

EMPIRICAL ANALYSIS OF RELATIVE MOVEMENT BETWEEN RETURN ON BOND INDEX AND STOCK INDEX IN AMERICAN MARKET

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ABSTRACT

The study of relationship between bond return and equity return has always been a topic of great interest. Given the increasing complexity of financial system and contribution of bonds and equities in portfolio selection, it has become necessary to study this dynamics from the scratch in post financial crisis era. In the last decade hedge funds and high frequency trading has changed the dynamics and process of trade and transaction of financial products. We have tried to study this relationship through return on yield of bond index with return on value weighted equity index with dividend and equal weighted equity return index with dividend on monthly data for last thirty years. We have found that in the decade of 2000-11 many prevailing relationships have ceased and have been replaced by new ones, which are tested through different statistical tools in this study. We find that correlation between return on bond index and return on equity index has changed. With it we also find that movement between yield return equity return are less likely to follow a prevailing pattern. We have applied techniques of regression, lag variable analysis, correlation analysis and plotting to perform our study.

KEYWORDS: return on yield of bond index, return on value weighted equity index with dividend, equal weighted equity return index with dividend, correlation, regression

INTRODUCTION

Bond and equity are fundamental pillars of financial market. These two have been the prime constituent of any portfolio in financial market irrespective of whether it is hedge fund or commercial bank or some utilities firm or else. Everyone has been creating his portfolio under this wisdom. This has added a lot of complexity. With easy and regular access of information through advances in technology and application of newer knowledge and efficiency in analysis has made market a mystic place. There are a lot of people and everyone is pursuing a different agenda with full intensity i.e arbitrageur, hedger, speculator, etc. This has led to the multidimensional complexity which needs deeper analysis and understanding to achieve the

goals. The co-movement and correlation analysis of asset class has played an important role in asset allocation in portfolio management and risk diversification process. But now it is not optimal to find the correlation and expect a big alpha from portfolio. We need many other considerations for the same problem of resource allocation in portfolio which has primarily been contested between bonds and equities. For example; reflections have been taken in terms of finding whether the performance of bonds are co-integrated with equities. If the answer is yes then to what extent; whether this co-integration prevails in long term or short term, etc. Another question which has lately crept in understandings the causal relationship between equities and bonds returns. There has been a lot of debate on which causes whom. Who leads; which lags? These questions have gained a lot of importance now as the quest of high return has put portfolio managers in pilot seat of a high speed car where they don't hesitate to review their portfolio every day. The application of automated trading has changed the market dynamics. Given such furious pace of market where even a small lead in understanding can do wonders, even a small change in macro and micro economic factors, other pertinent information can change market drastically; it attracts the need to test the old wisdom on empirical ground again. In this paper I present the preliminary analysis between monthly returns on bond index and equity indexes. This paper aims to examine the co-movement, correlation and causal structure between return on stock and bond market indices over a period from Jan 1980 to Dec 2011.

PURPOSE OF STUDY

This study tries to find the answer of four questions mentioned below. This study aims to find the answers for these questions through empirical study of data collected over last three decades and validate the prevailing wisdom if required with modification. The questions are:

- What is correlation between return on stock index and bond index? Is there any important pattern in correlation relationship overtime?
- Is there any co-integration between return on stock indexes and bond indexes?
- Does any causal relationship between stock index and bond index exist?

LITERATURE REVIEW

Federal Reserve Bank of Atlanta working paper series 2002-03 studies stock market uncertainty and relation between stock and bond returns. Ali Ahmed(2009) investigates equilibrium relation between stock index and bond index. Li (2001) investigates various macro-business cycle variables that may affect the equity-bond return correlation and concludes that uncertainty about expected inflation is the most dominant. Connolly, Stivers, and Sun (2004) propose making the co-movement of equity and bond returns a function of stock return uncertainty, which they measure by the VIX index. However, the unconditional correlation is found to be small. A vast body of research has been invested in the research to understand the co-movements between the stock and bond markets by Barsky (1989), Fama and French(1989), Shiller and Beltratti (1992), Campbell and Ammer(1993) and Fleming, Kirby and Ostdiek(1998). There has been a view that changes in return co-movements might be due to changing fundamentals, Campbell and Ammer (1993). Cross-market hedging Fleming, Kirby and Ostdiek(1998) and pricing influences related

to time-varying economic uncertainty Veronesi(1999) and (2001) has been some major inspiration for this body of work.

DATA

The monthly data for return on bond index yield is collected for corporate bonds from yield book. The data was provided in terms of monthly yield which was modified to get monthly return on yield. For the stock index return data, CRSP data was used. We have taken two equity indexes Value weighted index with dividend return and Equity weighted index return including dividend for study. Rationale for such selection is to get the understanding of relationship of bonds index return in both kind of equity setup and to find if there is any major change in relationship between bond yield return index and these two indexes. The data has been collected for a period from Jan'80 to Dec 2011.

RESEARCH DESIGN

The data has been collected for more than thirty years. This gave us advantage of having enough data points to analyze pattern of every decade separately, which has been done in this study and has found different trends in decades. A collective study for thirty years is also done. The study has been done in three extensive domains. First study consists of plotting all the returns on bond yield index and value weighted return index and equal weighted return index and infer the basic pattern through eyeballing and general observation which has been fair enough in sense of providing a general pattern of thirty years for understanding of highs and lows of overall market and co-movement of these three indexes. Second study consists of finding the correlation between all three returns for different decades and for overall three decades time period. This gives a fair understanding of correlation movement pattern for indexes which can be directly interpreted for the contribution of common factors in movement of bonds and equities. The third and most important study has been to find the causal relationship and co-movement factors for the return on bond index and value weighted index return and equity weighted index return. For this study we have applied the regression techniques. We have regressed for following relationship:

Model1 $VWRET_{D,t} = USBCret_{t-1} + \epsilon_{t-1}$
Mode2 $VWRET_{D,t} = EWRET_{D,t-1} + \epsilon_{t-1}$
Mode3 $USBCret_{t-1} = EWRET_{D,t-1} + \epsilon_{t-1}$
Mode4 $USBCret_{t-1} = VWRET_{D,t-1} + \epsilon_{t-1}$
Mode5 $EWRET_{D,t-1} = USBCret_{t-1} + \epsilon_{t-1}$
Mode6 $EWRET_{D,t-1} = VWRET_{D,t-1} + \epsilon_{t-1}$
Mode7 $EWRET_{D,t-1} = VWRET_{D,t-1} + USBCret_{t-1} + \epsilon_{t-1}$
Mode8 $EWRET_{D,t-1} = VWRET_{D,t-1} + USBCret_{t-1} + \epsilon_{t-1}$

Where $VWRET_{D,t}$ is Return on Value Weighted Index including Dividend

EWRETD is Return on Equal Weighted Index including Dividend

USBCret is return on yield of Corporate Bond Index

Lag01 is 1st time lag of factor

These eight models have been regressed by firstly being regressed for overall time period and secondly for the separate decades.

SCOPE AND LIMITATIONS

The beauty of this study lies in taking samples in value weighted index and equal weighted index, which has not been found in previous work on this topic. Another key thing of study is taking the corporate bond index. There are many studies which take treasury returns for study, but in my view corporate bond yields index better represent the comparative bond market. This study analyses the regular trend and change if any, in bond-equity index returns decade-wise for last three decades, which should give a fair understanding of market movement in course in time by explaining if bond index and equity index are getting into synergy or not. This study should also establish the causal relationship between return on bond index and equity index. We have also regressed the factors which should give a broad understanding of relative movement of factors. The decade wise correlation analysis should bring detail of pattern movement. This study has been done on monthly data, which if done on daily data can provide deeper understanding of microstructure and relationship. The study can also be elaborated for different bond indexes which are available in thousands. In my view a thorough study of return on equity index and junk bond index should be very useful to understand the market structure.

RESULTS

Regression Analysis:

The Overall Time Period Analysis: Table –I.

For the time period of Jan'80 to Dec'11, the regression results observe that R-square has been very small in all the regression models except regression of VWRETD with EWRETD. The high R-square for regression between VWRETD and EWRETD is as per expectation, as these two factors represent the same stock market with different weightage of different constituents. So, we couldn't expect R-square equal to one but high value was expected. In the case of regression of USBCret with VWRETD and EWRETD, and their lag has been different. R-square in these cases has not been above 0.25 in any case. This shows that explanatory power of return on bond index for return on equity index and vice versa is very low. For the test we regressed USBCretas dependent variable for explanatory variable VWRETD, EWRETD and their lag separately. We also regressed USBCret as explanatory variable and VWRETD and EWRETD as dependent variable. In both the cases we found low R-square. To find the effect of lag factor, we had taken the lag01 factor of explanatory variable in consideration, which is surprisingly significant in most of the cases. The other mystic result is intercepts being insignificant. The insignificant intercept infers that there is no portion of dependent variable left unexplained by the explanatory

variable but the same time small R-square says lower explanation. At the same time looking at the correlation between factors, we can see that correlation between factors, (whose regression R-square has been small) is around twenty five to thirty percent, which can be taken as a modest value. The significance of lag factor shows that it is not that data points of both dependent and explanatory variables are following each other by coincidence but they are somewhere related at the level of basic nature and property of data points, which represent the returns on bond index and equity index. To bolster this idea the several lag factors can be used to check if this assumption is right.

Given the modest correlation, insignificant intercept, and significant dependent variable and its lag in my view we can use the return on one index to forecast the return on other index.

The Segmental Time Period Analysis:

The segmental time frame has been taken as three time periods of one decade, i.e. from 1980-90, 1991-00, 2001-2011.

Table II: Regression of VWRETD vs USBCret, lag01USBCret: The segmental time frame analysis shows the same basic result for all the three periods which shows that there is no major change in macro perception of equity and bond market over time. This also shows that there has not been any significant change in explanatory power of the dependent factor's movement by explanatory factors, as explanatory power is small for all the periods (courtesy: small R-square). There is one interesting observation of lag factor being insignificant for the decade of 2001-2011, which infers that relationship between bond index return and equity index return and their co-movement might be diminishing somehow. This assumption is supported by the diminishing correlation between these factors, which has shed its value by almost fifty percent of its previous decade value (from forty percent to twenty one percent for decade 1991-2000 to 2001-11). This gives a blow to the assumption that in future financial market will get more and more integrated. This phenomena can be explained by looking backwards where can see the surge in trading volume of equities in last decade, which was mainly by hedge funds and high frequency trading (which contribute around seventy percent of overall equity trade), which is not based on the conventional market perception of risk and return but based on exploiting operational imperfections and other things. This gives a plausible explanation for decreasing correlation between return on bond index and return on equity index. In this way, we can expect lesser correlation between equity index return and bond index return in future. With this we can also assume that high frequency trading doesn't make market efficient in risk return way but takes it in some other direction. We can say so, because correlation between bond index and return and equity index return is diminishing. It is understood that bonds and equities have different reasons of movement and that's why we don't expect high correlation between them. But the correlation of thirty percent can be attributed towards the common factor bond and equities hold, which in my view can be taken as common attributes of risk return. For equities, decrease in this factor can be taken as movement is some different direction.

Table III: Regression of USBCret vs VWRETD, lag01VWRETD:

There is a curious result. Above in table II we find that regression of VWRETD as dependent and USBCret, lag01USBCret as explanatory factors have insignificant intercept, significant lag factor and small R-square, but in the regression of USBCret as dependent factor and VWRETD

and lag01VWRETD as explanatory factor have significant intercept and insignificant lag factor. This shows that movement of USBCret is not explained fully by VWRETD and its lag factor but movement of VWRETD is explained by USBCret and its lag factor. This shows that movement of VWRETD can be followed by USBCret, but movement of USBCret can't be followed by VWRETD. This assumption is also boosted by significance of lag factor for regression of VWRETD with USBCret, lag01 USBCret, and insignificance of lag factor in case of regression of USBCret with VWRETD and lag01VWRETD. This means that USBCret is a leading factor in between bond index return and equity index return. This also means that traders can take the hint from bond market and add other factors (i.e operational and other factors used in case of high frequency trading) to reach to future market price of equity.

Table IV: USBCret vs EWRETD, lag01EWRETD: In the same spirit of analysis for USBCret vs VWRETD, lag01VWRETD, analyzing this relationship we find that neither the movement of USBCret is explained fully by EWRETD and its lag factor nor is EWRETD explained by USBCret and lag01USBCret.

Insignificance of lag factor for regression of USBCret with EWRETD, lag01EWRETD and regression of EWRETD with USBCret, lag01 USBCret shows that there is no lead or lag factor in between USBCret and EWRETD.

Table V: EWRETD vs USBCret, lag01USBCret:

This regression provides different results for different periods. The USBCret factor has been insignificant for 1980's and 1990's, which can be explained by lesser participation of small firms in active issuance of investment grade bonds. The deeper inference of this regression should be avoided as most of the factors are insignificant which coupled with low R-square shows that factors are neither related nor explained.

Table VI: EWRETD vs VWRETD, lag01VWRETD:

In this regression all the results have been as per expectation except the significant intercept for decade 2001-11. In my view significant intercept in decade of 2001-2011 can be attributed to higher volume of trading on larger firm, which makes VWRETD more liquid than EWRETD and such liquidity premium is showing in terms of intercept. Another explanation we can put is that larger firms trade with tight spread, and as they have bigger representation in VWRETD; the return on VWRETD is supposed to be tighter with respect to EWRETD where smaller firms have bigger representation. This explanation seems plausible but curious fact is that when we regress VWRETD as dependent variable with EWRETD, lag01EWRETD as independent variable, the result comes just opposite in terms of significance of intercept, where it is insignificant for time period 2000-2011 but significant for 1980-90, 1991-2000.

Correlation Analysis:

VWRETD and EWRETD enjoy high correlation in all the decades, It decreased to seventy four percent in decade of 90's but has since increased to ninety percent in next decade. The correlation between VWRETD and Bond Index Return has been increasing in last two decades but in decade of 2000 it has dramatically decreased by around fifty percent to reach the value of

twenty percent. The correlation between Bond Index Return and EWRETD has been increasing through all the decades, but current correlation is still around twenty percent. Average correlation for whole period Cor(bond index return, VWRETD) is 29.44 percent. Cor(bond index return, EWRETD) is 21.11 percent. Cor(VWRETD, EWRETD) is 86.17 percent.

CONCLUSION

With our results we are able to infer that there is correlation between bond yield return indexes, value weighted equity return index with dividend and equal weighted equity return index with dividend. Correlation between bond yield return index and value-weighted index return with dividend has been declining in decade of 2000, and currently holds around twenty percent but correlation between return on yield index and equal weighted index has been growing and has reached to twenty percent in decade of 2000. This relationship can be attributed to high volume of equity trading by hedge funds and high frequency traders in last decade, which has been based on many different attributes than conventional financial aspects. With regression result we have reached to conclusion that there is relationship in movement between return on yield index, value weighted index and equal weighted index but the explanatory power of one factor to explain other's movement is very low, except the case of value weighted return and equal weighted return which being the equity return indexes were supposed to be highly correlated. We also find that in some cases return on bond index can be taken as a leading factor for analysis of return on equity index. We find that many prevailing trends like correlation between indexes have changed in last decade. We also find that most probably high frequency trading has changed the fundamentals of equity trading.

Refernces:

- Chen, N. F, R.Roll, and S. Ross (1986) "Economic Forces and the Stock Market", Journal of Business, 59(3) 383-403
- Ahmed (2009) "The Equilibrium Relations between Stock Index and Bond Index: Evidence from Bursa Malaysia", International Research Journal of Finance and Economics
- Lee, Marsh, Maxim, Pflleiderer(2006) "Co-Movements between Daily Returns on Global Bonds and Equities: A First Look", Working paper
- Litterman, Robert, and Jose Scheinkman, Jose, 1991, "Common Factors affecting Bond Returns," Journal of Fixed Income, June, 54-61.
- Chan, Louis K.C., J. Kaceski and J. Lakonishok, (1998) "The Risk and Return from Factors", Journal of Financial Quantitative Analysis", 33(2), 159-1888

Tables, Plots

Table-I:

Time Period	1980-2011					
Dependent Variable	Explanatory variable	Estimate	Error	T-value	Prob.	R-sqr
VWRETD	Intercept	0.00387	0.00242	1.60	0.1104	0.1053
	USBCret	0.4766	0.08169	5.85	<0.0001	
	lag01USBCret	0.18466	0.08119	2.27	0.0235	
USBCret	Intercept	0.00740	0.00141	5.26	<0.0001	0.1016
	VWRETD	0.18909	0.02940	6.43	<0.0001	
	Lag01VWRETD	-0.05562	0.02934	-1.90	0.0588	
EWRETD	Intercept	0.00489	0.00292	1.67	0.0951	0.0768
	USBCret	0.39282	0.09876	3.98	<0.0001	
	Lag01USBCret	0.32297	0.09816	3.29	0.0011	
USBCret	Intercept	0.00811	0.00142	5.73	<0.0001	0.0758
	EWRETD	0.13469	0.02578	5.23	<0.0001	
	Lag01EWRETD	-0.08282	0.02568	-3.23	0.0014	
EWRETD	Intercept	-0.00064	0.00140	-0.46	0.6444	0.7732
	VWRETD	1.00421	0.02922	34.37	<0.0001	
	Lag01VWRETD	0.21128	0.02916	7.24	<0.0001	
VWRETD	Intercept	0.00258	0.00120	2.15	0.0318	0.7600
	EWRETD	0.75345	0.02183	34.52	<0.0001	
	Lag01EWRETD	-0.11680	0.02175	-5.37	<0.0001	

Table II:

Dependent	Variable = VWRETD					
Time Period	Explanatory Variable	Estimate	Error	T-value	Prob.	R-Sq.
1980-90	Intercept	0.00572	0.00449	1.27	0.2050	0.1422
	USBCret	0.42412	0.12504	3.39	0.0009	
	Lag01USBCret	0.25409	0.12275	2.07	0.0407	
1991-2000	Intercept	0.00786	0.00365	2.15	0.0333	0.1986
	USBCret	0.95394	0.17760	5.37	<0.0001	
	Lag01USBCret	-0.07079	0.17808	-0.40	0.6917	
2001-2011	Intercept	-0.00158	0.00425	-0.37	0.7098	0.0626
	USBCret	0.36654	0.14029	2.61	0.0100	
	Lag01USBCret	0.18283	0.14085	1.30	0.1964	

Table III

Dependent	Variable =USBCret					
Time Period	Explanatory Variable	Estimate	Error	T-value	Prob.	R-Sq.
1980-90	Intercept	0.00987	0.00311	3.18	0.0019	0.1358
	VWRETD	0.24242	0.06072	3.99	0.0001	
	Lag01VWRETD	-0.11135	0.06043	-1.84	0.0679	
1991-2000	Intercept	0.00468	0.00171	2.74	0.0071	0.2019
	VWRETD	0.20845	0.03889	5.36	<0.0001	
	Lag01VWRETD	-0.03180	0.03942	-0.81	0.4215	
2001-2011	Intercept	0.00718	0.00237	3.03	0.0029	0.0527
	VWRETD	0.13578	0.048486	2.80	0.0058	
	Lag01VWRETD	-0.02121	0.04802	-0.44	0.6594	

Table IV

Dependent	Variable =USBCret					
Time Period	Explanatory Variable	Estimate	Error	T-value	Prob.	R-Sq.
1980-90	Intercept	0.01173	0.00307	3.82	0.0002	0.1015
	EWRETD	0.16373	0.05712	2.87	0.0049	
	Lag01EWRETD	-0.16221	0.05646	-2.87	0.0048	
1991-2000	Intercept	0.00661	0.00173	3.81	0.0002	0.0758
	EWRETD	0.10879	0.03705	2.94	0.0040	
	Lag01EWRETD	-0.06783	0.03738	-1.81	0.0721	
2001-2011	Intercept	0.00671	0.00238	2.82	0.0055	0.0751
	EWRETD	0.12974	0.03851	3.37	0.0010	
	Lag01EWRETD	-0.04121	0.03832	-1.08	0.2840	

Table V

Dependent	Variable =EWRETD					
Time Period	Explanatory Variable	Estimate	Error	T-value	Prob.	R-Sq.
1980-90	Intercept	0.00458	0.00517	0.89	0.3774	0.0916
	USBCret	0.23569	0.14381	1.64	0.1040	
	Lag01USBCret	0.37109	0.14119	2.63	0.0097	
1991-2000	Intercept	0.00832	0.00469	1.77	0.0787	0.0540
	USBCret	0.53690	0.22822	2.35	0.0203	
	Lag01USBCret	0.16651	0.22883	0.73	0.4683	
2001-2011	Intercept	0.00237	0.00529	0.45	0.6545	0.0915
	USBCret	0.52238	0.17465	2.99	0.0033	
	Lag01USBCret	0.33839	0.17534	1.93	0.0556	

Table VI

Dependent	Variable = EWRETD					
Time Period	Explanatory Variable	Estimate	Error	T-value	Prob.	R-Sq.
1980-90	Intercept	-0.00409	0.00224	-1.83	0.0704	0.8239
	VWRETD	0.98854	0.04370	22.63	<0.0001	
	Lag01VWRETD	0.15909	0.04349	3.66	0.0004	
1991-2000	Intercept	-0.00452	0.00274	-1.65	0.1019	0.6746
	VWRETD	0.91216	0.06239	14.62	<0.0001	
	Lag01VWRETD	0.36165	0.06324	5.72	<0.0001	
2001-2011	Intercept	0.00540	0.00274	-1.65	0.1019	0.6746
	VWRETD	0.91216	0.06239	14.62	<0.0001	
	Lag01VWRETD	0.361165	0.06324	5.72	<0.0001	

Table VII

Dependent	Variable = VWRETD					
Time Period	Explanatory Variable	Estimate	Error	T-value	Prob.	R-Sq.
1980-90	Intercept	0.00530	0.00198	2.68	0.0084	0.8171

	EWRETD	0.82971	0.03677	22.57	<0.0001	
	Lag01EWRETD	-0.10620	0.03634	-2.92	0.0042	
1991-2000	Intercept	0.00721	0.00233	3.09	0.0025	0.6288
	EWRETD	0.70188	0.04987	14.07	<0.0001	
	Lag01EWRETD	-0.18994	0.05032	-3.77	0.0003	
2001-2011	Intercept	-0.00299	0.00183	-1.63	0.1053	0.8118
	EWRETD	0.72842	0.02970	24.53	<0.0001	
	Lag01EWRETD	-0.09470	0.02955	-3.21	0.0017	

Correlation Table:

Correlation matrix: for 1980-2011

	YieldReturn	VWERD	EWERD
YieldReturn	1.000000		
VWERD	0.294416	1.000000	
EWERD	0.211160	0.861769	1.000000

Correlation matrix for 1980-90.

	YieldReturn	VWERD	EWERD
YieldReturn	1.000000		
VWERD	0.333439	1.000000	
EWERD	0.185405	0.896293	1.000000

Correlation matrix for 1991-00:

	YieldReturn	VWERD	EWERD
YieldReturn	1.000000		
VWERD	0.385266	1.000000	
EWERD	0.193256	0.749588	1.000000

Correlation matrix for 2001-11

	YieldReturn	VWERD	EWERD
YieldReturn	1.000000		
VWERD	0.218210	1.000000	
EWERD	0.256448	0.906951	1.000000