Hedge Fund Scenario Analysis

Dedicated to the memory of my 1988-89 Yamaichi Research colleagues who lost their jobs when Yamaichi Securities went bankrupt in 1995. Had the YRI management, then the sixth largest brokerage firm in the world, listened to the research they paid for in my crash study group, they would have taken actions to avoid this bankruptcy. The model presented here is simple but it works to call great crashes.

This issue of *Wilmott* focuses on hedge funds so my column on scenario generation and aggregations discusses these issues in the context of the current mid April 2004 stock market. There will be more on the technical aspects of the latter topic, as well as more on valuation measures, in my next two columns. I will focus on the US and SP500 index as that's the most important in the world and greatly influences other markets. See Siegel (2003) for the definitive treatment of benchmarks and indices and their use in portfolio management worldwide. I run for others, in private accounts, and with my own money, what amount to hedge funds in the equity and racetrack markets world so it's useful for me to collect my thoughts as well. The past two plus years since the end of 2001 have been good for me and my futures account is up about 100 per cent per year annualized so I hope it will continue: see Figure 1.

I continue to argue that getting the mean right; and watching our risk control and especially not overbetting are the keys to success. I have done three types of trades (I am small so that's enough for my resources in this futures account):

1. hedged currency trades where the key is to get the mean right and devise strategies and positons to capture this;

2. security market anomaly trades like the turn-of-the-year effect; and

3. exploiting systematic biases in the SP500 futures put and call markets.

Readers of *Wilmott* will have their own favorite trades so let me turn to the US stock market. I use several valuation measures for the SP500. There will be more on some of them in the next column when I have more space to discuss them. Of great-

est importance is to stay out of crashes if you are long and especially levered long. I have long used, since my days at Yamaichi Research in Tokyo in 1988, the bond-stock yield difference model. I first wrote about it in Ziemba-Schwartz (1991) and there is a good discussion in Ziemba (2003), which is available at the Financial World Bookshop in London. The idea is simple. Bonds and stocks compete for the money. When interest
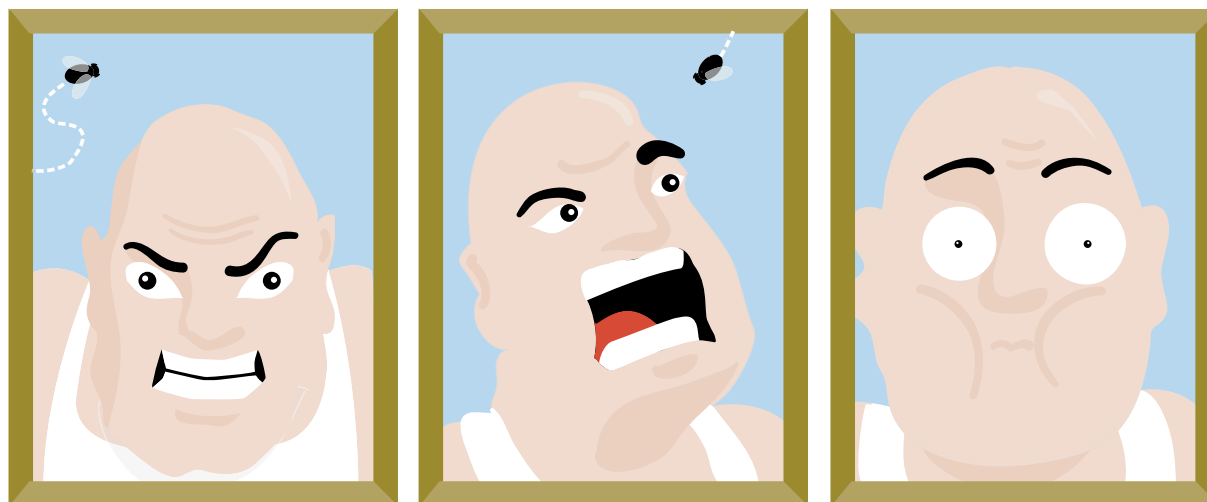
Figure 1: Net value private futures account of William T. Ziemba at Vision L.P. (Chicago and New York), December 31, 2001 to April 16, 2004
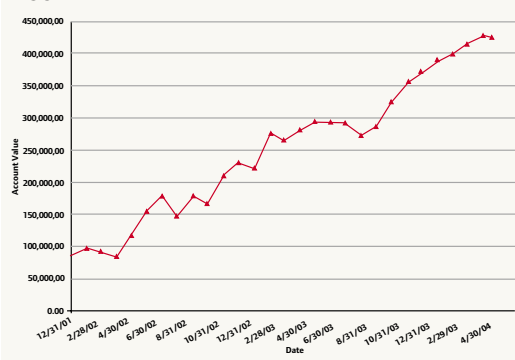

Figure 2: US Treasury yield curve, April 10, 2003, March 19 and April 16, 2004. Source: Bloomberg
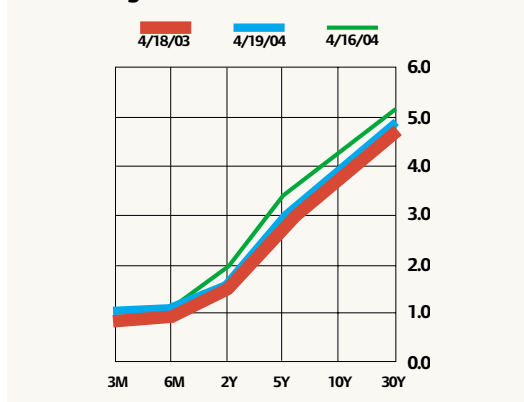
Table 1: SP500 index, PE ratios, government bond yields and the yield premium over stocks, January 1984 to August 1988. Source: Ziemba and Schwartz (1991)

		S&P Index	PER	(a) 30 Yr G bd	(b) 1/pe, %	(a)-(b)
1986	Jan	208.19	14.63	9.32	6.84	2.48
	Feb	219.37	15.67	8.28	6.38	1.90
	Mar	232.33	16.50	7.59	6.06	1.53
	Apr	237.98	16.27	7.58	6.15	1.43
	May	238.46	17.03	7.76	5.87	1.89
	Jun	245.30	17.32	7.27	5.77	1.50
	Jul	240.18	16.31	7.42	6.13	1.29
	Aug	245.00	17.47	7.26	5.72	1.54
	Sep	238.27	15.98	7.64	6.26	1.38
	Oct	237.36	16.85	7.61	5.93	1.68
	Nov	245.09	16.99	7.40	5.89	1.51
	Dec	248.60	16.72	7.33	5.98	1.35
1987	Jan	264.51	15.42	7.47	6.49	0.98
	Feb	280.93	15.98	7.46	6.26	1.20
	Mar	292.47	16.41	7.65	6.09	1.56
	Apr	289.32	16.22	**9.56**	6.17	**3.39**
	May	289.12	16.32	**8.63**	6.13	**2.50**
	Jun	301.38	17.10	**8.40**	5.85	**2.55**
	Jul	310.09	17.92	**8.89**	5.58	**3.31**
	Aug	329.36	18.55	**9.17**	5.39	**3.78**
	Sep	318.66	18.10	**9.66**	5.52	**4.14**
	Oct	280.16	14.16	9.03	7.06	1.97
	Nov	245.01	13.78	8.90	7.26	1.64
	Dec	240.96	13.55	9.10	7.38	1.72
1988	Jan	250.48	12.81	8.40	7.81	0.59
	Feb	258.10	13.02	8.33	7.68	0.65
	Mar	265.74	13.42	8.74	7.45	1.29
	Apr	262.61	13.24	9.10	7.55	1.55
	May	256.20	12.92	9.24	7.74	1.50
	Jun	270.68	13.65	8.85	7.33	1.52
	Jul	269.44	13.59	9.18	7.36	1.82
	Aug	263.73	13.30	9.30	7.52	1.78

Table 2: Bond and stock yield differential model for the SP500, 1995-1999. Source: Berge and Ziemba (2001)

year	month	S&P500 Index	a PER	b 30-yr gov't bond	c=1/a return on stocks	b-c crash signal	year	month	S&P500 Index	a PER	b 30-yr gov't bond	c=1/a return on stocks	b-c crash signal
1995	Jan	470.42	17.10	8.02	5.85	2.17	1997	Jul	954.29	23.67	6.78	4.22	2.56
	Feb	487.39	17.75	7.81	5.63	2.18		Aug	899.47	22.53	6.71	4.44	2.27
	Mar	500.71	16.42	7.68	6.09	1.59		Sep	947.28	23.29	6.70	4.29	2.41
	Apr	514.71	16.73	7.48	5.98	1.50		Oct	914.62	22.67	6.46	4.41	2.05
	May	533.40	16.39	7.29	6.10	1.19		Nov	955.40	23.45	6.27	4.26	2.01
	Jun	544.75	16.68	6.66	6.00	0.66		Dec	970.43	23.88	6.15	4.19	1.96
	Jul	562.06	17.23	6.90	5.80	1.10	1998	Jan	980.28	24.05	6.01	4.16	1.85
	Aug	561.88	16.20	7.00	6.17	0.83		Feb	1049.34	25.09	6.00	3.99	2.01
	Sep	584.41	16.88	6.74	5.92	0.82		Mar	1101.75	27.71	6.11	3.61	2.50
	Oct	581.50	16.92	6.55	5.91	0.64		Apr	1111.75	27.56	6.03	3.63	2.40
	Nov	605.37	17.29	6.36	5.78	0.58		May	1090.82	27.62	6.10	3.62	2.48
	Dec	615.93	17.47	6.25	5.72	0.53		Jun	1133.84	28.65	5.89	3.49	2.40
1996	Jan	636.02	18.09	6.18	5.53	0.65		Jul	1120.67	28.46	5.83	3.51	2.32
	Feb	640.43	18.86	6.46	5.30	1.16		Aug	97.28	27.42	5.74	3.65	2.09
	Mar	645.50	19.09	6.82	5.24	1.58		Sep	1017.01	26.10	5.47	3.83	1.64
	Apr	654.17	19.15	7.07	5.22	1.85		Oct	1098.67	27.41	5.42	3.65	1.77
	May	669.12	19.62	7.21	5.10	2.11		Nov	1163.63	31.15	5.54	3.21	2.33
	Jun	670.63	19.52	7.30	5.12	2.18		Dec	1229.23	32.34	5.47	3.09	2.38
	Jul	639.96	18.80	7.23	5.32	1.91	1999	Jan	1279.64	32.64	5.49	3.06	2.43
	Aug	651.99	19.08	7.17	5.24	1.93		Feb	1238.33	32.91	5.66	3.04	2.62
	Sep	687.31	19.65	7.26	5.09	2.17		Mar	1286.37	34.11	5.87	2.93	2.94
	Oct	705.27	20.08	6.95	4.98	1.97		Apr	1335.18	35.82	5.82	2.79	**3.03**
	Nov	757.02	20.92	6.79	4.78	2.01		May	1301.84	34.60	6.08	2.89	**3.19**
	Dec	740.74	20.86	6.73	4.79	1.94		Jun	1372.71	35.77	6.36	2.80	**3.56**
1997	Jan	786.16	21.46	6.95	4.66	2.29		Jul	1328.72	35.58	6.34	2.81	**3.53**
	Feb	790.82	20.51	6.85	4.88	1.97		Aug	1320.41	36.00	6.35	2.78	**3.57**
	Mar	757.12	20.45	7.11	4.89	2.22		Sep	1282.70	30.92	6.50	3.23	**3.27**
	Apr	801.34	20.69	7.23	4.83	2.40		Oct	1362.92	31.61	6.66	3.16	**3.50**
	May	848.28	21.25	7.08	4.71	2.37		Nov	1388.91	32.24	6.48	3.10	**3.38**
	Jun	885.14	22.09	6.93	4.53	2.40		Dec	1469.25	33.29	6.69	3.00	**3.69**

rates are high bonds look better. When interest rates are low, stocks provide more return and are preferred. A steep yield curve like that in Figure 2, is very good for stocks and dangerous for bonds. You want to buy bonds before interest rate declines and avoid them before interest rate rises. Bonds are very complex because inflation is crucial as well and there is so much discounting and various types of expectations.

The effect of interest rates

Let's go first to the interest rates. As of April 16, 2004, the odds now favor a rather sharp increase in short-term rates and sooner rather than later.

The crash measure comes in various versions but simply subtracting the 30-year T-bond rate from the reciprocal of the SP500 price earnings ratio (using trailing earnings) is a good way to measure the market risk. Table 1 shows the measure around the 1987 crash. The measure went into the danger zone (above a 95 per cent confidence band) in April 1987 with the PP500 at 289.32. Then the SP500 went higher before the eventual crash in October 1987. The danger points are in bold in the column on the right. The measure called the 1990 crash in Japan. It was no surprise. The indicator was further in the danger zone at the end of 1989 then it ever was in the previous 40-years including the 1987 crash. Whenever this measure was in the danger zone in Japan from 1948-88, there was a crash of at least 10 per cent in one year with no misses. There were other crashes. So this measure is more like a sufficient rather than a necessary condition for a crash. I can refer the reader to Ziemba and Schwartz (1991), Berge and Ziemba (2003) and Koivu, Pennanen and Ziemba (2004) for more on Japan. Also, when the measure goes into the danger zone, the market ignores it and continues to rally. But eventually, within one year, there is a crash of at least 10 per cent from the initial value of the index when the measure went into the danger zone. Timing the fall is difficult. Just ask George Soros. His funds lost $5 billion shorting the Nasdaq in early 2000 when it was in the danger zone but still rising. Had his funds waited to start shorting in April 2000 they might have made $50 billion.

The 2000–2002 crash in the SP500

Table 2 shows that the measure entered the danger zone in April 1999 when the spread was 3.03 per cent; see the column on the right, with the SP500 at 1335.18. The bond-stock return crash danger model went deeper into the danger zone

as the year progressed with the spread at 3.69 per cent in December 1999 and the SP500 rose from 1229.23 at the end of December 1998 to 1469.25 at the end of December 1999. The stage was set for a crash that did occur; see Figure 4.

Meanwhile, the P/E ratio was flat, increasing only from 32.34 to 33.29, and long-bond yields rose from 5.47 to 6.69 per cent. The SP500 fell to 1085 on September 17, 2000, prior to 9/11. Again, the SP500 went higher and hit 1527.46 on March 24, 2000 and then again reached 1520 on September 1, 2000. But when it fell it went to 1085 in September 2000 and eventually to 768.63 on October 10, 2003. On April 21, 2004 the index closed at 1122.60.

Figure 3 shows the late 2002 values for the crash indicator using the Fed model. That model uses 10-year bond yields and computes the ratio of the bond and stock yields in terms of a percent over- or under-valued. This measure is close to our difference crash model. This graph from Ned Davis Research indicates that very under-valued markets since 1980 have historically had high returns. When the measure is above 15 per cent then mean SP500 returns average a loss of 6.7 per cent. From 5 to 15 per cent had mean gains of 4.9 per cent and below -5 per cent had mean gains of 31.7 per cent. In late 2002/early 2003, the market was at one of its steepest discount to fair value. See Figure 4 for our calculations which mirror those of Davis. The length and depth of the 2000-2003 decline is seen in the jagged parts of Figure 4. One sees the initial danger zone for the measure in 1999 but then the market returned to the danger zone in 2001 and 2002 because stock prices fell but earnings fell even more. This was a period where consensus future earnings forecasts were invariably far too optimistic. The SP500 index fell from 1460.25 at the end of December 1999 to 885.76 on October 31, 2002 down 37 per cent. The SP500 fell 22 per cent in 2002. This was a phenomenal call since

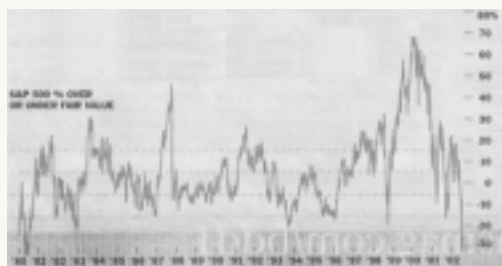**Figure 3: Race to the bottom, Source: Ned Davis Research**

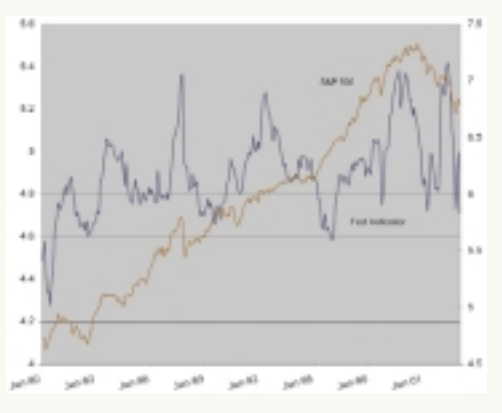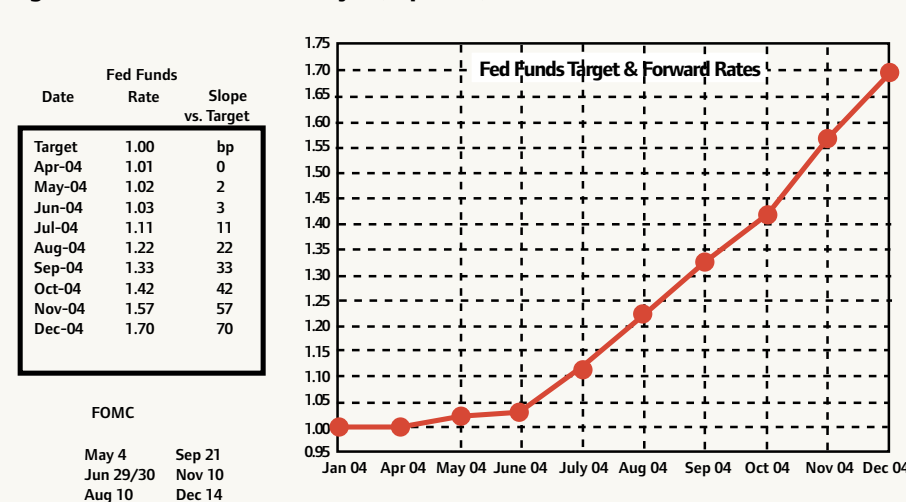**Figure 4: The FED model, 1980-2003. Source: Koivu, Pennanen and Ziemba (2003)**

many institutions assumed, wrongly, that the trouble was over. The short term measure based on behavioral finance ideas about option prices discussed in my next column called the circa July 2002 fall in the SP500 when the bulk of the 2002 damage occurred.

What is the bond-stock earnings yield model saying now in April 2004 and what are the prospects for the SP500 for the rest of 2004 and 2005? As of April 16, 2004 the price-earnings ratio of the SP500 was estimated to be 23.28. Hence, the earnings yield was 4.30 per cent; see www.spglobal.com/earnings.html. This is based on reported earnings of 48.74. Dividends of 18.95 provided a yield of 1.67 per cent. The book value, for fiscal year 2002, was 324.14 providing a 3.50 market to book value ratio.

On April 16, 2004, the 30-year T-bond was yielding 5.19 per cent and the much more liquid 10-year bond was yielding 4.37 per cent. My original studies used 30-year bond rates but Berge and Ziemba (2003) and Koivu, Pennanen and Ziemba (2004) use 10-year rates since they more accurately reflect long term interest rates. The conclusion though is that with either bond rate, the SP500 is not in the danger zone in April 2004. The short-term measure is not in the danger zone either; see my next column. That does not mean that there cannot be a 10 per cent plus decline but the cause for this would seem to have to come from elsewhere. Terrorism is one possibility not to be discounted. A sharp increase in interest rates is another and then these measures would go into the danger zone later.

The best predictor of short-term interest rate movements that I know about is the Fed funds futures contract. Its prices yield useful scenarios for this variable, see Table 3. The recent CPI and core CPI, retail sales, and non-farm March payroll increases led to a sharp increase in the Fed funds futures prices on Wednesday, April 14, 2004.

The market prices suggest about 50-50 odds on the initial

Figure 5: US forward rate analysis, April 14, 2004

Date	Fed Funds Rate	Slope vs. Target
Target	1.00	bp
Apr-04	1.01	0
May-04	1.02	2
Jun-04	1.03	3
Jul-04	1.11	11
Aug-04	1.22	22
Sep-04	1.33	33
Oct-04	1.42	42
Nov-04	1.57	57
Dec-04	1.70	70

FOMC

May 4	Sep 21
Jun 29/30	Nov 10
Aug 10	Dec 14

**Table 3: The Fed funds futures contracts, April 2004.
Source: Bloomberg**

Month	April 13	April 14	April 21	
April	1.01%	1.01%	1.01%	
May	1.02%	1.02%	1.02%	
June	1.03%	1.03%	1.03%	
July	1.11%	(1.04%)	1.10%	
August	1.22%	(1.08%)	1.24%	
September	1.33%	(1.13%)	1.335%	
October	1.42%	(1.18%)	1.46%	
November	1.57%	(1.27 %)	1.59%	
December	1.70%	(1.35 %)	1.70-1.75%	no trades
January '05			1.80-1.95%	no trade
February '05			1.90-2.20 %	no trades

25bp tightening move occurring on June 30 above the current (April, 2004) Fed funds target of 1.00 per cent. The first 25bp tightening move is now more than fully discounted at the August 10 meeting (versus 45 per cent before the March employment report), and a second 25bp move is about two-thirds discounted at the ensuing meeting on September 21. A cumulative tightening of 75 bp is discounted following the December 14 FOMC meeting.

So the 1 per cent dream world of 40 plus year low interest rates will soon change. Until the bond stock measure moves into the danger zone, and even some time after, there is no crash coming based on earnings and interest rate concerns. The other big event in addition to the short-term interest rate rise is the election, which I now discuss.

The effect of the election

The effect of the election is complex. First, who will win? Second, what is the likely impact of each possible outcome? There are various polls but the best odds/probabilities are likely from the betting exchanges. The largest of them is Betfair in London. You can access their website without an account to find out the odds, just look under special bets and go to the US presidential election. On April 21, 2004 the odds that Kerry will get the Democratic nomination are basically 1-33 or 97 per cent based on bid-ask prices of 1.02 and 1.04. Using the British odds system, this means bet 33, collect 34 and win one. So it's not 100 per cent certain that he will get the nomination but

it's quite likely. These prices have now stabilized. Earlier, Dean was 1.8 (British odds), 4-5 (US odds) and I shorted him at that. Later he jumped to 6-1, then 16-1. He is now 75-95. Hillary Clinton is 95-130. I somehow shorted her at 5-1, remember stink bids often get filled at great prices and hedged long at 11-1. Edwards is 160 to 390. These are the leading longshots.

A great stink bid was the 5000 trade on the Nikkei stock index in 1990 when the index was over 20,000. If you are the only bid and someone goes market, you fill your stink bid.

Let's assume that Kerry wins or if one of the others pulls an upset then the candidate will have similar policies vis-a-vis the stock market prospects. For the election, the April 21, 2004 odds are

Republicans 1.73-1.77
Democrats 2.30-2.38.

There is no market for any candidates besides Bush for the Republican nomination. So the candidates are in the ratio of about 1.75 to 2.34. So Bush's chances are about 57 per cent and Kerry's 43 per cent.

The effect of presidential election results on stock prices is studied by several authors. My work appears in Hensel and Ziemba (1995, 2000). The main conclusions are that, on average, returns are higher with Democrats than with Republicans, that returns in the last two years of electoral terms are much higher than in the first two years and that small cap stocks are much higher with Democrats than with Republicans, especially outside of the small cap dream month of January. Tables 4 and 5 detail this across years for the first, first two and last two years of the

administration; and by month, respectively.

Ned Davis, in an interview in this week's Barron's provides further insights. Table 6 shows the 1900 to 2000 results if the incumbent wins or loses versus all election years. From the Hensel-Ziemba results above, we assume that the last year, the election year of the cycle, has high returns. This is borne out in Davis' results; see Table 5. Interestingly, Davis' results separate the year into January to May and June to December. For both cases, incumbent wins or loses, the January to May returns are much lower than the June to December returns. The latter average 14.70 per cent. So if Bush were to win, the return in the latter part of the year would average 14.70 per cent with probability 57 per cent and with Kerry 4.24 per cent with probability 43 per cent. So the forecast is for a 10.20 per cent gain versus 10.68 per cent for the 26 previous elections since 1900.

There were 81 per cent winners: 94 per cent when the incumbent is re-elected but only 60

2005 looks much more difficult as interest rates will be higher and its the first year of a presidential term

per cent when the incumbent loses. Davis adds that his research shows that after the first Fed interest rate rise the market typically rises for the next year. The first hike is usually because higher earnings which offset the short-term interest rate rise. Only after a series of interest rate rises is the result a negative. Since the Fed funds rate already predicts a greater than 1 per cent rise by February 2004, and Fed governors are talking about a 3-3.5 per cent neutral Fed funds rate, there likely will be many increases.

So what do we conclude? Bonds look the most risky. Stocks probably can eke out gains in 2004 especially if Bush wins. But 2005 looks much more difficult as interest rates will then be higher and it's the first year of a presidential term. Davis points out that with $34.5 trillion of debt, the US cannot afford much higher interest rates. He is buying bonds when the rates in the 10-year get to 4.75 to 5.00 per cent. These rates are 4.40 today.

Table 4: Average annual percentage returns for the first year and four years of Democratic and Republican presidencies. Statistically significant differences at the 5 per cent level (2-tail) are shown in bold. Source: Hensel and Ziemba (2000)

	January 1937 to December 1997		January 1929 December 1997	
	S&P 500 TR	U.S. Small Stk TR	S&P 500 TR	U.S. Small Stk TR
Democrat				
Avg 1st Yr	6.58	11.32	10.24	19.06
Avg 1st 2Yrs	6.14	11.85	8.09	15.90
Avg Last 2Yrs	16.13	24.11	17.40	24.65
Avg. Term	10.81	16.71	12.62	20.15
Std.Dev. Term	16.35	27.76	18.26	30.69
Number of Years	36	36	37	37
Republican				
Avg 1st Yr	1.87	-6.22	0.54	-14.45
Avg 1st 2Yrs	6.98	1.39	3.77	-6.29
Avg Last 2Yrs	15.03	16.95	9.06	10.18
Avg. Term	11.00	9.17	6.42	1.94
Std.Dev. Term	15.12	19.89	21.17	27.81
Number of Years	28	28	32	32
Diff 1st Yr	4.72	17.54	9.71	33.51
Diff 1st 2Yrs	-0.84	10.46	4.32	22.19
Diff Last 2Yrs	1.10	7.16	8.33	14.47
Diff Term	-0.19	7.55	6.20	18.21
1st year t-values (Ho:Diff=0)	0.67	1.39	1.15	**2.58**
First 2-years t-values (Ho:Diff=0)	-0.14	1.13	0.69	**2.39**
Last 2-years t-values (Ho:Diff=0)	0.20	0.69	1.20	1.41
Term t-values (Ho:Diff=0)	-0.05	1.04	1.29	**2.57**

REFERENCES

■ Berge, K. and W. T. Ziemba (2003). The predictive ability of the bond stock earnings yield differential in worldwide equity markets. Technical report, Sauder School of Business, University of British Columbia.
■ Hensel, C. R. and W. T. Ziemba (1995). U.S. small and large capitalized stocks, bonds and cash returns during Democratic and Republican administrations, 1928–1993. *Financial Analysts Journal* 51 (2), 61-69.
■ Hensel, C. R. and W. T. Ziemba (2000). How did Clinton stand up to history? US stock market returns and presidential party affiliations. In D. B. Keim and W. T. Ziemba (Eds.), *Security market imperfections in world wide equity markets*, pp. 203-217. Cambridge University Press.
■ Koivu, M., T. Pennanen, and W. T. Ziemba (2004). Cointegration analysis of the FED model. Technical report, Sauder School of Business, University of British Columbia.
■ Siegel, L. B. (2003). Benchmarks and investment management. AIMR.
■ Ziemba, W. T. (2003). The Stochastic Programing Approach to Asset Liability and Wealth Management. AIMR.

Table 5: Average percentage monthly small- and large-cap stock returns during Democratic and Republican presidencies, January 1929 – December 1997. Source: Hensel and Ziemba (2000)

	Democratic Administrations			Republican Administrations		
	S&P 500 Total Return	US Small Cap Total Return	Small Cap minus Large Cap	S&P 500 Total Return	US Small Cap Total Return	Small Cap minus Large Cap
January	1.72	6.45	4.72	1.65	5.93	4.28
February	-0.38	0.74	1.11	1.59	2.78	1.19
March	-0.58	-0.91	-0.34	0.96	1.21	0.25
April	2.25	2.58	0.33	-0.24	-1.82	-1.57
May	1.07	1.40	0.33	-0.50	-1.52	-1.02
June	1.57	1.71	0.14	0.78	-0.40	-1.18
July	1.95	2.81	0.86	1.69	1.11	-0.58
August	1.17	1.65	0.47	1.73	1.25	-0.47
September	0.40	0.78	0.38	-2.87	-3.31	-0.45
October	0.42	-0.24	-0.67	-0.40	-2.66	-2.26
November	1.44	1.61	0.17	0.44	-0.53	-0.97
December	1.56	1.58	0.02	1.59	-0.09	-1.68

Table 6: Historical reaction of the market to elections. Source: Ned Davis Research, Barron's, April 19, 2004.

	Incumbent Wins		Incumbent Loses		All Election Years		Non-Election Years	
	Avg Gain	Time Mkt Is Up, %	Avg Gain	Time Mkt Is Up	Avg Gain	Time Mkt Is Up, %	Avg Gain	Time Mkt Is Up %
Month								
January	0.23	53	-0.48	40	-0.04	50	1.42	68
February	-0.46	50	-1.59	40	-0.83	48	0.13	51
March	2.80	88	1.31	60	2.06	74	0.24	56
April	-0.87	44	-2.26	40	-1.41	42	1.95	59
May	-0.73	56	-1.87	40	-1.17	50	0.29	53
June	1.04	62	0.61	50	0.87	58	0.22	49
July	1.99	56	2.65	50	2.24	54	1.00	64
August	2.59	81	3.86	50	3.08	69	0.38	62
September	0.61	44	-1.05	40	-0.03	42	-1.60	40
October	2.95	88	-1.52	40	1.23	69	-0.13	52
November	3.75	69	-0.40	60	2.15	65	0.53	60
December	0.99	62	0.55	50	0.82	58	1.76	78
January-May	1.78	60	-4.53	40	-0.75	52	4.12	65
June-December	14.70	94	4.24	60	10.68	81	2.15	63