BEHAVIOR OF MONTHLY TOTAL RETURNS OF U.S. GOVERNMENT BONDS: 1926-2007

Shaikh A. Hamid
Southern New Hampshire University
Abraham Habib
University of Massachusetts-Boston

ABSTRACT: We explore for presence of monthly seasonality in monthly total returns of U.S. long term government bonds from January 1926 to December 2007. We test three types of effects with respect to monthly seasonality. We further partition the data into three sub-periods and explore monthly seasonality. In addition, we explore monthly seasonality based on Republican and Democratic presidencies. We look at the nature of monthly returns during contraction and expansion periods, as well as periods of crisis.

The mean of monthly total returns of long term government bonds for the entire data set (0.47%) was significantly greater than zero. The mean of monthly returns of none of the months was significantly greater than the mean of the other eleven months stacked together. We find evidence of month effect with respect to variances of monthly returns. When we partition the data into three sub-periods, we do not find any discernible monthly seasonality. We also find the mean of monthly returns during the Republican presidencies to be significantly higher than during the Democratic presidencies. Government bond returns were on average significantly higher during contraction periods than during expansion periods. The Great Depression was good for the bond market; war periods were comparatively not as attractive for bond investing because governments tend to peg interest rates during such periods. Though not fully efficient, the U.S. long term government bond market exhibits a high degree of efficiency.

INTRODUCTION

Since the time stock exchanges were first established, traders and investors have exhaustively looked for patterns in securities prices that they could exploit to realize superior returns. However, as early as 1900, Bachelier characterized security prices as being efficient. Over thirty years later came the landmark work by Cowles (1933) in which he documented the inability of forty-five professional agencies to forecast stock prices. The conclusion was that stock prices are random – in general they do not exhibit patterns. A large array of research – bulk of them devoted to analysis of the stock markets – has looked at the issue of efficiency of financial markets. The evidence with regard to efficiency is mixed.

The bond market is a very sizable market, and trading in bonds, especially treasury bonds, is very brisk. Bonds are appropriate for investors seeking income, as well as for investors looking for broad diversification. In contrast to research with regard to the stock markets, a small number of researchers have looked at the issue of efficiency of the bond markets. An aspect that has possibly not been rigorously looked at is whether the bond market exhibits monthly seasonality. This research seeks to fill that void. As of December 2008 $10.7 trillion worth of treasury securities were outstanding. It is expected that the highly liquid Treasury bond market will exhibit a high degree of efficiency, and hence seasonal patterns in monthly returns will be absent. Our findings indicate that though total patterns show an increasing or decreasing trend over certain months, the mean total returns of none of the months were significantly greater than the mean returns of the other eleven months stacked together. However, we do find evidence of significant difference in volatility for some of the months compared to the other months.

In subsequent sections we review previous research on the efficiency of the bond markets, outline the research methodology of this study, analyze results, and round off with summary and conclusion.

LITERATURE SURVEY

In contrast to the extensive research on equity returns, few investigations examine seasonality in the fixed income market. Schneeweis and Woolridge (1979) find evidence of a January effect in various municipal, corporate, public utility, and government bond series from 1952 to 1977. Smirlock (1985) finds a January effect for low-grade corporate bonds, but not for high-grade corporate or U.S. Government bonds from 1953 to 1981. Chang and Pinegar (1986) also find a January effect for lower quality bonds. Wilson and Jones (1990) find a January effect for corporate bonds and commercial paper. Jordan and Jordan (1991) examine seasonality in daily corporate bond returns using the Dow Jones Composite Bond Average and compare it to seasonality of equity using daily S&P 500 stock returns. For the period 1963-1986, corporate bond returns exhibit January, turn of the year, and week of the month effects, but no significant day of the week effects or turn of the month effects. And finally, Cooper and Shulman (1994) find significant year-end effect in junk bond prices from 1980 to 1991.

A rigorous analysis of existence or non-existence of seasonality in the U.S. Treasury bond market appears to have been overlooked. That is what we aim to do. We use a much longer data period (1926 to 2007) and a different methodology to explore seasonality. We also explore seasonality for sub-periods carved out of structural changes in the economy. That will increase our understanding of the nature of the government bond market how efficient the market is. It will also help investors to time their investments and the U.S. Treasury to time bond issues. In addition we examine whether there is difference in returns of Treasury bonds during (i) Republican versus Democratic presidential periods, and (ii) expansion and contraction periods. We also look at the behavior of Treasury bonds in periods of crisis.

We hypothesize that the ideology of smaller government embraced by Republicans will cause lower demand for funds during Republican presidential months and so lower Treasury borrowing, which will cause yields to go down and total returns to go up because of higher monthly capital gains. This should create a situation in which the total returns during Republican periods should be higher than during Democratic periods, which is what we find.

The same line of argument applies to contraction periods. The lower demand for funds during contraction periods should cause yields to go down and hence total returns to go up. This should create a situation in which the total returns during contraction periods should be higher than during expansion periods, which is what we find.

RESEARCH METHODOLOGY

The goal of this research was to find out, for the length of period of study, if there was a month effect in U.S. long term government bonds total monthly returns, and if so, was it more pronounced during certain periods. We studied the month effect in three different ways. Unless otherwise stated, significance in all cases is tested at the 5% level.

1. Was the mean of total monthly returns of long term government bonds different from zero? We tested this by subjecting the mean of monthly returns for a given month i to the following hypothesis test: H_o: $\mu_i = 0$ vs. H_a: $\mu_i \neq 0$. We used the standard t-test for testing this hypothesis.

2. Was the mean of total monthly returns of long term government bonds of a given month different from the mean of the other months stacked together? We performed this by conducting the following hypothesis test for a given month i: H_o: $\mu_i = \mu_j$ vs. H_a: $\mu_i \neq \mu_j$, where j represents the remaining 11 months other than i. Since the variances for many (i, j) periods and the sample sizes were unequal, we used the more conservative t-test assuming unequal variances.

3. Was the variance of the total monthly returns of long term government bonds for a given month different from the variance for the other months stacked together? We tested this by conducting the following hypothesis test for a given month i: H_o: $\sigma_i^2 = \sigma_j^2$ vs. H_a: $\sigma_i^2 \neq \sigma_j^2$, where j represents the remaining 11 months other than i. We used the standard F-test for testing this hypothesis.

In addition to the t-tests and F-tests, we used Kruskal-Wallis nonparametric tests for differences in population medians. We also use the Mood's Median test which is more robust against outliers.

Many studies have used the dummy variable methodology to detect market seasonality. Chien, Lee and Wang (2002) provide statistical analysis and empirical evidence that the methodology may lead to misleading results. We avoided this problem by following the methodology used in Hamid and Dhakar (2005) using which they analyze seasonality in the Dow Jones Industrial Average.

To gain deeper insight into the month effect, we partition the entire period (January 1926 to December 2007) into three sub-periods:

- 1913 to 1945 (which includes the First World War, the Great Depression years, and the Second World War);
- 1946 to 1972 (which includes the Breton Woods fixed exchange rate era, and the breakdown of that era in 1972);
- 1973 to 2007 (which includes the volatile world we live in since the first oil crisis of 1973).

We analyze the seasonality of monthly total returns of long term government bonds for (a) the entire data, (b) the three sub-periods, (c) the periods of contraction and expansion (d) the Democratic presidencies, and (e) the Republican presidencies.

We obtain data from Stocks, Bonds, Bills and Inflation 2008 Yearbook.

ANALYSIS OF RESULTS

Entire Period: 1926 – 2007: We analyze the entire U.S. long term government bonds monthly total returns data set from January 1926 to December 2007 to identify month effect. Table 1 summarizes the statistical output and results of the tests.

Table 1: Month Effect in Long Term Government Bonds Total Returns (%): 1926 to 2007

	All	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Count	984	82	82	82	82	82	82	82	82	82	82	82	82
Mean	0.47	0.34	0.38	0.14	0.27	0.43	0.79	0.33	0.45	0.37	0.91	0.74	0.50
Median	0.33	0.31	0.37	0.21	0.24	0.28	0.51	0.34	0.16	0.19	0.74	0.34	0.47
Minimum	-9.82	-7.41	-5.20	-5.39	-5.88	-5.16	-3.12	-9.82	-4.35	-5.45	-8.41	-4.71	-7.13
Maximum	15.23	6.66	11.45	7.70	15.23	8.96	6.13	6.93	7.81	6.18	8.29	14.10	5.81
Range	25.05	14.07	16.65	13.09	21.11	14.12	9.25	16.75	12.16	11.63	16.70	18.81	12.94
Standard Deviation	2.27	2.03	2.41	2.07	2.65	2.42	1.69	2.43	2.21	2.18	2.50	2.46	2.07
Sample Variance	0.05	0.04	0.06	0.04	0.07	0.06	0.03	0.06	0.05	0.05	0.06	0.06	0.04
p-value (m=0)	0.00	0.14	0.16	0.54	0.37	0.11	0.00	0.22	0.07	0.13	0.00	0.01	0.03
p-value (t test)		0.54	0.73	0.14	0.46	0.87	0.09	0.58	0.94	0.66	0.10	0.30	0.90
p-value (F test)		0.08	0.24	0.12	0.03	0.22	0.00	0.20	0.36	0.31	0.11	0.16	0.13
Mean % Change	Pos						Pos				Pos	Pos	Pos
Month Effect (Mean)													
Month Effect (Var)					Higher		Lower						

Note 1. "Pos" implies that the mean of monthly returns was significantly greater than zero.

Note 2. "Higher" implies that the mean of monthly returns for a month was significantly greater than the rest of the months. "Lower" implies that the mean of monthly returns for a month was significantly smaller than the rest of the months.

The mean of total monthly returns for the entire data set, 0.47%, is significantly greater than zero (p = 0.00). The means of monthly total returns of June, October, November and December were significantly greater than zero. October experienced the highest mean monthly return (0.91%) followed by June (0.79%) and November (0.74%). March had the lowest mean (0.14%). The mean of total returns of none of the months was significantly different from the mean of total returns of the other months stacked together. The total returns of October were greater than the other months at 10% level of significance. The difference in medians of monthly returns of long term government bonds was not significant based on two non-parametric tests (Kruskal-Wallis test H statistic = 10.02 and p = 0.53; Mood's Median test yields a Chi-square of 11.83 and p value = 0.46). In regard to volatility, the mean variance of only April was significantly higher compared to the mean of the other eleven months stacked together. June exhibited significantly lower variance compared to the other months.

A graph of the mean monthly percentage changes for the entire data (figure not shown) shows an upward trend from March to June, followed by a dip in July and a rise in October. We then see a falling trend in total returns from October to March.

Returns in Real Terms: Table 2 below shows the monthly returns in real terms for the entire study period and three sub-periods. It shows the mean long term government bond return, mean CPI, and their difference. We see

a positive monthly real return of 0.22% for the entire study period. The first and third sub-periods have positive monthly real returns (0.38% and 0.37% respectively). However, the second sub-period has a negative monthly real return of 0.10%. This period coinciding with the Breton Woods fixed exchange rate era was the most stable period in terms of asset prices, commodity prices, interest rates, and exchange rates.

Table 2: Mean Real Monthly Returns for Long Term Government Bonds

Period	Mean LTGB	Mean CPI	Difference
1926-2007	0.47	0.25	0.22
1926-1945	0.39	0.01	0.38
1946-1972	0.17	0.26	-0.10
1973-2007	0.75	0.38	0.37

First Sub-Period: 1926-1945: Table 3 shows that for the period January 1926 to December 1945, in spite of the Great Depression and deflation, the mean of monthly total returns was 0.39% which was significantly greater than zero. The mean returns of April, June, and November were significantly greater than zero.

Table 3: Month Effect in Long Term Government Bonds Total Returns (%): 1926 to 1945

	All	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Count	240	20	20	20	20	20	20	20	20	20	20	20	20
Mean	0.39	0.36	0.53	0.45	0.94	0.30	0.48	0.39	-0.05	-0.28	0.72	0.61	0.26
Median	0.39	0.45	0.70	0.64	0.62	0.47	0.40	0.35	0.16	0.16	0.52	0.35	0.58
Minimum	-5.45	-2.01	-2.58	-4.11	-0.35	-2.99	-0.69	-2.17	-2.01	-5.45	-3.30	-1.49	-2.20
Maximum	6.04	2.57	4.13	2.53	6.04	3.03	2.58	4.81	1.11	1.10	4.10	2.36	1.94
Range	11.49	4.58	6.71	6.64	6.39	6.02	3.27	6.98	3.12	6.55	7.40	3.85	4.14
Standard Deviation	1.24	1.08	1.24	1.38	1.47	1.36	0.72	1.27	0.77	1.48	1.54	0.98	1.08
Sample Variance	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.02	0.02	0.01	0.01
p-value (m=0)	0.00	0.15	0.07	0.16	0.01	0.33	0.01	0.19	0.78	0.41	0.05	0.01	0.30
p-value (t test)		0.89	0.61	0.85	0.09	0.76	0.62	0.98	0.02	0.04	0.32	0.31	0.57
p-value (F test)		0.23	0.54	0.28	0.16	0.31	0.00	0.47	0.01	0.14	0.10	0.10	0.23
Mean % Change	Pos				Pos		Pos					Pos	
Month Effect (Mean)									Lower	Lower			
Month Effect (Var)							Lower		Lower				

Note 1. "Pos" implies that the mean of monthly returns was significantly greater than zero.

Note 2. "Lower" implies that the mean of monthly returns for a month was significantly smaller than the rest of the months.

The mean return of August was significantly lower compared to the mean of the other eleven months stacked together. The mean return of September

was also significantly lower compared to the mean of the other eleven months stacked together. The difference in medians of monthly returns for the first sub-period is not significant based on two nonparametric tests (Kruskal-Wallis H statistic = 16.03 and p = 0.14; Mood's Median test yields a Chi-square of 18.80 and p value = 0.07).

There was also some month effect in terms of variance as can be seen from the last row of Table 2 (June and August had lower variances compared to the other months).

Second Sub-Period: 1946-1972: This was an era of fixed-exchange rates and relative domestic progress and prosperity. It was an era in which America helped Europe to rise up from the ashes of the Second World War under the Marshall Plan and also helped Japan to get back on its feet. (The Marshall Plan itself was worth $120 billion in today's dollars.) Compared to the previous sub-period, the mean of monthly returns in long term government bonds total returns halved (0.39% vs. 0.17%) and this mean was significantly greater than zero at 7% level.

In terms of month effect, this sub-period was not eventful. Table 4 shows none of the months experienced mean monthly returns significantly different from zero.

Table 4: Month Effect in Long Term Government Bonds Total Returns (%): 1946 to 1972

	All	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Count	324	27	27	27	27	27	27	27	27	27	27	27	27
Mean	0.17	0.33	0.37	0.51	-0.19	-0.13	0.23	0.42	-0.13	0.12	0.41	0.06	0.02
Median	0.10	0.12	0.21	0.20	0.01	0.01	0.10	0.33	-0.08	-0.04	0.27	-0.45	0.16
Minimum	-5.31	-2.41	-2.50	-2.12	-4.13	-4.90	-3.12	-2.78	-4.35	-5.31	-4.00	-2.69	-3.63
Maximum	7.91	5.06	5.87	5.26	4.27	2.70	4.86	3.68	4.71	3.32	3.65	7.91	4.13
Range	13.22	7.47	8.37	7.38	8.40	7.60	7.98	6.46	9.06	8.63	7.65	10.60	7.76
Standard Deviation	1.64	1.60	1.59	1.56	1.76	1.62	1.62	1.43	1.50	1.62	1.43	2.20	1.77
Sample Variance	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.02	0.05	0.03
p-value (m=0)	0.07	0.30	0.24	0.10	0.58	0.67	0.47	0.14	0.66	0.71	0.15	0.89	0.94
p-value (t test)		0.59	0.50	0.25	0.28	0.32	0.84	0.35	0.30	0.86	0.37	0.79	0.66
p-value (F test)		0.45	0.43	0.39	0.33	0.49	0.49	0.19	0.29	0.48	0.18	0.02	0.32
Mean % Change													
Month Effect (Mean)													
Month Effect (Var)												Higher	

Note 1. "Higher" implies that the mean of monthly returns for a month was significantly greater than the rest of the months.

In terms of month effect, the mean of total returns of none of the months was significantly different from the means of the other eleven months. The difference in medians of monthly returns for the second sub-period (1946-1972) was not significant based on two nonparametric tests. (Kruskal-Wallis H statistic

= 10.15 and p = 0.52; Mood's Median test yields a Chi-square of 9.91 and p value = 0.54).

November experienced significantly higher volatility than the other months. Thus, this sub-period exhibits very little month effect.

Third Sub-Period: 1973-2007: From a mean of monthly returns of 0.39% in the first sub-period and 0.17% in the second sub-period, the mean increased to 0.75% in the third sub-period as can be seen in Table 5. It was significantly greater than zero. The means of returns of June, August, October, November and December were significantly greater than zero compared to three months with significant means in the first sub-period.

In terms of the month effect, the mean of March was significantly lower than the mean of the other months stacked together. The difference in medians of monthly returns was significant at 8% level based on Kruskal-Wallis test (H-statistic is 18.27 with p=0.077), and at 7$ level based on Mood's median test (Chi-square=18.85 and p=0.066). June was the only month that exhibited volatility that was different from that of the other months (lower volatility).

So the month effect that we see in the three sub-periods does not show a consistent pattern with respect to mean or volatility.

Table 5: Month Effect in Long Term Government Bonds Total Returns (%): 1973 to 2007

	All	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Count	420	35	35	35	35	35	35	35	35	35	35	35	35
Mean	0.75	0.33	0.31	-0.32	0.23	0.93	1.40	0.23	1.19	0.93	1.40	1.34	1.00
Median	0.82	0.9	0.3	-0.44	0.18	0.34	1.5	0.18	1.99	0.96	1.55	0.97	1.39
Minimum	-9.82	-7.41	-5.2	-5.39	-5.88	-5.16	-2.23	-9.82	-4.32	-5	-8.41	-4.71	-7.13
Maximum	15.23	6.66	11.45	7.7	15.23	8.96	6.13	6.93	7.81	6.18	8.29	14.1	5.81
Range	25.05	14.07	16.65	13.09	21.11	14.12	8.36	16.75	12.13	11.18	16.7	18.81	12.94
Standard Deviation	3.00	2.68	3.32	2.62	3.57	3.22	1.95	3.40	2.92	2.74	3.40	3.07	2.59
Sample Variance	0.09	0.07	0.11	0.07	0.13	0.10	0.04	0.12	0.09	0.07	0.12	0.09	0.07
p-value (m=0)	0.00	0.47	0.59	0.48	0.70	0.10	0.00	0.70	0.02	0.05	0.02	0.01	0.03
p-value (t test)		0.27	0.41	0.02	0.37	0.73	0.06	0.35	0.36	0.69	0.24	0.24	0.55
p-value (F test)		0.17	0.22	0.16	0.08	0.30	0.00	0.16	0.44	0.24	0.17	0.45	0.13
Mean % Change	Pos						Pos		Pos		Pos	Pos	Pos
Month Effect (Mean)				Lower									
Month Effect (Var)							Lower						

Note 1. "Pos" implies that the mean of monthly returns was significantly greater than zero.

Note 2. "Higher" implies that the mean of monthly returns for a month was significantly greater than the rest of the months. "Lower" implies that the mean of monthly returns for a month was significantly smaller than the rest of the months

Comparison of Three Sub Periods: A graph **of** the means of monthly returns of the various months for the entire data set as well as the three sub-periods (figure not included) shows no discernible pattern. But there appears to be a high degree of co movement between the trend lines of the first two sub-

periods. The trend line for the third sub-period shows the higher volatility of this period. The mean monthly returns are pretty close for all the periods for the first three months.

An interesting trend we observe is the fluctuations in the mean of monthly returns for each of the three successive sub-periods (0.39%, 0.17% and 0.75%) and in the medians (0.39%, 0.10% and 0.82%) – a fall and then a rise. During the first sub-period, long-term Treasury bond yields fall from about 3.75% to 2%. Yields on long-term Treasury bonds rose from about 2% to 6% during the second sub-period. Yields on long-term Treasury bonds initially rose and then fell during the third sub-period (from an average of about 6.8% to 14.82% to 4.5%). However, the standard deviations of the monthly returns increase over successive sub-periods (1.24%, 1.64% and 3.00 %). The yield series of long-term Treasury bonds is much more volatile. This is a reflection of the increasing volatility of interest rates over time.

The mean for the second sub-period (0.17%) is significantly lower than the mean of the first sub-period (0.39%) with a p-value = 0.07. The mean for the third sub-period (0.76%) is significantly higher than the mean of the first sub-period (0.39%) and the second sub-period (0.17%) with a p-values = 0.00. The medians of the three sub-periods (0.39%, 0.10% and 0.82%) are significantly different from each other (Kruskal-Wallis H statistic = 19.04 and p value = 0.00; Mood's Median test yields a Chi-square of 23.97 and p value = 0.00). The lower mean of the second sub-period is attributable to the relative calm brought about by the fixed exchange rate era after 1944 Breton Woods agreement.

Thus we find the mean monthly returns have increased in recent decades and so has the volatility.

Month Effect: Republican and Democratic Presidential Periods: Given the important impact party philosophies have on the economy, we explored the three types of month effects during the Republican and Democratic presidencies.

Republican Presidencies: Table 6 shows the statistical output for monthly returns during Republican presidencies over the period 1926-2007. The mean of monthly returns (0.64%) over the 505 Republican months was significantly greater than zero. The overall median of monthly returns during Republican periods was 0.46%. The means of monthly returns for February, June, October, and November were significantly greater than zero.

The mean of monthly returns for October was higher than the mean of the other months stacked together based on t-tests, Kruskal-Wallis and Mood's Median test found no significant difference in the medians of various months (Kruskal-Wallis H-statistic = 15.55, p = 0.161, and Mood's Median test Chi-square of 17.1 and p value = 0.107). October had the highest average rank based on median followed by June and February. April had the lowest average rank followed by March. In regard to the month effect in variance of long term government bonds total returns, the variance of June was lower than the other months.

Table 6: Month Effect in Long Term Government Bonds Total Returns: Republican Presidencies

	All	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Count	505	42	43	42	42	42	42	42	42	42	42	42	42
Mean	0.64	0.37	0.89	0.09	-0.11	0.30	0.98	0.27	0.77	0.74	1.60	1.12	0.69
Median	0.46	0.40	0.63	-0.04	-0.02	0.06	0.75	0.37	0.17	0.74	1.47	0.40	0.68
Minimum	-9.82	-3.88	-4.93	-5.39	-5.88	-5.16	-2.23	-9.82	-4.35	-5.31	-3.3	-4.71	-7.13
Maximum	14.1	6.66	11.45	7.7	6.04	8.96	6.13	6.93	7.81	6.18	8.29	14.1	5.81
Range	23.92	10.54	16.38	13.09	11.92	14.12	8.36	16.75	12.16	11.49	11.59	18.81	12.94
Standard Deviation	2.64	2.28	2.68	2.40	2.67	2.95	2.03	3.03	2.57	2.53	2.64	3.09	2.44
Sample Variance	0.07	0.052	0.072	0.057	0.071	0.087	0.041	0.092	0.066	0.064	0.07	0.096	0.06
p-value (m=0)	0.00	0.30	0.04	0.80	0.79	0.52	0.00	0.57	0.06	0.07	0.00	0.02	0.07
p-value (t test)		0.43	0.53	0.13	0.06	0.43	0.27	0.40	0.75	0.80	0.02	0.30	0.89
p-value (F test)		0.11	0.46	0.21	0.48	0.16	0.01	0.11	0.42	0.36	0.50	0.08	0.26
Mean % Change	Pos		Pos				Pos				Pos	Pos	
Month Effect (Mean)											Higher		
Month Effect (Var)							Lower						

Note 1. "Pos" implies that the mean of monthly returns was significantly greater than zero.

Note 2. "Higher" implies that the mean of monthly returns for a month was significantly greater than the rest of the months. "Lower" implies that the mean of monthly returns for a month was significantly smaller than the rest of the months.

Democratic Presidencies: Table 7 shows the statistical output for monthly total returns of long term government bonds during Democratic presidencies over 1926-2007. The mean (0.30%) over the 479 Democratic months was significantly greater than zero. May and June yielded monthly total returns significantly greater than zero.

Though the means of two months were significantly greater than zero, no month experienced mean return significantly greater than the mean of the other eleven months. We got similar findings from Kruskal-Wallis and Mood's Median test for difference in the medians of the monthly returns; there is no significant difference in the medians of various months (Kruskal-Wallis H-statistic = 7.73, p = 0.737, Mood's Media test Chi Square = 12.39 p= 0.337). Though the result is not significant, June had the highest average rank based on median followed by April.

We see month-effect in terms of variance. June exhibited lower standard deviations and April exhibited higher standard deviations compared to the other months. The range of standard deviations were lower under Democrats (ranging from 1.46% to 2.61%) than under Republican presidents (ranging from 2.03 % to 3.09 %).

Hamid and Habib

Table 7: Month Effect in Long Term Government Bonds Total Returns (%): Democratic Presidencies

	All	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Count	479	40	39	40	40	40	40	40	40	40	40	40	40
Mean	0.30	0.30	-0.18	0.19	0.66	0.56	0.68	0.39	0.12	-0.02	0.19	0.34	0.30
Median	0.23	0.27	0.20	0.30	0.36	0.37	0.34	0.32	0.16	0.04	0.26	0.23	0.40
Minimum	-8.41	-7.41	-5.20	-4.11	-2.91	-2.99	-3.12	-4.76	-4.32	-5.45	-8.41	-2.69	-3.63
Maximum	15.23	3.28	3.54	3.67	15.23	7.90	4.49	6.26	4.65	3.95	4.10	3.51	4.13
Range	23.64	10.69	8.74	7.78	18.14	10.89	7.61	11.02	8.97	9.40	12.51	6.20	7.76
Standard Deviation	1.81	1.75	1.94	1.68	2.61	1.71	1.46	1.61	1.72	1.70	2.15	1.48	1.60
Sample Variance	0.03	0.03	0.04	0.03	0.07	0.03	0.02	0.03	0.03	0.03	0.05	0.02	0.03
p-value (m=0)	0.00	0.28	0.56	0.48	0.12	0.04	0.01	0.13	0.65	0.94	0.58	0.15	0.25
p-value (t test)		0.98	0.11	0.68	0.35	0.31	0.09	0.69	0.51	0.23	0.74	0.83	1.00
p-value (F test)		0.41	0.27	0.28	0.00	0.34	0.04	0.17	0.35	0.31	0.07	0.05	0.16
Mean % Change	Pos					Pos	Pos						
Month Effect (Mean)													
Month Effect (Var)					Higher		Lower						

Note 1. "Pos" implies that the mean of monthly returns was significantly greater than zero.

Note 2. "Higher" implies that the mean of monthly returns for a month was significantly greater than the rest of the months. "Lower" implies that the mean of monthly returns for a month was significantly smaller than the rest of the months.

Comparison between Republican and Democratic Presidencies for 1926-2007: A graph of the mean monthly total returns for the entire data set as well as the mean monthly returns under Republican and Democratic presidencies shows a sharp rise from September to October. The peak is reached in October. We can see a falling trend after that for the rest of the year. Though the monthly rising and falling trends are similar, the mean monthly total returns have been higher under Republican presidencies than under Democratic presidencies in eight of the twelve months.

Two-sample t-test assuming unequal variances shows a significant difference (p = 0.00) between the mean for the Republican periods of 0.64% and for Democratic periods of 0.30%. The difference in the medians during Republican and Democratic periods for long term government bond total returns was significant, based on two non-parametric tests. Kruskal-Wallis H-statistic is 4.14 while p = 0.042. Mood's Median test has Chi-square value of 8.28 and p = 0.004.

The variances of the monthly long term government bonds total returns for Republican versus Democratic periods 0.07% vs. 0.035 are significantly different with a p value = 0.00.

The lower mean return during Democratic presidencies may lie in the alleged "infatuation" of "big government" of Democratic presidents, in the effect of fiscal/monetary policies pursued during Democratic presidents, and may also be the effect of wars. Democrats have had more than their share of war presidents:

52

- Woodrow Wilson: World War I (not within this study period)
- Franklin Delano Roosevelt: World War II
- Harry Truman: Korean War
- Kennedy and Johnson: Presided over at least half of the Vietnam War

Contraction and Expansion Periods: There were 182 contraction months and 802 expansion months during the period we analyze. The monthly returns had significantly higher means during contraction periods (0.89%) as compared to expansion periods (0.38%), with medians equaling 0.57% and 0.25% respectively. These evidences support the general concept of capital flows between different types of securities as economic prospect changes. This theory asserts that in times of contraction investors are more inclined towards using bond markets since bond yields tend to fall and as a result returns from bonds increase. Alternatively, during expansion periods investors would increase their stock holdings and demand for bonds would substantially shrink since bond yields tend to increase and returns from bonds fall.

As Table 8 shows, of the 182 contraction months, 144 were months with a Republican president, and 38 were Democratic months. That may explain why the mean monthly returns during Republican presidencies were higher given that bonds provide higher monthly returns during contraction periods. Of the expansion months, 361 were Republican months, and 441 were Democratic months.

Table 8: Breakdown of Contraction and Expansion Months into Republican and Democratic Presidencies

	Contraction	**Expansion**
Republican	144	361
Democratic	38	441
Total	182	802

The volatilities of monthly returns were higher during contraction periods (2.76%) than during expansion periods (2.14%). This reflects the greater uncertainty during recessions and hence the higher volatility. Contraction data was significantly skewed to the right and expansion data was skewed to the left. The lowest returns during a contraction month (-7.13%) was in December 1981 and in July 2003 for expansion period (-9.82%). The highest return for contraction period (15.23%) was in April 1980 as markets were rebounding after a year long extremely low returns.

Crisis Periods: The mean monthly returns during the various crisis years are shown in Table 8. Except for the Great Depression which was an economic and financial crisis, the other periods are war related. Contraction periods were

good for bond investing, and that is borne out by the mean monthly returns during 43 months of the Great Depression. War periods have proved to be boon for the stock market and hence a bane for bonds.

Table 9: Mean Monthly Total Returns (%) of Long Term Government Bonds in Periods of Crisis

Period	From	To	Mean
Great Depression	October-1929	November-1933	0.43
World War II [1]	January-1939	August-1945	0.33
World War II [2]	December-1941	August-1945	0.26
Korean War	June-1950	July-1953	-0.12
Vietnam War[4]	August-1964	January-1973	0.19
Vietnam War [5]	August-1964	April-1975	0.2

Notes: 1: The entire war period.
2: This is when America formally entered the war.
3: We start with the returns of July 1950.
4: The start of the Vietnam War is assumed as August 1964 when President Johnson got Congressional authorization for use of force for going into combat operations. Prior to that, the U.S. had mainly training and support role with the South Vietnamese Armed Forces. The war formally ended on April 30, 1975, but in this case, the end of U.S. active involvement is taken as the Paris accord of January 1973.
5: This scenario takes into account the final fall of the South Vietnamese regime.

Part of the Vietnam War period was Republican President Nixon's presidency (January 1969 to August 1974) and then it was Republican President Ford (August 1974 to January 1977). The Vietnam War cost $118 billion, and started the inflationary cycle that engulfed the Carter presidency (February 1977 to January 1981). The mean monthly return during Carter presidency was -0.02% (not included in the table).

The means of monthly returns during World War II, Korean War, and Vietnam War are lower than the mean monthly returns for the entire period (0.50%), but lower than for the Great Depression, and higher than the mean monthly return during Democratic presidencies (0.33%). So we find that the Depression years were good for bond investing. The depression in the stock market caused bond returns to be higher.

The mean return during the Korean War (0.03%) was much lower than the means of monthly returns for World War II and the Vietnam War (0.23% to 0.28%). When United States entered World War II it had to finance the skyrocketing government spending. Interest rates were pegged at low levels which caused bond returns during the war to be reasonably high. With the outbreak of Korean War in 1950, interest rates began to increase. The Fed was forced to expand the monetary base at a fast pace. The CPI rose 8% between

1950 and 1951 and interest rate pegging was abandoned. That caused the mean monthly return during the Korean War to be low as interest rates rose. The Fed could not keep interest rates at low levels for large part of the Vietnam War. The cost the war and resulting borrowing interest rates to go up. The average monthly returns from bonds during the war went up.

SUMMARY AND CONCLUSION

We analyzed the seasonality of total monthly returns of long term government bonds for the period January 1926 to December 2007. We explored three types of month effects: if the mean of monthly returns for the entire data set as well as for each month was different from zero, if the mean of monthly returns for a month was different from the mean of the other eleven months stacked together, and if variance of monthly returns for a month was different from the variances of the other eleven months. We also partitioned the data into three sub-periods based on structural changes in the economy. Further, we explored monthly seasonality based on Republican and Democratic presidencies. In addition, we looked at the nature of monthly returns based on periods of contraction and expansion as well as periods of crisis.

The mean of monthly total returns of long term government bonds for the entire data set (0.47%) was found to be significantly greater than zero. The means of four months were significantly greater than zero. The mean of total monthly returns of none of the months was significantly greater than the mean monthly returns of the other eleven months stacked together. The means of monthly returns do not show a discernible trend. We find evidence of month effect with respect to variances of monthly returns. When we sliced the data into three sub-periods, we do not find any discernible pattern in monthly seasonality. The mean of monthly returns during the Republican presidencies (0.64%) was significantly higher than during the Democratic presidencies (0.30%). Long term government bonds had significantly higher mean returns during contraction periods than during expansion periods. The Great Depression was good for the bond market; war periods are comparatively not as attractive for bond investing because of the tendency of governments to peg interest rates during such periods. Though not fully efficient, the U.S. government long term bond market exhibits a high degree of efficiency.

Similar analysis of intermediate term government market, the T-Bill market, high-grade corporate bond market, and the junk bond market will greatly increase our understanding of the behavior of bond markets. We plan to follow up with that line of research.

REFERENCES

Bachelier, L., 1900, Theorie de la Speculation. Paris, Gauthier-Villars, reprinted 1964, in P. Cootner, ed.: The Random Character of Stock Market Prices (Massachusetts Institute of Technology, Cambridge, Massachusetts), 17 – 78.

Chang, E. C. and J. M. Pinegar.(1986) Return Seasonality and Tax-Loss Selling in the Market for Long-Term Government and Corporate Bonds, *Journal of Financial Economics*, Dec, Vol. 17 pp. 391-415.

Chien, Chin-Chen, Cheng-few Lee and Andrew M. L. Wang (2002) A note on stock market seasonality: The impact of stock price volatility on the application of dummy variable regression model, *The Quarterly Review of Economics and Finance,* Spring, Vol. 42, pp. 155-62.

Cooper, R. A. and J. M. Shulman. (1994) The Year-End Effect in Junk Bond Prices, *Financial Analysts Journal*, Sept/ Oct, Vol. 50, pp. 61-65.

Cowles, A., 1933, Can Economic Forecasters Forecast? Econometrica 7(3), 229 – 263.

Hamid, S. A. and Dhakar, T. S. (2005) "Behavior of DJIA: A Hundred Year Analysis of Means and Volatility, *Working Paper No. 2005-04,* The Center for Financial Studies, Southern New Hampshire University.

Jordan, S. D. and B. D. Jordan (1991) Seasonality in Daily Bond Returns, *Journal of Financial and Quantitative Analysis*, Jun, Vol. 26, pp. 269-285.

R.G. Ibbotson Associates, Ibbotson Associates, Capital Market Research Center and Morningstar, Inc. (2008) Stocks, Bonds, Bills and Inflation 2008 Yearbook , *R.G. Ibbotson Associates,* pp. 36-37, pp. 241-261.

Schneeweis, T. and J. R. Woolridge. (1979) Capital Market Seasonality: The Case of Bond Returns, *Journal of Financial and Quantitative Analysis*, Dec, Vol. 14, pp. 939-958.

Smirlock, M.(1985) Seasonality and Bond Market Returns. *Journal of Portfolio Management*, Spring, Vol. 11, pp. 42-44.

Wilson, J. W. and C. P. Jones. (1990) Is There a January Effect in Corporate Bond and Paper Returns? *The Financial Review*, Feb, Vol. 25, pp. 55-75.