25	51.35	31.16	16.04	6.78	2.39	0.79	0.17
Median	461.28	273.99	206.81	140.09	80.48	37.88	17.08	6.57
St Deviation	481.17	352.03	224.69	121.10	53.38	19.58	6.72	1.49
Sample Var	231526	123926	50486	14666	2849	383.53	45.13	2.23
Kurtosis	-1.10	-0.55	0.51	1.62	0.96	-1.11	-0.71	-0.36
Skewness	0.73	0.99	1.25	1.45	1.17	0.48	0.57	0.33
Range	1430.72	1114.26	841.43	483.07	209.09	64.57	25.52	6.59
Minimum	208.84	133.29	65.04	40.36	24.92	15.34	8.54	3.73
Maximum	1639.56	1247.55	906.47	523.43	234.02	79.92	34.06	10.32
Sum	29448	21990	15266	9505	5366.03	2791	1336	516
Count	42	47	52	57	62	67	72	77

These Wealth Relatives are combined-- inflation and Dow 30 returns.

Table 2b gives the summary statistics of retirement period wealth relatives generated by increasing each year's nominal contribution rate by the CPI-U and investing in the 'market' as defined by T-Bills. Unlike

the Dow portfolios summarized above, there is no holding period horizon where you ‘lose it all.’ There are also no periods where you didn’t get at least a return of the inflated retirement contributions. As can be seen you do sacrifice the potential for much larger gains in your retirement account.

Table 2b

Summary Statistics for various Retirement Saving Period Wealth Relatives from 1930-2010								
It is assumed that the yearly savings is increased by the CPI-U and the yearly return on the market								
	Retirement Saving Periods							
	40	35	30	25	20	15	10	5
Mean	449.30	284.58	173.13	101.05	57.2165059	30.96	15.43	6.05
Std Error	30.44	20.45	12.70	7.24	3.65191919	1.57	0.52	0.10
Median	487.75	280.40	154.36	72.96	44.18672	25.32	13.97	5.85
St Deviation	197.25	140.22	91.60	54.70	28.7552404	12.84	4.41	0.86
Sample Var	38908.46	19662.58	8390	2992	827	164.81	19.42	0.74
Kurtosis	-1.17	-1.38	-1.39	-1.14	-0.64	0.00	0.81	1.73
Skewness	-0.42	-0.01	0.31	0.61	0.88	1.09	1.18	1.08
Range	611.31	446.91	279.14	173.15	94.98	46.81	18.33	4.33
Minimum	91.07	59.59	41.99	29.10	19.70	13.18	8.57	4.36
Maximum	702.39	506.50	321.13	202.25	114.68	59.99	26.90	8.68
Sum	18870.68	13375.42	9002.91	5760	3547.42	2074	1111	466
Count	42	47	52	57	62	67	72	77

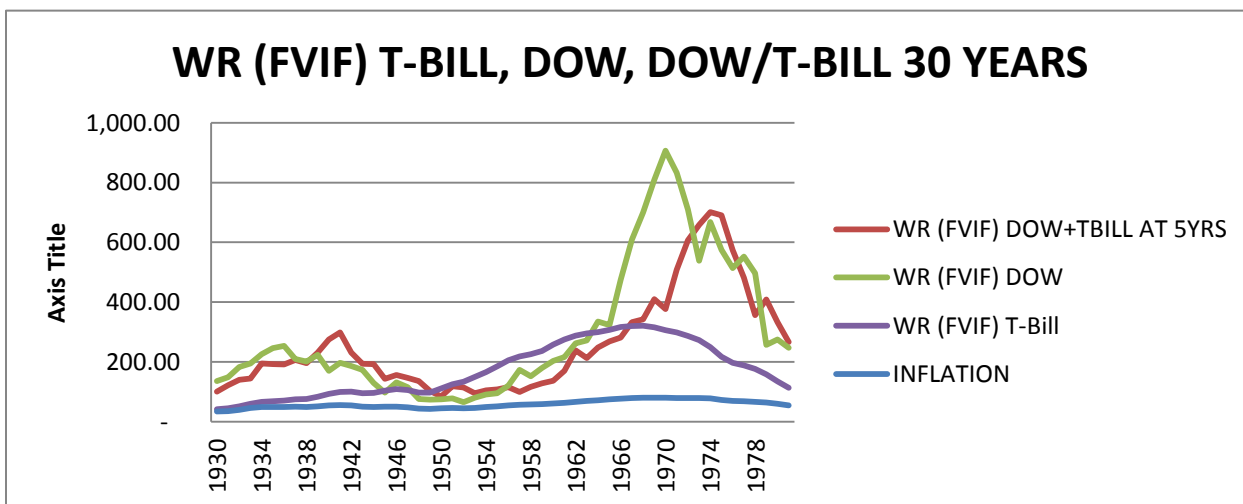
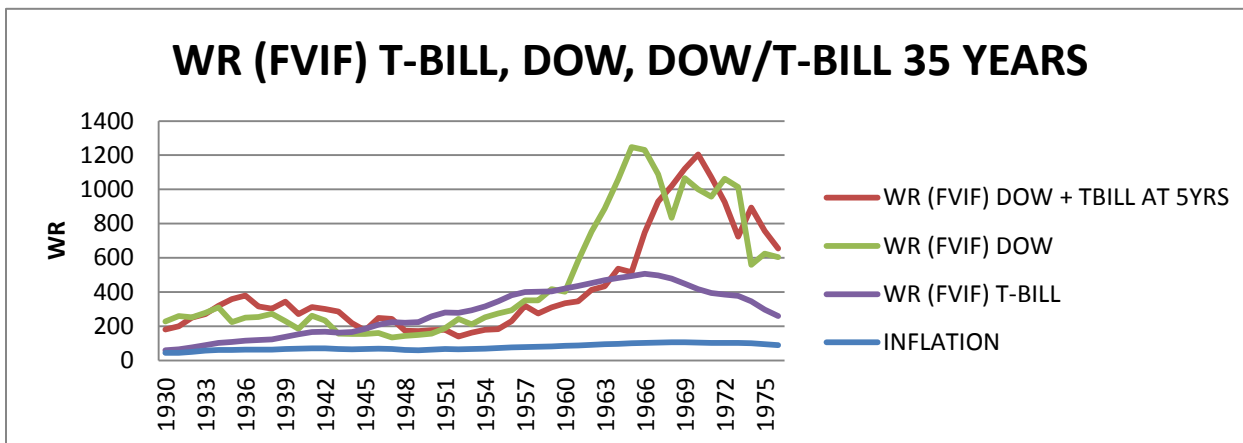
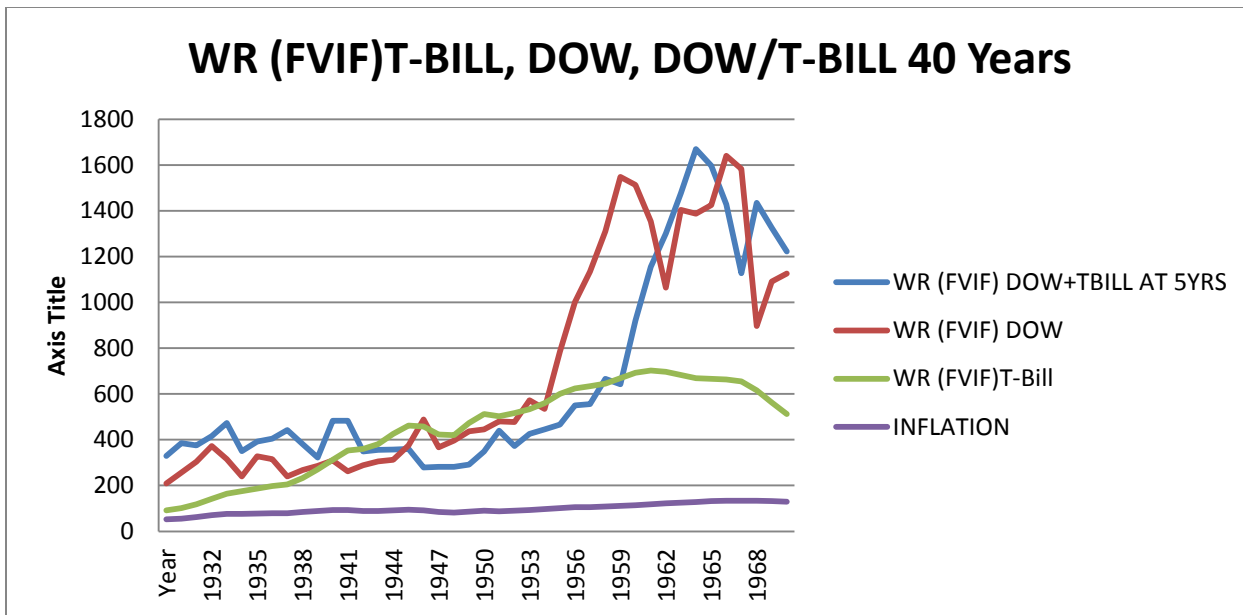
These Wealth Relatives are combined-- inflation and T-Bill returns.

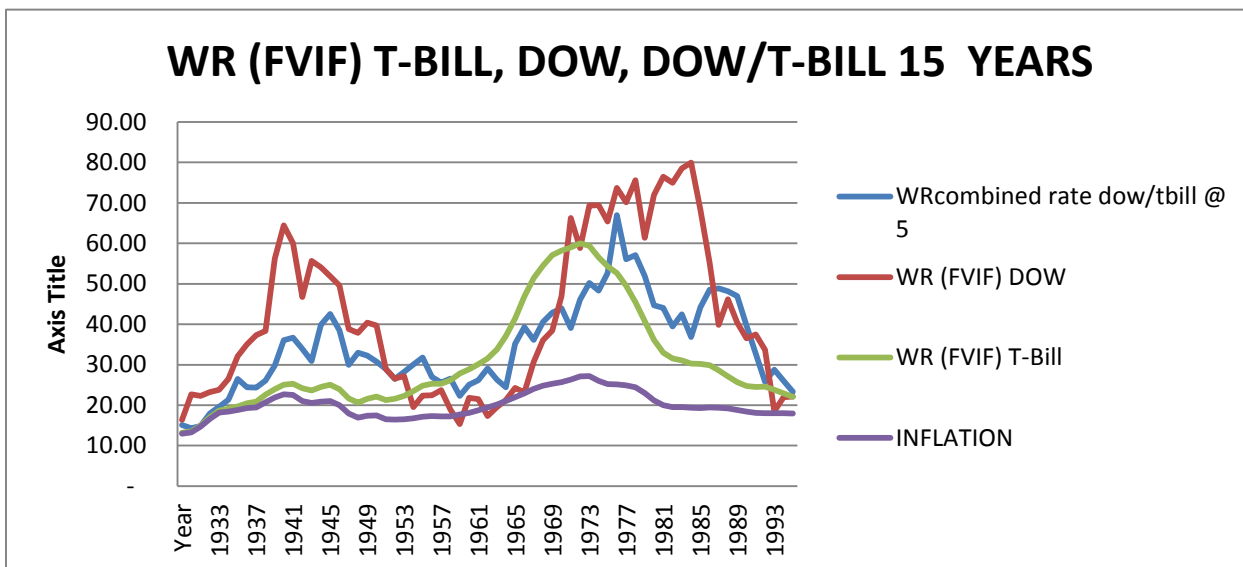
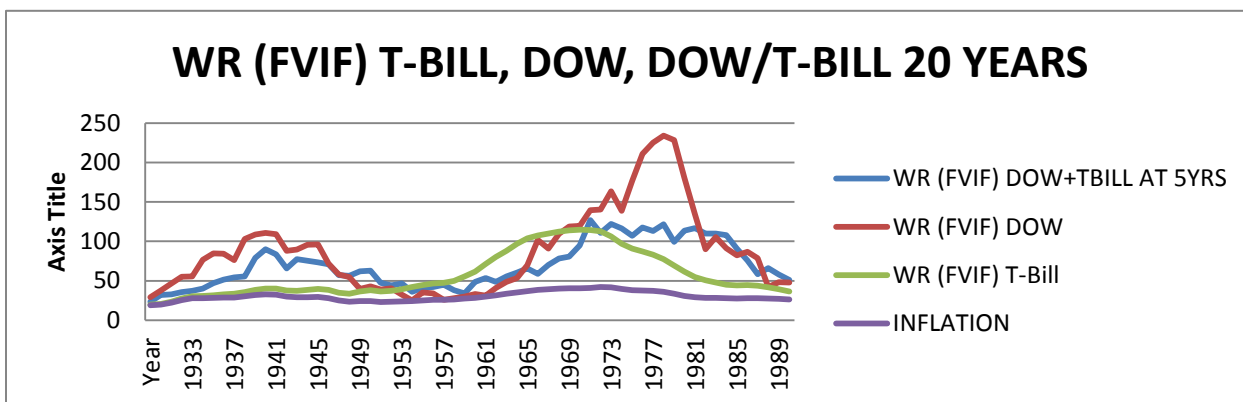
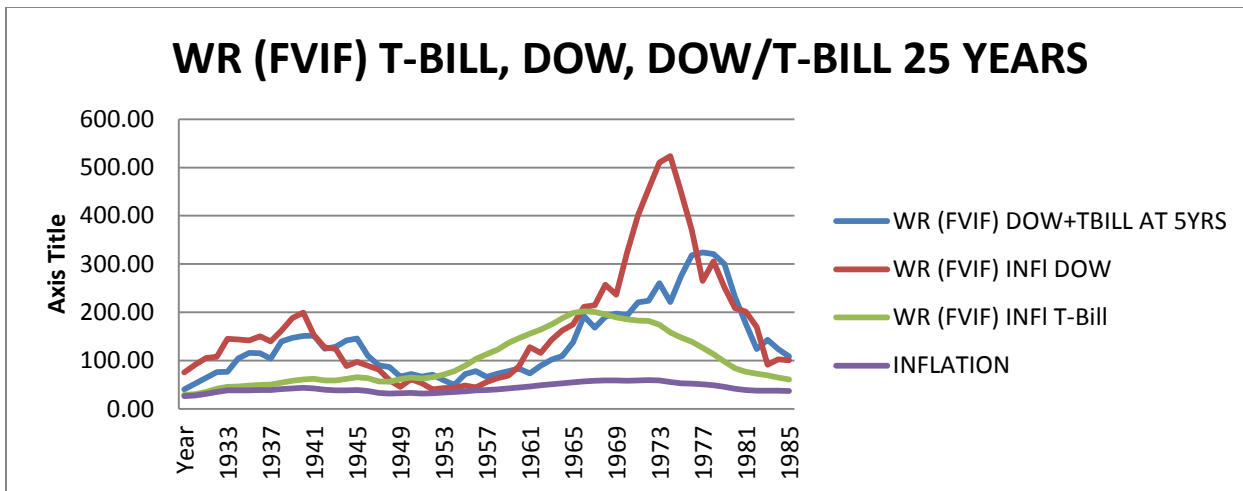
Table 2c gives the summary statistics of retirement period wealth relatives generated by increasing each year’s nominal contribution rate by the CPI-U and investing in the ‘market’ as defined by the Dow30, but switching the entire portfolio at the beginning of the remaining five years. Like the Dow portfolios summarized above, there are periods where you didn’t get at least a return of the inflated retirement contributions, but there are far fewer instances of this. This happens only twice. Both times was for a 10 year investment horizon where you started saving in 1936 and 1937. For this additional safety you do sacrifice the potential for much larger gains in your retirement account, but not as much if you only invested in T-Bills.

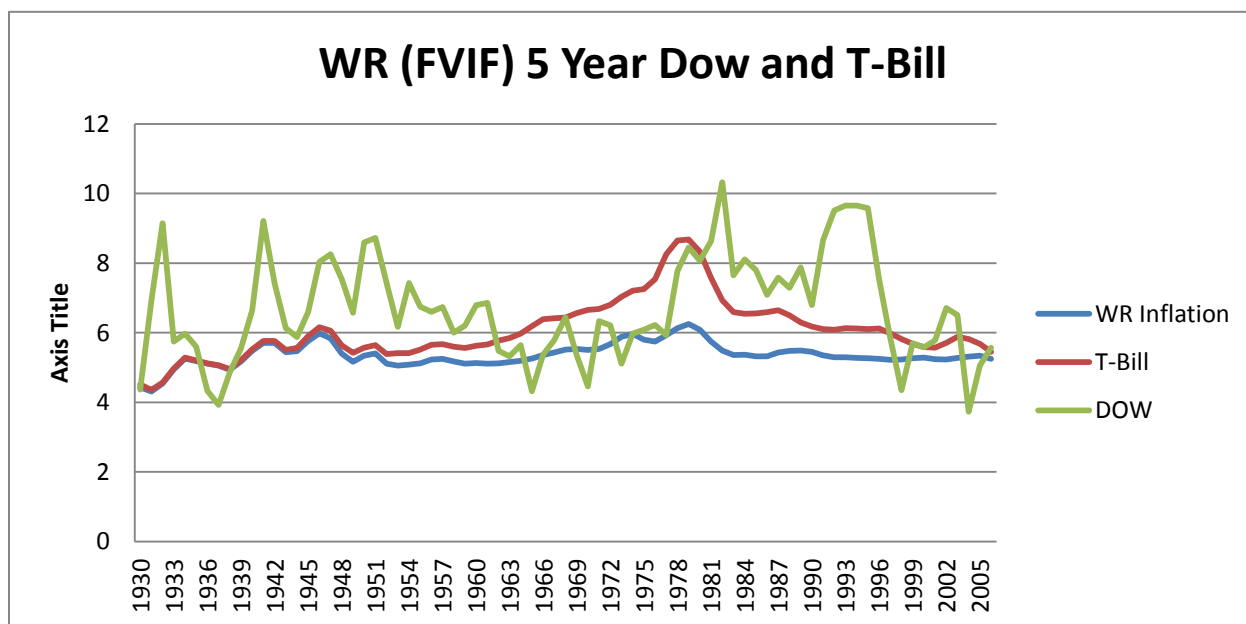
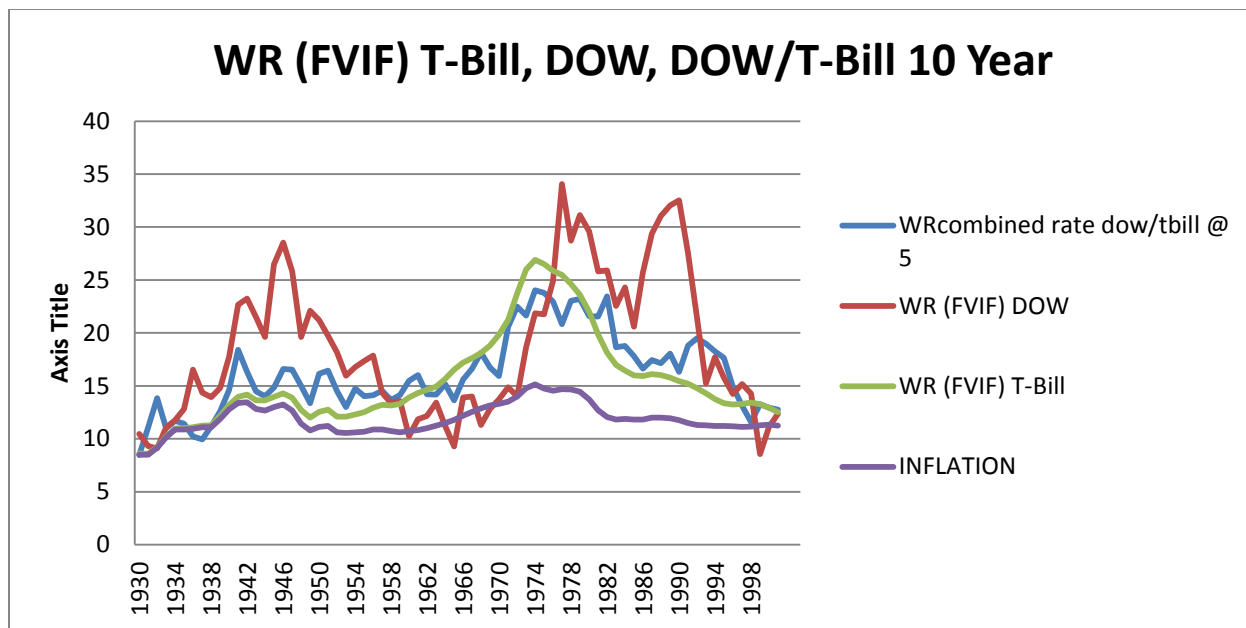
Table 2c								
Summary Statistics for various Retirement Saving Period Wealth Relatives from 1930-2010								
It is assumed that the yearly savings is increased by the CPI-U and the yearly return on the market								
	Retirement Saving Periods							
	40	35	30	25	20	15	10	5
Mean	651.44	427.54	255.64	137.41	70.09	34.68	16.17	6.05
Std Error	66.76	43.25	22.90	9.88	3.61	1.36	0.43	0.10
Median	440.38	310.97	195.25	115.80	62.48	32.71	15.75	5.85
St Deviation	432.67	296.49	165.12	74.62	28.41	11.13	3.67	0.86
Sample Var	187201.28	87906.52	27263.01	5568.21	807.40	123.93	13.49	0.74
Kurtosis	-0.11	0.49	1.05	0.36	-0.94	-0.11	-0.36	1.73
Skewness	1.21	1.30	1.34	1.06	0.50	0.45	0.42	1.08
Range	1391.27	1064.63	616.68	283.27	103.32	52.64	15.55	4.33
Minimum	278.39	139.34	84.89	40.63	23.43	14.31	8.47	4.36
Maximum	1669.66	1203.97	701.56	323.90	126.74	66.95	24.03	8.68
Sum	27360.54	20094.49	13293.26	7832.56	4345.43	2323.31	1164.34	466.22
Count	42	47	52	57	62	67	72	77

These Wealth Relatives are combined-- inflation and Dow 30 returns with a shift to T-Bills for the last five years of the investment horizon

The Wealth Relative graphs below are plots of the Wealth Relatives (FVIF). Each point represents the ending WR for the holding period starting in that year. This illustrates the combined impact of disciplined systematic retirement savings with raises (and givebacks) based on the CPI-U and the market performance of the Dow 30, the Dow 30 with a switch to T-Bills in the remaining five years of the holding period, and investing in a safe asset T-Bill for 8 savings horizons (e.g. 25 years) initiated at each year starting in 1930. Unfortunately for most who are reading this paper we didn’t do nearly as well as those who started their careers earlier. One can *see* that the best time to retire (for all holding periods) would have been about the year 2000. The Reagan/Clinton bull market was truly phenomenal. Each of these graphs includes the Wealth Relatives for raises based on the CPI-U. The reason is to show the few instances where one would have been better off to take your contributions and put them into a safety deposit box.







Summary:

Tables 1 shows that the decades of 1930 and 2000 were the worst decades for the time period of this study. Table 1 also shows the decades of 1950, 1980 and 1990 were the best decades for the time period of this study. For most of us we had the two best and the second worst decades for our retirement accounts. Table 2a and b, and the graphs suggest that for normal retirement saving horizons (15 years or more) one would have done fine. Even with the terrible 2000s nothing suggests that we shouldn't save for retirement.

Tables 2a and 2b suggest that there may be some merit for shifting out of the risky asset into the riskless asset at five years. Table 2c does support this may be a sound tactic, but it does come at a cost of return.

The tables and the graphs indicate that for most saving horizons there is little to be gained and much to be lost by being invested in something other than the stock market (using the Dow 30 as a proxy). This is consistent with the works cited in this paper.

Future studies will explore investing in small company stocks and Treasure Bonds.

Works Cited

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