
Risk Measurement of the Bond Mutual Funds Operating in Greece

John N. Sorros*

Abstract

The present article aims to measure and analyze the systematic risk undertaken by the Greek bond mutual funds. The capital asset pricing model is applied using as an approximation of the market portfolio the General Index of the Athens Stock Exchange, and a specific Bond Index. The performance of twenty-eight mutual funds is affected, and can be explained to a satisfactory level by the movements in the Bond Index. On the contrary, in only fifteen mutual funds the performance is affected, and can be explained to a satisfactory level by the movements in the General Index of the ASE. The empirical evidence suggests that the Bond Index approximates the market portfolio much closer than the General Index of the Athens Stock Exchange.

Keywords: Mutual funds, bond, bond index, capital asset pricing model

JEL Classification: G20, G23

1. Introduction

An attempt is made to measure and analyze the systematic risk undertaken by the bond mutual funds operating in the Greek financial market over the period 15-3-1999 to 31-12-2001.

The capital asset pricing model is applied using as an approximation of the market portfolio (Greek bond market), first the General Index of the Athens Stock Exchange (ASE), and secondly a specific Bond Index.

The Bond Index used is that developed by P. G. Artikis (2003a). This is the weighted average of all bond issues which satisfy the following conditions: (a) they are bond that have been issued by the Greek state, (b) they provide either fixed or floating interest rate, (c) the amount of outstanding bonds should be greater than 200 billion drachmas in order to overcome the problem of thin trading, and (d) they should be outstanding during the whole period under consideration.

The results from the applications of the Bond Index, and the General Index of the ASE are compared with each other to decide which of these two indices approximates closer the market portfolio.

* Deputy General Manager ATE Leasing S.A.
2 Ermou Str., Athens 10561, e-mail: sorros@otenet.gr

2. Return

The return of the bond mutual funds per unit was calculated as follows:

$$R_t = \frac{NAV_t - NAV_{t-1}}{NAV_{t-1}}$$

where,

R_t = Return of bond mutual fund before taxes

NAV_t = Net asset value per unit during the period t

NAV_{t-1} = Net asset value per unit during period the period t-1

It should be noted that during the period under consideration the sample bond mutual funds did not pay dividends. Also, the tax rate is same for all bond mutual funds operating in Greece, therefore, there is no reason to compute the return after taxes.

3. Risk

The capital asset pricing model with independent variable the General Index of the ASE is as follows (Elton, and Gruber 1995):

$$R_i = a_i + b_i R_{si} + \varepsilon_i$$

where,

R_i = Return of bond mutual fund i

a_i = Return of bond mutual fund i when the market is constant

b_i = Beta coefficient of bond mutual fund i

R_{si} = Return of stock index (market portfolio)

ε_i = Non systematic factors that are independent from the market fluctuations

The capital asset pricing model with independent variable the proposed Bond Index is as follows:

$$R_i = a_i + b_i R_{bi} + \varepsilon_i$$

where,

R_{bi} = Return of bond index (market portfolio)

The Econometric Views (1997-1999) have been used for the needs of the regression analysis. The methods of Durbin-Watson (Anderson, Sweeney, and Williams 1999), and White (Salvatore 1996) have been applied to test the results for autocorrelation, and heteroscedastisity respectively.

4. The Sample

The sample includes all the bond mutual funds operating in the Greek financial market over the period 15-3-1999 to 31-12-2001. These bond mutual funds amount to 30. For each of these 30 bond mutual funds, daily data where collected.

5. Findings

The results from the use of the General Index of the ASE as an approximation of the market portfolio point out the existence of autocorrelation (20 mutual funds), and heteroscedasticity (15 mutual funds), which in turn have been corrected properly.

Combining the information presented in Tables 1 and 2 it becomes apparent that fifteen mutual funds have both beta coefficient statistically significant at 5 per cent level of significance, and coefficient of determination higher than 10 per cent. This means that the performance of these mutual funds is not only affected, but also can be explained to a satisfactory level by the movements in the General Index of the ASE. These mutual funds are shown in decreasing order on the basis of the coefficient of determination in Table 1. From the remaining fifteen mutual funds, eight have statistically significant beta coefficient at 5 per cent level of significance, while all of them have coefficient of determination less than 10 per cent.

With probability 95 per cent, all sample mutual funds are expected to achieve beta coefficient lower than 1. This means that the above fifteen mutual funds are defensive in relation to the General Index of the ASE. The sample mutual funds in decreasing order on the basis of beta coefficient are shown in Table 2.

Thirteen from the above fifteen mutual funds have alpha coefficient statistically not significant at 5 per cent level of significance (Table 3). Put another way, only two out of fifteen mutual funds show values for alpha coefficient different than zero value that is assumed by the capital asset price in model.

The results from the use of the proposed Bond Index as an approximation of the market portfolio point out the existence of autocorrelation (21 mutual funds), and heteroscedasticity (23 mutual funds), which in turn have been corrected properly.

Combining the information presented in Tables 4 and 5 it becomes apparent that twenty-eight mutual funds have both beta coefficient statistically significant at 5 per cent level of significance, and coefficient of determination higher than 10 per cent. This means that the performance of these mutual funds is not only affected, but also can be explained to a satisfactory level by the movements in the Bond Index. These mutual funds are shown in decreasing order on the basis of the coefficient of determination in Table 4. The remaining two mutual funds have coefficient of determination less than 10 per cent, although they have statistically significant beta coefficient at 5 per cent level of significance.

With probability 95 per cent, all sample mutual funds are expected to achieve beta coefficient lower than 1. This means that all sample mutual funds are defensive in relation to the Bond Index. The sample mutual funds in decreasing order on the basis of beta coefficient are shown in Table 5.

Twenty-six from the above twenty-eight mutual funds have alpha coefficient statistically significant at 5 per cent level of significance (Table 6). Put another way, only two out of twenty-eight mutual funds show values for alpha coefficient equal to zero value that is assumed by the capital asset price in model.

Comparing the adjusted coefficients of determination that appeared in the Table 7 it becomes apparent that in only four out of thirty mutual funds the General

Index of the Athens Stock Exchange approximates the market portfolio closer than the Bond Index.

6. Conclusions

The performance of twenty-eight mutual funds is affected, and can be explained to a satisfactory level by the movements in the Bond Index. In addition, all sample mutual funds are defensive in relation to the Bond Index.

On the contrary, in only fifteen mutual funds the performance is affected, and can be explained to a satisfactory level by the movements in the General Index of the ASE. Besides, these fifteen mutual funds are defensive in relation to the General Index of the ASE.

Put another way the proposed Bond Index appears to approximate the market portfolio much better than the General Index of the Athens Stock Exchange. This also results from the fact that in only four mutual funds the adjusted coefficient of determination on the basis of the General Index of the ASE is higher than the corresponding coefficient on the basis of the Bond Index.

It is worth emphasizing that the present research supports the empirical evidence resulted from other research carried out in the bond mutual funds operating in the Greek financial market (Artikis G. P. 2003b).

References

1. Anderson D. R., D. J. Sweeney, T. A. Williams, 1999, "*Statistics for Business and Economics*", South- Western College Publishing, 7th Edition, USA, pp.712-718.
2. Artikis Panayiotis G., 2003, "Measuring Risk in the Greek Bond Market, An Alternative Approach", *Journal of Managerial Finance*, Vol. 29, No 9, pp.9-20.
3. Artikis George P., 2004, "Risk Analysis, A Case Study of the Greek Bond Mutual Funds", *Journal of Managerial Finance*, 2004.
4. Elton E. J., M. J. Gruber, 1995, "*Modern Portfolio Theory and Investment Analysis*", John Willey and Sons Inc., 5th Edition, USA, pp. 128-140.
5. QMS, EViews 3.1, 1997 – 1999.
6. Salvatore D. 1996, "*Managerial Economics in a Global Economy*", McGraw – Hill, Inc., 3rd Edition, USA, pp.151-153.

Table 1: Bond Mutual Funds Based on Determination Coefficient (ASE general index)

MUTUAL FUNDS	R^2	Adj R^2	DW
ABN AMRO	.1283	.1271	1.91
ALICO EUROBANK	.0930	.0904	2.00
ALLIANZ DOMESTIC BONDS	.1193	.1167	2.00
ALLIANZ PLUS	.2119	.2107	1.91
ALPHA DOMESTIC BONDS	.0177	.0149	1.99
ALPHA REGULAR INCOME	.1952	.1929	1.99
ALPHA TRUST INCOME	.1377	.1352	2.00
ASPIS	.3051	.3031	2.00
ATE ONCOME	.0259	.0231	1.99
ATE CAPITAL AND GROWTH	.0639	.0612	2.00
ATTIKIS	.2511	.2489	2.06
BETA	.0034	.0005	2.00
CITI INCOME	.0053	.0024	2.00
DELOS	.2061	.2038	1.99
EGNATIA-MYCYNEA	.1574	.1562	1.97
HERMES	.3907	.3890	1.98
EUROBANK	.0094	.0065	2.00
EUROPAIKI PISTI	.0840	.0813	1.97
GENIKI	.2791	.2781	1.91
HSBC	.1319	.1294	2.00
INTERAMERICAN LONG TERM	.0050	.0022	2.00
INTERAMERICAN MIKTO	.2461	.2451	1.95
INTERAMERICAN STABLE	.0026	-.0002	2.00
INTERNATIONAL	.0506	.0493	1.99
IONIKI LIFE	.0004	-.0014	1.96
CYPRUS	.0247	.0218	1.99
LAIKI	.0125	.0097	2.00
METROLIFE	.1245	.1232	1.92
PIRAEUS	.2318	.2306	2.01
SOGEN INCOME	.0292	.0278	1.94

Table 2: Bond Mutual Funds Based on Beta Coefficient (ASE general index)

MUTUAL FUNDS	b	Confidence Interval		T(b)
		Min	Max	
ABN AMRO	.0352	.0268	.0437	8.14
ALICO EUROBANK	.0255	.0166	.0345	5.57
ALLIANZ DOMESTIC BONDS	.0386	.0287	.0485	7.64
ALLIANZ PLUS	.0599	.0492	.0706	10.94
ALPHA DOMESTIC BONDS	-.0001	-.0050	-.0048	-.03
ALPHA REGULAR INCOME	.0157	.0108	.0205	6.32
ALPHA TRUST INCOME	.0334	.0242	.0426	7.13
ASPIS	.0603	.0531	.0674	16.57
ATE INCOME	.0076	.0010	.0143	2.26
ATE CAPIATAL AND GROWTH	.0193	.0127	.0259	5.75
ATTIKIS	.0329	.0257	.0400	9.01
BETA	.0033	-.0037	.0104	.93
CITI INCOME	-.0015	-.0047	.0016	-.97
DELOS	.0350	.0297	.0403	12.98
EGNATIA-MYCYNEA	.0446	.0345	.0547	8.64
HERMES	.0336	.0285	.0387	12.92
EUROBANK	-.0036	-.0115	.0042	-.91
EUROPAIKI PISTI	.0137	.0063	.0211	3.62
GENIKI	.0477	.0420	.0534	16.39
HSBC	.0285	.0194	.0377	6.09
INTERAMERICAN LONG TERM	-.0011	-.0046	.0024	-.62
INTERAMERICAN MIKTO	.0436	.0379	.0493	15.05
INTERAMERICAN STABLE	-.0017	-.0033	.0030	-.10
INTERNATIONAL	.0493	.0334	.0652	6.08
IONIKI LIFE	-.0024	-.0032	.0027	-.15
CYPRUS	.0164	.0077	.0251	3.71
LAIKI	.0109	.0013	.0205	2.22
METROLIFE	.0252	.0203	.0302	9.93
PIRAEUS	.0366	.0299	.0432	10.80
SOGEN INCOME	.0475	.0271	.0678	4.56

Table 3: Bond Mutual Funds Based on Alpha Coefficient (ASE general index)

MUTUAL FUNDS	A	Confidence Interval		t(a)
		Min	Min	
ABN	.000218	.000078	.00036	3.05
ALICO EUROBANK	.000177	.000017	.00034	2.17
ALLIANZ DOMESTIC BONDS	.000201	.000024	.00038	2.22
ALLIANZ PLUS	.000221	.000044	.00040	2.45
ALPHA DOMESTIC BONDS	.000255	.000140	.00037	4.35
ALPHA REGULAR INCOME	.000210	.000139	.00028	5.80
ALPHA TRUST INCOME	.000274	.000116	.00043	3.40
ASPIS	.000110	-.000057	.00028	1.29
ATE INCOME	.000216	.000108	.00032	3.93
ATE CAPITAL AND INCOME	.000252	.000100	.00040	3.24
ATTIKIS	.000386	.000269	.00050	6.48
BETA	.000392	.000254	.00053	5.53
CITI INCOME	.000190	.000146	.00023	8.48
DELOS	.000219	.000102	.00034	3.64
EGNATIA-MYCYNEA	.000146	-.000012	.00030	1.81
HERMES	.000211	.000142	.00028	6.05
EUROBANK	.000292	.000182	.00040	5.19
EUROPAIKI PISTI	.000262	.000140	.00038	4.20
GENIKI	.000211	.000094	.00033	3.52
HSBC	.000299	.000141	.00046	3.70
INTERAMERICAN LONG TERM	.000180	.000104	.00026	4.62
INTERAMERICAN MIKTO	.000175	.000058	.00029	2.92
INTERAMERICAN STABLE	.000218	.000150	.00029	6.28
INTERNATIONAL	.000275	-.000052	.00060	1.64
IONIKI LIFE	.000200	.000139	.00026	6.42
CYPRUS	.000301	.000112	.00049	3.11
LAIKI	.000223	.000011	.00043	2.06
METROLIFE	.000304	.000201	.00041	5.81
PIRAEUS	.000219	.000117	.00032	4.21
SOGEN INCOME	.000413	-.000006	.00083	1.93

Table 4: Bond Mutual Fund Based on Determination Coefficient (BOND index)

MUTUAL FUNDS	R ²	AdjR ²	DW
LAIKI	.8612	.8608	1.99
ATE CAPITAL AND GROWTH	.7112	.7103	1.99
CYPRUS	.7110	.7101	2.02
ALLIANZ DOMESTIC BONDS	.7085	.7081	1.96
ATE INCOME	.6639	.6634	1.98
GENIKI	.5740	.5727	1.99
DELOS	.5709	.5697	1.99
ABN AMRO	.5522	.5509	1.99
ALICO EUROBANK	.5498	.5485	1.99
ALLIANZ PLUS	.5110	.5096	1.99
ALPHA TRUST INCOME	.4891	.4876	2.00
PIRAEUS	.4694	.4679	1.98
ALPHA DOMESTIC BONDS	.4122	.4105	1.99
EGNATIA-MYCYNEA	.3523	.3514	2.00
IONIKI LIFE	.3188	.3178	2.01
INTERAMERICAN MIKTO	.3163	.3143	2.00
HSBC	.2948	.2928	1.99
METROLIFE	.2927	.2907	2.02
EUROBANK	.2755	.2745	1.91
INTERAMERICAN STABLE	.2693	.2672	2.00
CITI INCOME	.2618	.2607	2.05
EUROPAIKI PISTI	.2393	.2371	1.93
HERMES	.1798	.1774	1.97
INTERAMERICAN LONG TERM	.1781	.1758	2.00
ATTIKIS	.1463	.1439	2.05
BETA	.1432	.1419	2.06
ALPHA REGULAR INCOME	.1392	.1367	1.97
ASPIS	.1273	.1247	1.97
INTERNATIONAL	.0799	.0786	1.97
SOGEN INCOME	.0711	.0697	1.95

Table 5: Bond Mutual Funds Based on Beta Coefficient (BOND index)

MUTUAL FUNDS	b	Confidence Interval		t(b)
		Min	Max	
ABN AMRO	.5949	.5353	.6545	19.56
ALICO EUROBANK	.5760	.5127	.6394	17.81
ALLIANZ DOMESTIC BONDS	.7887	.7345	.8430	28.50
ALLIANZ PLU	.7592	.6811	.8373	19.05
ALPHA DOMESTIC BONDS	.3372	.2782	.3962	11.19
ALPHA REGULAR INCOME	.0962	.0727	.1197	8.03
ALPHA TRUST INCOME	.5487	.4819	.6155	16.09
ASPIS	.2901	.2087	.3716	6.98
ATE INCOME	.4289	.4062	.4516	37.02
ATE CAPITAL AND GROWTH	.6179	.5681	.6677	24.31
ATTIKIS	.1780	.1211	.2349	6.13
BETA	.2947	.2411	.3484	10.76
CITI INCOME	.1144	.1001	.1287	15.68
DELOS	.4851	.4424	.5279	22.25
EGNATIA-MYCYNEA	.5452	.4531	.6373	11.59
HERMES	.1807	.1374	.2240	8.17
EUROBANK	.2859	.2514	.3204	16.24
EUROPAIKI PISTI	.2452	.1899	.3005	8.69
GENIKI	.5590	.5049	.6132	20.25
HSBC	.3818	.3171	.4465	11.56
INTERAMERICAN LONG TERM	.1595	.1174	.2015	7.42
INTERAMERICAN MIKTO	.3990	.3347	.4633	12.16
INTERAMERICAN STABLE	.1787	.1459	.2115	10.68
INTERNATIONAL	.5061	.3783	.6339	7.76
IONIKI LIFE	.1839	.1454	.2224	9.35
CYPRUS	.8100	.7299	.8901	19.82
LAIKI	.9775	.9355	1.0194	45.66
METROLIFE	.3140	.2674	.3608	13.18
PIREAUS	.4256	.3817	.4695	18.99
SOGEN INCOME	.6048	.4421	.7674	7.28

Table 6: Bond Mutual Funds Based on Alpha Coefficient (BOND index)

MUTUAL FUNDS	a	Confidence Interval		t(a)
		Min	Max	
ABN AMRO	.000218	.000105	.000331	3.79
ALICO EUROBANK	.000179	.000074	.000284	3.35
ALLIANZ DOMESTIC BONDS	.000203	.000109	.000297	4.20
ALLIANZ PLUS	.000216	.000065	.000367	2.80
ALPHA DOMESTIC BONDS	.000261	.000173	.000349	5.79
ALPHA REGULAR INCOME	.000206	.000128	.000284	5.15
ALPHA TRUST INCOME	.000273	.000143	.000403	4.13
ASPIS	.000096	-.000098	.000290	0.96
ATE INCOME	.000221	.000164	.000278	7.58
ATE CAPITAL AND GROWTH	.000257	.000174	.000340	6.11
ATTIKIS	.000379	.000240	.000518	5.34
BETA	.000397	.000262	.000532	5.76
CITI INCOME	.000192	.000156	.000228	10.47
DELOS	.000217	.000132	.000302	5.00
EGNATIA-MYCYNEA	.000141	.000002	.000280	1.99
HERMES	.000203	.000119	.000287	4.72
EUROBANK	.000299	.000212	.000386	6.73
EUROPAIKI PISTI	.000262	.000144	.000380	4.34
GENIKI	.000206	.000104	.000308	3.94
HSBC	.000296	.000139	.000453	3.70
INTERAMERICAN LONG TERM	.000184	.000113	.000255	5.08
INTERAMERICAN MIKTO	.000167	.000039	.000295	2.56
INTERAMERICAN STABI E	.000222	.000164	.000280	7.46
INTERNATIONAL	.000267	-.000054	.000588	1.62
IONIKI LIFE	.000204	.000154	.000254	7.94
CYPRUS	.000311	.000229	.000393	7.46
LAIKI	.000238	.000172	.000304	7.06
METROLIFE	.000302	.000197	.000407	5.64
PIRAEUS	.000215	.000125	.000305	4.65
SOGEN INCOME	.000408	-.000002	.000818	1.95

Table 7: Summary Information

MUTUAL FUNDS	Adjusted R ²		Change
	Bond Index	Stock Index	
ABN AMRO	.5509	.1271	.4238
ALICO EUROBANK	.5485	.0904	.4581
ALLIANZ DOMESTIC BONDS	.7081	.1167	.5914
ALLIANZ PLUS	.5096	.2107	.2989
ALPHA DOMESTIC BONDS	.4105	.0149	.3956
ALPHA REGULAR INCOME	.1367	.1929	-.0562
ALPHA TRUST INCOME	.4876	.1352	.3524
ASPIS	.1247	.3031	-.1784
ATE INCOME	.6634	.0231	.6403
ATE CAPITAL AND GROWTH	.7103	.0612	.6491
ATTIKIS	.1439	.2489	-.1050
BETA	.1419	.0005	.1414
CITI INCOME	.2607	.0024	.2583
DELOS	.5697	.2038	.3659
EGNATIA-MYCYNEA	.3514	.1562	.1952
HERMES	.1774	.3890	-.2116
EUROBANK	.2745	.0065	.2680
EUROPAIKI PISTI	.2371	.0813	.1558
GENIKI	.5727	.2781	.2946
HSBC	.2928	.1294	.1634
INTERAMERICAN LONG TERM	.1758	.0022	.1736
INTERAMERICAN MIKTO	.3143	.2451	.0692
INTERAMERICAN STABLE	.2672	-.0002	.2674
INTERNATIONAL	.0786	.0493	.0293
IONIKI LIFE	.3178	-.0014	.3192
CYPRUS	.7101	.0218	.6883
LAIKI	.8608	.0097	.8511
METROLIFE	.2907	.1232	.1675
PIRAEUS	.4679	.2306	.2373
SOGEN INCOME	.0697	.0278	.0419

