A quantitative assessment of the Actively vs Passively managed debate, framed within the context of the Efficient Market Hypothesis

John Kane

MSc in Finance

National College of Ireland

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Abstract

"A quantitative assessment of the Actively vs Passively managed debate, framed within the context of the Efficient Market Hypothesis" – John Kane

The research into this topic is numerous and detailed both from an academic, as well as an industry participant viewpoint. Thus, the author wished to set his research apart and did so via a distinction in asset class and domicile. The majority of literature on the debate and hypothesis focus on single equities or indeed, equity indices, usually domiciled in the United States of America, and so the author choice to focus on a relative grey area, Euro denominated and focused, fixed income, retail collective investment schemes which were domiciled in Ireland and regulated by the Central Bank of Ireland.

The process and approach used to answer the research question and all subsequent objectives was that of a deductive process followed by the application of a positivist approach. The research determined that a link between the efficient market hypothesis and the active versus passive debate, and thus the testing and financial modelling undertaken herein was influenced by said linkage via design. The research sought to straddle the academic standard, while acting as a guide in respect of actual market participants. The dissertation subsequently concludes that while active investment funds do not statistically outperform passive investment funds, the research as a whole indicates that active investment management is a better investment proposition for investors than that of passive investment management.

Declaration

The library submission sheet and declaration will be bound into the soft-copy bindings.

Acknowledgements

I would like to thank my wife, Ciara for her enduring support and tireless encouragement over the course of this dissertation, and master's degree as a whole. Secondly, I would like to thank my mother, Fiona, who inspired in me a love of finance and investment from an early age, and who continues to bestow knowledge and wisdom upon me to this very day. Finally, I wish to acknowledge the Central Bank of Ireland, and in particular, the Funds Authorisation Management Team, within the Securities and Markets Directorate for providing me both support and flexibility in working to ensure I could complete this undertaking to my very best ability.

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Table 1.

	Active UCITS Funds						
DATE	European High Yield Bond Portfolio	BNY Mellon European Credit Fund	European Short Term Government Bond Fund	BlackRock Euro Core Bond Fund	MGI Euro Long Bond Fund	MGI Euro Bond Fund	Russell Investments Euro Fixed Income Fund
24/07/2018	€ 115.46	€ 125.05	€ 112.50	€ 210.280	€ 129.940	€ 134.480	€ 1,819.260
29/06/2018	€ 115.69	€ 124.74	€ 112.46	€ 210.180	€ 130.460	€ 134.580	€ 1,816.500
31/05/2018	€ 116.33	€ 125.08	€ 112.67	€ 209.130	€ 129.690	€ 134.060	€ 1,812.550
30/04/2018	€ 117.12	€ 125.60	€ 113.02	€ 210.750	€ 126.820	€ 134.980	€ 1,838.480
30/03/2018	€ 116.09	€ 125.46	€ 113.07	€ 211.180	€ 128.020	€ 135.350	€ 1,844.910
28/02/2018	€ 116.70	€ 125.51	€ 113.05	€ 208.910	€ 124.970	€ 134.030	€ 1,825.370
31/01/2018	€ 117.80	€ 126.06	€ 113.03	€ 208.650	€ 124.370	€ 133.880	€ 1,824.610
29/12/2017	€ 117.27	€ 125.81	€ 113.16	€ 209.480	€ 127.530	€ 134.670	€ 1,829.750
30/11/2017	€ 117.80	€ 125.95	€ 113.39	€ 210.580	€ 128.060	€ 135.670	€ 1,845.980
31/10/2017	€ 118.62	€ 125.64	€ 113.46	€ 209.780	€ 125.740	€ 135.340	€ 1,841.750
29/09/2017	€ 117.58	€ 124.86	€ 113.37	€ 207.970	€ 125.750	€ 134.140	€ 1,823.550
31/08/2017	€ 116.70	€ 124.75	€ 113.43	€ 208.680	€ 126.540	€ 134.700	€ 1,831.380
31/07/2017	€ 116.86	€ 124.03	€ 113.44	€ 207.190	€ 124.240	€ 133.940	€ 1,820.070
30/06/2017	€ 116.74	€ 123.22	€ 113.30	€ 206.610	€ 124.450	€ 133.650	€ 1,814.220
31/05/2017	€ 116.30	€ 123.26	€ 113.56	€ 207.380	€ 126.110	€ 134.310	€ 1,822.820
28/04/2017	€ 115.15	€ 122.74	€ 113.43	€ 206.610	€ 125.660	€ 133.720	€ 1,813.500
31/03/2017	€ 114.33	€ 121.99	€ 113.35	€ 205.480	€ 124.340	€ 133.100	€ 1,805.710
28/02/2017	€ 114.74	€ 121.99	€ 113.31	€ 206.230	€ 125.940	€ 133.850	€ 1,814.690
31/01/2017	€ 114.25	€ 120.54	€ 113.44	€ 204.310	€ 122.910	€ 132.270	€ 1,792.830
30/12/2016	€ 113.32	€ 121.13	€ 113.68	€ 207.480	€ 128.040	€ 134.850	€ 1,825.150
30/11/2016	€ 111.27	€ 120.20	€ 113.10	€ 206.130	€ 127.250	€ 133.830	€ 1,812.330
31/10/2016	€ 111.85	€ 121.46	€ 113.43	€ 208.390	€ 131.040	€ 135.790	€ 1,845.220
30/09/2016	€ 110.81	€ 122.28	€ 113.68	€ 211.780	€ 136.840	€ 138.520	€ 1,879.010
31/08/2016	€ 111.48	€ 122.34	€ 113.82	€ 211.310	€ 136.510	€ 138.320	€ 1,879.670
29/07/2016	€ 110.19	€ 121.62	€ 113.77	€ 211.380	€ 138.580	€ 138.650	€ 1,878.240
30/06/2016	€ 107.76	€ 119.44	€ 113.45	€ 209.260	€ 137.180	€ 137.390	€ 1,851.080
31/05/2016	€ 109.39	€ 118.74	€ 113.78	€ 205.790	€ 128.280	€ 134.700	€ 1,818.250
29/04/2016	€ 109.13	€ 118.48	€ 113.80	€ 204.060	€ 125.020	€ 133.440	€ 1,804.130
31/03/2016	€ 106.92	€ 117.35	€ 113.76	€ 205.190	€ 128.570	€ 134.630	€ 1,815.090
29/02/2016	€ 104.22	€ 115.58	€ 113.67	€ 203.630	€ 127.820	€ 133.870	€ 1,798.250
29/01/2016	€ 105.01	€ 115.53	€ 113.86	€ 202.370	€ 123.780	€ 132.830	€ 1,787.580
31/12/2015	€ 106.26	€ 115.31	€ 113.78	€ 199.880	€ 117.430	€ 130.680	€ 1,766.520
30/11/2015	€ 106.73	€ 116.42	€ 113.96	€ 201.760	€ 120.110	€ 132.140	€ 1,787.600
30/10/2015	€ 105.41	€ 115.66	€ 113.81	€ 200.610	€ 120.520	€ 131.560	€ 1,778.220
30/09/2015	€ 103.75	€ 114.26	€ 113.51	€ 198.600	€ 118.850	€ 130.230	€ 1,753.640
31/08/2015	€ 104.68	€ 114.98	€ 113.42	€ 197.880	€ 115.410	€ 128.930	€ 1,746.700
31/07/2015	€ 104.71	€ 115.69	€ 113.65	€ 199.400	€ 118.970	€ 130.360	€ 1,767.670
30/06/2015	€ 104.11	€ 114.35	€ 113.33	€ 195.350	€ 114.120	€ 127.690	€ 1,735.370
29/05/2015	€ 105.04	€ 116.43	€ 113.54	€ 200.000	€ 122.340	€ 130.990	€ 1,778.670
30/04/2015	€ 104.83	€ 117.38	€ 113.68	€ 202.680	€ 126.710	€ 133.000	€ 1,804.670
31/03/2015	€ 104.19	€ 116.82	€ 113.61	€ 204.710	€ 131.050	€ 134.860	€ 1,829.880
27/02/2015	€ 103.36	€ 116.88	€ 113.60	€ 202.680	€ 125.380	€ 133.500	€ 1,815.840
30/01/2015	€ 101.95	€ 115.70	€ 113.30	€ 200.280	€ 125.980	€ 132.470	€ 1,799.740
31/12/2014	€ 101.23	€ 114.06	€ 113.04	€ 196.530	€ 117.820	€ 129.850	€ 1,762.730
28/11/2014	€ 101.29	€ 113.73	€ 113.05	€ 194.910	€ 114.750	€ 128.630	€ 1,749.850
31/10/2014	€ 101.06	€ 113.09	€ 112.85	€ 193.090	€ 111.420	€ 127.110	€ 1,731.040
30/09/2014	€ 101.50	€ 112.88	€ 113.15	€ 192.660	€ 109.630	€ 126.820	€ 1,727.270
29/08/2014	€ 102.77	€ 112.54	€ 113.13	€ 192.010	€ 110.830	€ 126.840	€ 1,727.990
31/07/2014	€ 102.52	€ 111.34	€ 113.00	€ 189.090	€ 105.630	€ 124.720	€ 1,700.180
30/06/2014	€ 102.99	€ 110.96	€ 112.86	€ 187.520	€ 103.280	€ 123.800	€ 1,686.650
30/05/2014	€ 101.82	€ 110.11	€ 112.61	€ 185.720	€ 101.630	€ 122.660	€ 1,670.940
30/04/2014	€ 101.45	€ 108.75	€ 112.43	€ 183.980	€ 100.000	€ 121.500	€ 1,656.110
31/03/2014	€ 100.61	€ 107.96	€ 112.39	€ 182.160	€ 100.000	€ 120.490	€ 1,639.480
28/02/2014	€ 100.000	€ 107.39	€ 112.15	€ 180.590	€ 100.000	€ 119.550	€ 1,626.770
31/01/2014	€ 100.000	€ 106.59	€ 111.85	€ 179.200	€ 100.000	€ 118.830	€ 1,614.330
31/12/2013	€ 100.000	€ 105.07	€ 111.31	€ 175.780	€ 100.000	€ 116.540	€ 1,587.480

Table 2.

	Passive UCITS Funds						
DATE	SPDR Bloomberg Barclays 0-3 Year Euro Corporate Bond UCITS ETF	The NT High Quality Euro Government Bond Index Fund	SPDR Bloomberg Barclays Euro High Yield Bond UCITS ETF	iShares Euro Investment Grade Corporate Bond Index Fund (IE)	SPDR Bloomberg Barclays Euro Government Bond UCITS ETF	SPDR Bloomberg Barclays Euro Corporate Bond UCITS ETF	ISHARES EURO CORP LARGE CAP UCITS ETF
24/07/2018	€ 26.49	€ 113.99	€ 57.64	€ 12.97	€ 62.07	€ 57.35	€ 134.72
29/06/2018	€ 26.52	€ 114.19	€ 56.78	€ 12.93	€ 62.15	€ 56.93	€ 134.34
31/05/2018	€ 26.52	€ 113.82	€ 56.82	€ 12.94	€ 61.72	€ 57.09	€ 134.52
30/04/2018	€ 26.57	€ 112.50	€ 57.57	€ 12.97	€ 62.47	€ 57.10	€ 135.02
30/03/2018	€ 26.53	€ 113.04	€ 57.31	€ 12.97	€ 62.71	€ 57.25	€ 134.88
28/02/2018	€ 26.82	€ 111.56	€ 57.41	€ 12.98	€ 61.74	€ 57.27	€ 135.33
31/01/2018	€ 26.55	€ 111.30	€ 58.45	€ 12.98	€ 61.82	€ 57.62	€ 135.36
29/12/2017	€ 26.88	€ 112.48	€ 58.54	€ 13.02	€ 62.10	€ 57.84	€ 135.97
30/11/2017	€ 26.76	€ 113.22	€ 58.53	€ 13.06	€ 62.59	€ 57.99	€ 136.72
31/10/2017	€ 26.65	€ 112.99	€ 58.81	€ 13.07	€ 62.40	€ 57.91	€ 136.99
29/09/2017	€ 26.74	€ 112.10	€ 58.38	€ 12.94	€ 61.72	€ 57.46	€ 135.57
31/08/2017	€ 27.98	€ 112.86	€ 58.11	€ 12.96	€ 62.03	€ 57.61	€ 136.44
31/07/2017	€ 27.16	€ 111.61	€ 59.05	€ 12.89	€ 61.78	€ 57.65	€ 135.71
30/06/2017	€ 26.62	€ 111.53	€ 58.62	€ 12.79	€ 61.62	€ 57.25	€ 134.56
31/05/2017	€ 26.42	€ 112.61	€ 57.90	€ 12.87	€ 61.93	€ 57.59	€ 135.89
28/04/2017	€ 25.55	€ 112.17	€ 58.05	€ 12.82	€ 61.62	€ 57.33	€ 135.48
31/03/2017	€ 25.90	€ 111.38	€ 57.52	€ 12.75	€ 61.33	€ 57.04	€ 134.76
28/02/2017	€ 25.94	€ 112.31	€ 57.57	€ 12.80	€ 61.70	€ 57.15	€ 135.78
31/01/2017	€ 26.10	€ 110.83	€ 57.94	€ 12.64	€ 61.20	€ 56.77	€ 134.22
30/12/2016	€ 26.05	€ 113.44	€ 57.80	€ 12.73	€ 62.53	€ 57.30	€ 135.28
30/11/2016	€ 25.71	€ 112.72	€ 56.66	€ 12.63	€ 62.04	€ 56.81	€ 134.68
31/10/2016	€ 27.29	€ 114.15	€ 57.04	€ 12.77	€ 63.05	€ 57.53	€ 136.37
30/09/2016	€ 26.25	€ 116.47	€ 56.63	€ 12.86	€ 64.42	€ 57.89	€ 137.66
31/08/2016	€ 25.83	€ 116.19	€ 57.12	€ 12.87	€ 64.28	€ 58.16	€ 138.35
29/07/2016	€ 25.62	€ 116.95	€ 57.42	€ 12.84	€ 64.77	€ 58.35	€ 138.31
30/06/2016	€ 25.40	€ 116.35	€ 56.11	€ 12.63	€ 64.24	€ 57.22	€ 136.11
31/05/2016	€ 23.22	€ 113.19	€ 56.28	€ 12.51	€ 62.83	€ 56.63	€ 135.09
29/04/2016	€ 23.76	€ 111.88	€ 56.36	€ 12.46	€ 62.18	€ 56.65	€ 134.75
31/03/2016	€ 24.00	€ 113.14	€ 55.43	€ 12.43	€ 62.89	€ 56.47	€ 134.67
29/02/2016	€ 23.60	€ 113.06	€ 53.72	€ 12.26	€ 62.59	€ 55.66	€ 133.22
29/01/2016	€ 23.13	€ 111.49	€ 54.64	€ 12.19	€ 62.28	€ 55.83	€ 132.42
31/12/2015	€ 22.27	€ 108.91	€ 55.14	€ 12.13	€ 61.11	€ 55.62	€ 131.52
30/11/2015	€ 21.30	€ 110.11	€ 56.36	€ 12.22	€ 61.78	€ 56.07	€ 133.13
30/10/2015	€ 21.59	€ 109.87	€ 56.25	€ 12.14	€ 61.50	€ 55.64	€ 132.32
30/09/2015	€ 22.23	€ 109.12	€ 54.20	€ 11.97	€ 60.86	€ 54.71	€ 130.29
31/08/2015	€ 22.09	€ 108.10	€ 55.64	€ 12.07	€ 60.26	€ 55.14	€ 131.51
31/07/2015	€ 21.39	€ 108.95	€ 56.16	€ 12.15	€ 60.71	€ 55.65	€ 132.94
30/06/2015	€ 21.46	€ 107.17	€ 56.80	€ 12.00	€ 59.70	€ 55.34	€ 131.07
29/05/2015	€ 21.83	€ 109.93	€ 57.58	€ 12.24	€ 61.29	€ 56.49	€ 133.87
30/04/2015	€ 22.11	€ 111.23	€ 57.68	€ 12.30	€ 62.29	€ 56.76	€ 134.92
31/03/2015	€ 21.97	€ 112.69	€ 57.55	€ 12.36	€ 63.19	€ 57.04	€ 135.67
27/02/2015	€ 22.04	€ 111.14	€ 57.85	€ 12.38	€ 62.37	€ 57.17	€ 135.95
30/01/2015	€ 22.83	€ 111.22	€ 56.83	€ 12.31	€ 61.93	€ 56.89	€ 135.80
31/12/2014	€ 23.77	€ 108.58	€ 57.55	€ 12.19	€ 60.99	€ 56.90	€ 134.72
28/11/2014	€ 24.19	€ 107.42	€ 57.64	€ 12.13	€ 60.00	€ 56.57	€ 134.25
31/10/2014	€ 23.79	€ 106.23	€ 56.93	€ 12.06	€ 60.00	€ 56.21	€ 134.33
30/09/2014	€ 23.63	€ 105.62	€ 57.02	€ 12.01	€ 60.00	€ 56.04	€ 133.79
29/08/2014	€ 24.08	€ 105.84	€ 57.32	€ 11.99	€ 60.00	€ 55.90	€ 133.57
31/07/2014	€ 23.99	€ 103.84	€ 56.76	€ 11.85	€ 60.00	€ 55.25	€ 132.72
30/06/2014	€ 24.29	€ 102.97	€ 58.24	€ 11.79	€ 60.00	€ 55.56	€ 131.99
30/05/2014	€ 24.68	€ 102.15	€ 57.83	€ 11.73	€ 60.00	€ 55.22	€ 131.24
30/04/2014	€ 24.88	€ 101.06	€ 57.51	€ 11.62	€ 60.00	€ 54.78	€ 130.73
31/03/2014	€ 24.99	€ 100.32	€ 57.08	€ 11.51	€ 60.00	€ 54.27	€ 129.48
28/02/2014	€ 24.84	€ 99.77	€ 56.68	€ 11.47	€ 60.00	€ 54.11	€ 129.07
31/01/2014	€ 24.71	€ 99.65	€ 55.71	€ 11.40	€ 60.00	€ 53.86	€ 129.12
31/12/2013	€ 25.23	€ 97.64	€ 57.08	€ 11.25	€ 60.00	€ 53.83	€ 127.38

Table 3.

Date	Active Returns	Passive Returns	Euro area yield curve - IF5
29/06/2018	-0.00186	0.02423	-0.38998
31/05/2018	0.00684	0.00437	0.00000
30/04/2018	-0.02038	-0.02123	0.12056
30/03/2018	-0.00824	-0.00458	-0.25157
28/02/2018	0.04997	0.01189	0.00315
31/01/2018	-0.00604	-0.01325	-0.32707
29/12/2017	-0.03235	-0.04031	0.10637
30/11/2017	-0.03329	-0.02086	-0.01995
31/10/2017	0.02177	0.00318	-0.17671
29/09/2017	0.04325	0.05079	0.19540
31/08/2017	-0.01033	-0.06303	-0.12770
31/07/2017	0.04170	0.03916	0.02035
30/06/2017	0.01535	0.05391	0.18260
31/05/2017	-0.02544	-0.01691	-0.12280
28/04/2017	0.03212	0.05146	-0.07260
31/03/2017	0.03899	0.02321	0.07308
28/02/2017	-0.03025	-0.03010	-0.18363
31/01/2017	0.07279	0.03967	0.34863
30/12/2016	-0.09233	-0.06495	-0.03572
30/11/2016	0.05846	0.06851	0.35944
31/10/2016	-0.09128	-0.13141	0.64913
30/09/2016	-0.09715	-0.01826	-0.11023
31/08/2016	-0.00203	0.00175	-0.03826
29/07/2016	0.00103	-0.01161	-0.22397
30/06/2016	0.08716	0.09686	-0.36091
31/05/2016	0.10941	0.16378	-0.18173
29/04/2016	0.05573	0.00402	0.25906
31/03/2016	-0.01810	-0.01004	-0.13100
29/02/2016	0.07007	0.09291	-0.13658
29/01/2016	0.04336	0.03080	-0.27527
31/12/2015	0.08400	0.08652	0.22748
30/11/2015	-0.07054	-0.02658	-0.14060
30/10/2015	0.03228	0.01539	-0.13254
30/09/2015	0.07888	0.07176	-0.12657
31/08/2015	0.03246	-0.02612	0.08203
31/07/2015	-0.06941	-0.01909	-0.23197
30/06/2015	0.12149	0.05085	0.27281
29/05/2015	-0.17198	-0.14383	0.31256
30/04/2015	-0.08560	-0.06013	0.20032
31/03/2015	-0.05989	-0.03375	-0.04874
27/02/2015	0.07971	0.01217	-0.06827
30/01/2015	0.05028	0.00090	-0.22289
31/12/2014	0.15024	0.00392	-0.11540
28/11/2014	0.05369	0.02205	-0.21024
31/10/2014	0.07123	0.05208	-0.09410
30/09/2014	0.01772	0.02205	-0.00342
29/08/2014	-0.01732	-0.02027	-0.19597
31/07/2014	0.11076	0.06237	-0.06252
30/06/2014	0.04633	-0.02476	-0.10022
30/05/2014	0.06569	0.01614	-0.09978
30/04/2014	0.06171	0.02955	-0.07787
31/03/2014	0.04440	0.03888	0.00046
28/02/2014	0.03768	0.02819	-0.01968
31/01/2014	0.03159	0.03407	-0.15677
31/12/2013	0.07478	0.00239	0.00000

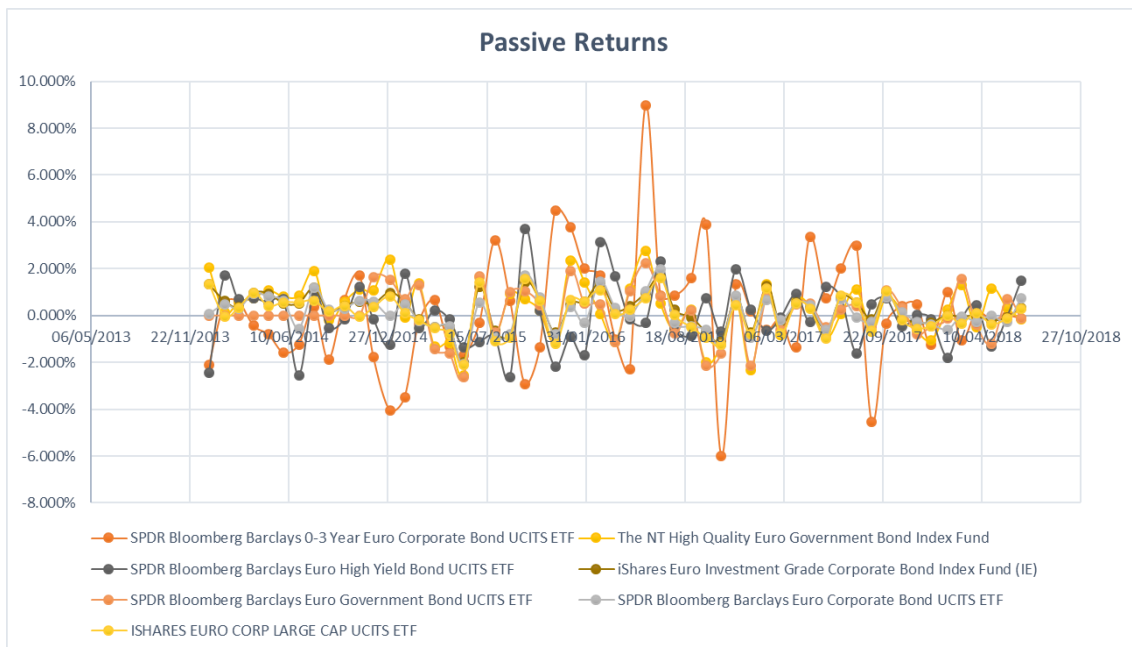# List of Appendices
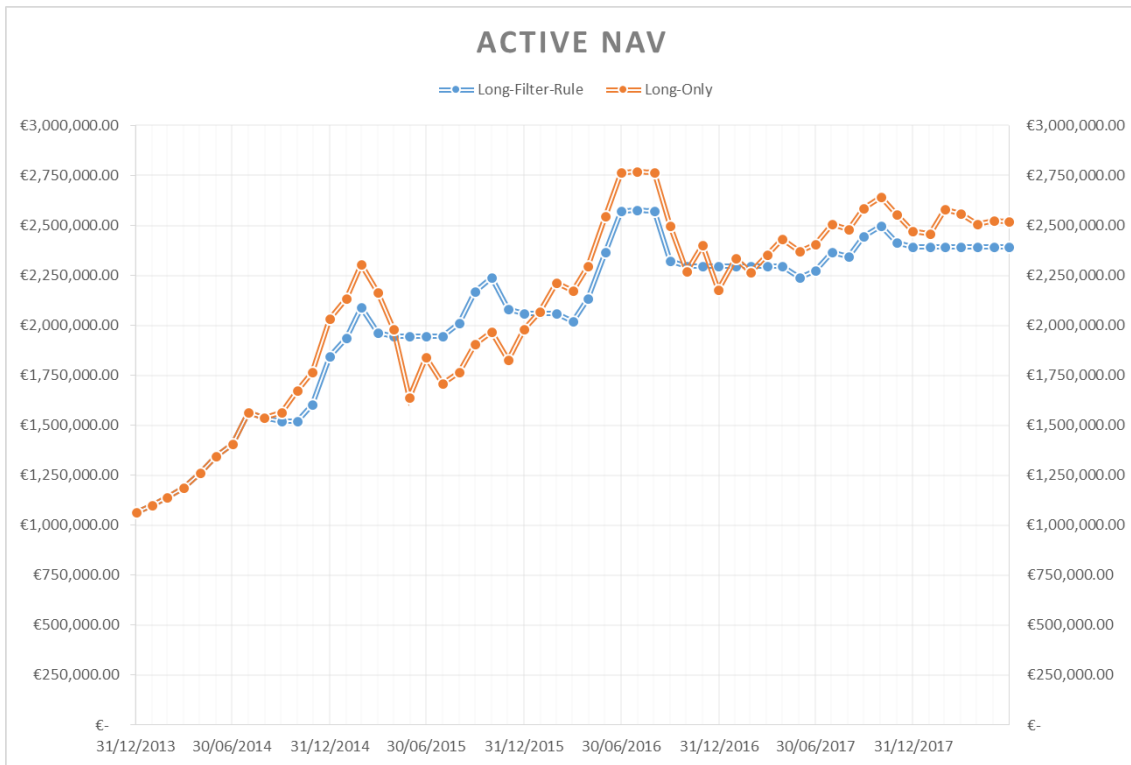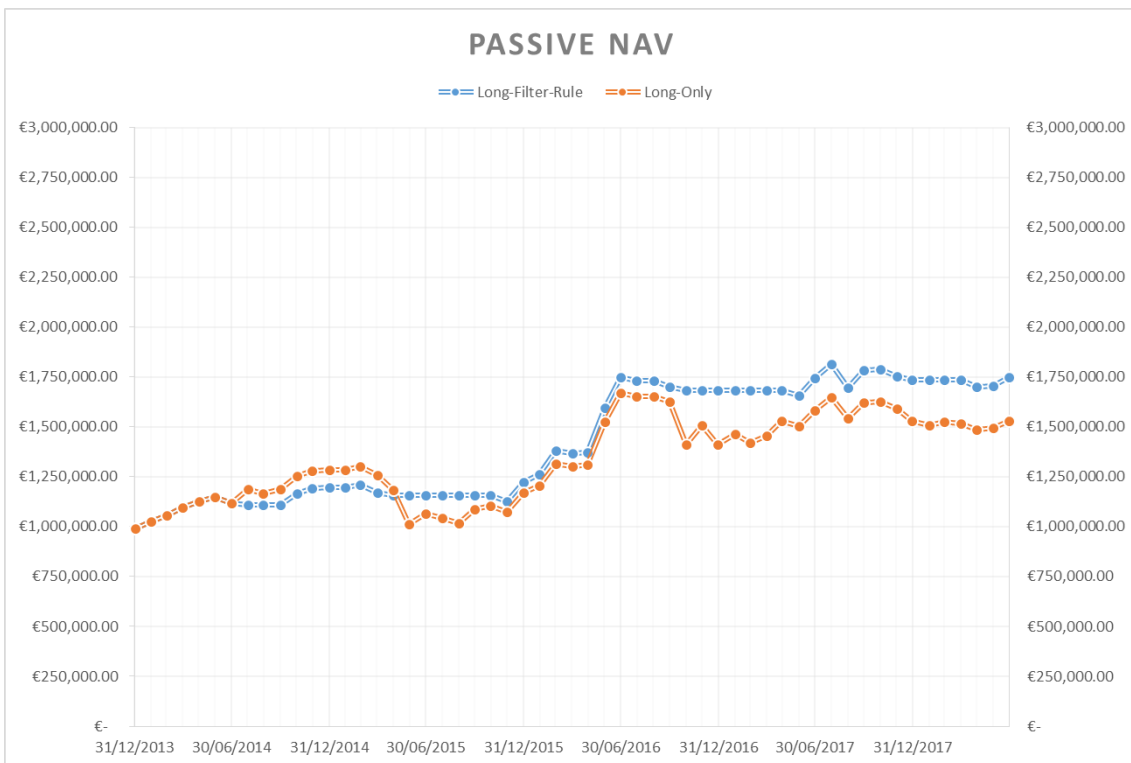
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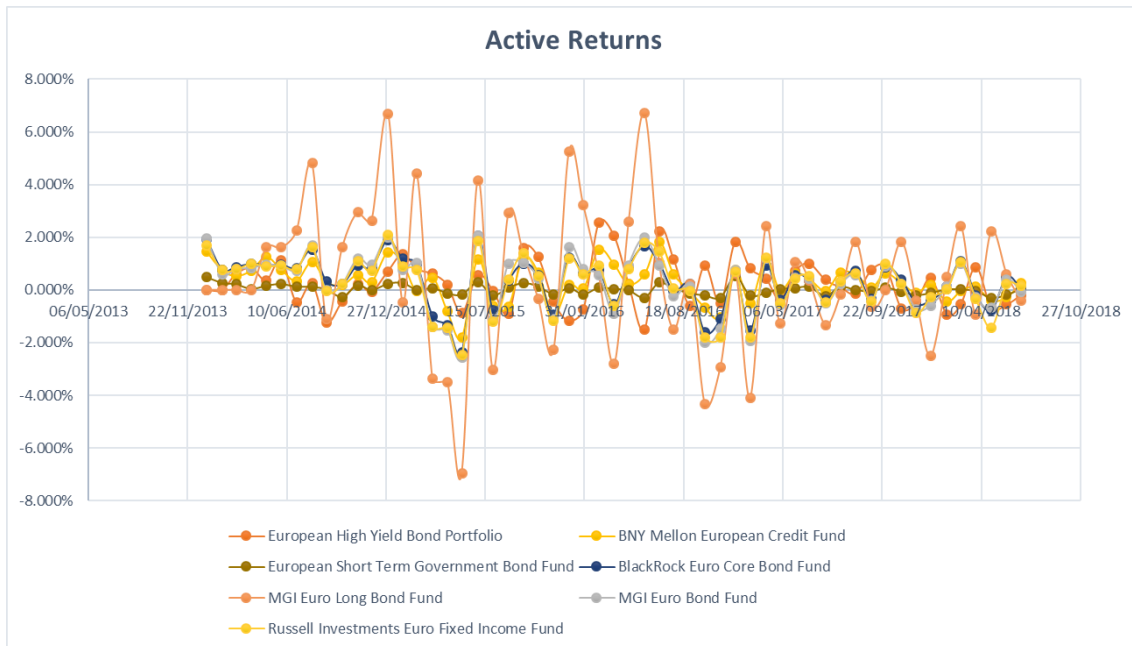
Chart 2.

Chart 3.

Chart 4.

Introduction

"[An] Increasing numbers of clients will realise that in toe-to-toe competition versus near-equal competitors, most active managers will not and cannot recover the costs and fees they charge"[1]. This statement strikes the author in a profound way and goes to the very core of the author's choice to undertake this research proposition. The author has a keen interest in the world of investments and markets has held a perhaps naive notion that active investment will always deliver returns, provided enough analysis and due diligence has been undertaken. Contrary to this and in effect, what Ellis is stating is that regardless of the returns derived from active management, the fees associated with the generation of that return will generally be greater and thus, an investor's initial invested capital will be eroded. This viewpoint from Ellis is a common inkling brought out against active investment management and furthermore, this statement is a stark warning aimed directly at retail investors whom may consider this style as an avenue of investment. As noted, Ellis's statement is much to the dismay of the active investment managers, who often so boldly quote that their portfolio results are a product of active skill and high conviction (Wendler & Peckham, Invesco, 2017). In fact, active managers have begun not only to defend their positions and philosophy, but to attack the very core ideas behind passive investment management. These two opposing philosophies set up the basis of the debate the author wishes to research; The Active vs Passive Investment Management Debate, which can effectively be summarised as "active funds have portfolio managers who make [investment] decisions, and passive funds seek to replicate the holdings of an index"[2].

Through researching both philosophies, one conclusion is continually drawn, active investors believe the market is inefficient and thus gains and/or returns can be derived through analysis and effectively, find a situation to exploit, which will result in gains. And conversely, passive investors believe the market is efficient and thus, no one investor's or indeed investment manager's analysis can outperform the market, due to the current market prices representing all available information. These two beliefs effectively form the corner stone of acceptance or rejection of the Efficient Market Hypothesis. It would then

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[1] Ellis, CDE, 2017. The end of active investing? Financial Times, 20 January 2017. 1.
[2] Wendler & Peckham, GW & JP, 2015. Think active can't outperform? Think again. DC Matters, [Online]. Fall/Winter 2015, 22. Available at: https://www.invesco.com/pdf/DCMTRS-BRO-2.pdf [Accessed 28 July 2018].

seem rather natural to pursue this linkage. Accordingly, the author aims to explore the efficient market hypothesis, its origins and why this economic theory is often linked with the active vs passive debate. If the author find sufficient evidence of such a linkage, the author will aim to frame the above debate within the context of the Efficient Market Hypothesis for the purposes of methodology and testing, which will not only aim to answer the author's research question, but perhaps also add to the debate surrounding the validity of the hypothesis, which as noted, in many ways can be considered the basis of the belief either in favour or against active or indeed passive investment management. Through this research proposition, the author will indeed find the debate to be linked to the hypothesis. This linkage can effectively be summarised as the following; a retail investor should "consider investing in… tracker funds if [they] believe that the EMH is true"[3]. Thus, the two ideas are explicitly connected, which in turn supports the authors choice to examine one through the other. This examination will consist of quantitative testing, further explained in the Methodology section, based on simple principles of a comparison of returns vis-à-vis hypothesis testing for the significance of difference, as well as detailed quantitative modelling based on the principles of the efficient market hypothesis, such as the "random walk" and "filter-rule" tests. Prior to this testing, the author will comprehensively list the requirements for data selection and refinement, to ensure the results of said testing and modelling are sufficiently valid.

Although there have been numerous studies and papers relating to the Efficient Market Hypothesis, in the context of the Active vs Passive Investment, as documented by Sewell in "History of the Efficient Market Hypothesis", through research and practice, the author's reading and understanding of these papers are usually either highly academic and thus impractical for real-world application, or conversely, issued via active or indeed passive investment houses and thus the results can be deemed to be somewhat bias. The author will thus attempt to straddle these two extremes by creating and documenting a form of research and testing that appreciates the academic significance, institution and deference, while ensuring the output of the research and testing is applicable and beneficial to industry participants alike. Additionally, the author has no such bias found within the grey literature,

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[3] O'Neill, Bodie, Tai, Cormack, Tyson, et al, V., 2014. QFINANCE: The Ultimate Resource. 1st ed. United States of America: Bloomsbury Information.

and thus would favour neither argument for or against the active vs passive investment debate.

The high-level aim of the authors research and testing is to determine which side of the active or passive debate is correct, and thus provide better returns for investors. The author proposes several tests in order to determine and inform which philosophy is ultimately a better proposition for investing. As noted above, and indeed in the following sections, the author also infers that through framing and subsequently testing the Efficient Market Hypothesis in the context of Irish domiciled European fixed income focused Undertakings for Collective Investment in Transferable Securities ('UCITS'), he will be able to more accurately advise an entrenched industry, as to which whether active investment in worth the costs and whether passive investment delivers returns in line with the market it seeks to replicate. Moreover, through understanding both of these philosophies, their underlying mechanics and their implications for investors, the author aims at a secondary level to understand how the two opposing styles deal with market shocks and from a retail investor point of view, if the passive or active UCITS provide better value, in terms of returns and net returns I.e. returns less fees. Noting the above, the author would infer that this sets up the research proposition as something very interesting, which will have a wide range of benefits applicable to academics and investors alike.

In the next section, the author will review the literature underlying the two philosophies and the linkages associated with the efficient market hypothesis, in respect of this debate.

Literature Review

As noted in the introduction, the active vs passive debate is one which is hotly contested, in fact, few topics in any other area of finance and economics are as hotly disputed as the debate between the advocates of active or passive investing. First, we will define active and passive investing as "buying a broad cross section of the market and weighting the components based on their market capitalizations. Everything else is active"[4]. The definition here is that of Gadfly's Nir Kaissar of Bloomberg LP and an active investing enthusiast. This definition assists the author's understanding of the two views which are often regarded in terms of the financial benefit returned to an investor and the philosophy they follow in order to achieve said benefit. In effect, absolute returns, regardless of market movements (active) and the return of a benchmark (passive). These investment strategy styles are often considered opposing investment strategies and thus the author infers that both styles can be summarised as follows:

- Active: Returns on investment are based off of careful selection of stocks, bonds, commodities, REITs, etc. The selection process usually involves forms of both quantitative and qualitative assessments. I.e. Value is based on fundamental, technical or other forms of analysis.

- Passive: The market is efficient and thus the ideal way to achieve a return is to replicate a representative index or hold the market capitalisation of a certain number of stocks that are representative of the broader market. I.e. Value and return, or indeed loss, in line with the market through diversification.

It is now established that activist and passivist investors are at opposite ends of the investment style spectrum and changing one's viewpoint can prove difficult, particularly in an industry as competitive as the Fund's Industry "it took years to convince AllianzGI staff to fully support its active-only strategy in the face of a rapidly growing [passive] market... the

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[4] www.bloomberg.com. 2017. Passive Versus Active Investing: A Debate. [ONLINE] Available at: https://www.bloomberg.com/view/articles/2017-10-11/passive-versus-active-investing-a-debate. [Accessed 14 July 2018].

people who thought we should be in [passives], and there were plenty, have either left..."[5] This statement by Andreas Utermann, Allianz CEO, represents a shift away from the multi-asset management style of investment houses, into a defined active or passive position. However, this does not necessarily mean that the opposing styles are non-complementary for investors. Indeed, the author has uncovered in practice and via research that a mix strategy, which in effect, relates to a passive strategy with an active overlay or indeed using a passive overlay for diversification purposes within an active profile, can lead to significant returns and protection from an investor prospective. Roger Aliaga-Díaz, Senior Economist at Vanguard Institutional Investors Inc. argues that "conceptually an index really represents the aggregation of all active managers in the market. So, from a purely risk perspective, [an investor] is looking to diversify manager risk can add a broad index [into] the portfolio for that purpose"[6]. Roger goes on to discuss the benefits associated with diversification in a mixed strategy portfolio, particularly from a risk management viewpoint. Thus, the debate over active or passive investment strategies may be resolved via a hybrid strategy with elements of both.

As alluded to in the introduction to this research piece and above, any reader with knowledge of the efficient market hypothesis will have seen the connection between a passive view and a belief in the efficient market hypothesis. The author will now explore said connection.

As noted in the section above, there is a strong correlation between a believer in passive over active and the belief in the efficient market hypothesis. This hypothesis, in its most practical form, can be defined as "the markets do not allow investors to revive above

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[5] Ignites Europe. 2018. Active firms face struggle to win ideological battle, says Allianz CEO. [ONLINE] Available at:
http://igniteseurope.com/c/1946894/229704?referrer_module=SearchSubFromIE&highlight=active%20passive%20fees. [Accessed 9 July 2018].
[6] Vanguard.com. 2015. Combining Active and Passive Investments. [ONLINE] Available at:
https://institutional.vanguard.com/iam/pdf/TSACTPAS.pdf. [Accessed 13 July 2018].

average returns, without taking above average risk"[7]. As noted above, the use of indexing or passivist diversification as a tool of risk mitigation, demonstrate a linkage between the two ideas. However, said linkage between the hypothesis and the debate can also be found not in the correlation of passivists and the hypothesis, but also as a direct transgression against activists. The author will explore this transgression in the latter area of the literature review, however, firstly the author must define the hypothesis within an academic framework. When the idea and label of an "efficient market" was introduced into the financial and economic literature some fifty years ago, it was defined as "a market which adjusts rapidly to new information (Fama et al 1969). It soon became clear, however, that while rapid adjustment to new information is an important element of an efficient market [hypothesis], it is not the only one. A more modern definition [of the hypothesis] is that asset prices in an efficient market 'fully reflect all available information' (Fama 1991). This implies that the market processes information rationally, in the sense that relevant information is not ignored, and systematic errors are not made. As a consequence, prices are always at levels consistent with fundamentals"[8].

The hypothesises origins are well documented in "History of the Efficient Market Hypothesis" by Martin Sewell, published 2011. This historical account sets out that the hypothesis has its origins among a variety of different economists, theorists, mathematicians and even a botanist (Robert Brown), however, the hypothesis gained industry backing in the early 1950s by economists such as Milton Friedman, who argued that "due to arbitrage, the case for the EMH can be made even in situations where the trading strategies of investors are correlated"[9]. This is not to suggest that the hypothesis is accepted as absolute, Marsh and Merton (1986) analysed and then inferred that the variance-bound methodology used by Shiller (1979), in which the volatility of long-term interest rates is greater than forecast by expectations models and conclude that this approach cannot be used to test the hypothesis of stock market rationality. They also highlight the practical

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[7] Malkiel, B.G.M, 2003. The Efficient Market Hypothesis and its Critics. Journal of Economic Perspectives, [Online]. vol. 17, 60. Available at: https://pubs.aeaweb.org/doi/pdfplus/10.1257/089533003321164958 [Accessed 14 July 2018].

[8] Beechey, Gruen & Vickery, MB, DG & JV, 2000. THE EFFICIENT MARKET HYPOTHESIS: A SURVEY. Economic Research Department Reserve Bank of Australia: Research Discussion Paper 2000-01, 1, 2.

[9] Sewell, MS, 2011. History of the Efficient Market Hypothesis. UCL DEPARTMENT OF COMPUTER SCIENCE: Research Note RN/11/04, 1, 3.

consequences of rejecting the hypothesis. A more recent form of analysis into the hypothesis by Wilson and Marashdeh (2007) would conclude that "cointegrated stock prices are inconsistent with the [hypothesis] in the short run, but consistent with the [hypothesis] in the long run. The elimination of arbitrage opportunities means that stock market inefficiency in the short run ensures stock market efficiency in the long run". Thus, the hypothesis has continued to receive a majority of industry support, albeit a substantial minority appear to be against the inferences of said hypothesis. This majority support however, is manifested in the form support which exists more for a lack of alternative, rather than absolute acceptance. The research piece by Sewell, noted above, reviews both of these arguments, for and against the hypothesis as well as reviewing those arguments put forward by general academia and industry alike. The piece then ultimately concludes that "Strictly speaking the EMH is false, but in spirit is profoundly true. Besides, science concerns seeking the best hypothesis, and until a flawed hypothesis is replaced by a better hypothesis, criticism is of limited value." The author can thus be satisfied that there is enough evidence on either side of the debate to warrant further study.

Moving into the practical side of the hypothesis (and for the purposes of future testing), "The efficient market hypothesis is associated with the idea of a "random walk," which is a term loosely used in the finance literature to characterise price series where all subsequent price changes represent random departures from previous prices"[10]. This "random walk" tenet of the hypothesis and is the absolute opposite of what an active investor believes, as ultimately, if the market price movements are random, then the analysis undertaken pre-investment yield no benefit. This random walk would then infer that a passive strategy which captures the broad market, would thus stand a better chance of returning gains then a selective active strategy. This test was empirically reviewed in the Asian Economic and Financial Review journal, which ultimately found that "share price movements on the Nigerian Stock Exchange do not follow the random walk pattern described by Fama (1965) i.e. not random. This result supports the findings of Kapetanios et al. (2003) and Lo and

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[10] Malkiel, B.G.M, 2003. The Efficient Market Hypothesis and its Critics. Journal of Economic Perspectives, [Online]. vol. 17, 59. Available at: https://pubs.aeaweb.org/doi/pdfplus/10.1257/089533003321164958 [Accessed 14 July 2018].

Mackinlay (1988; 1987)"[11]. However, this study was isolated to the Nigerian capital market. In the same article, an important caveat is added "The test of the random walk model unadjusted in all economies to Oprean (2012) seems defective, contending that tests of this model in emerging economies should take into consideration the level of development of the capital market studied as well as the institutional features of these markets: thin trading, non-linearity of asset prices, financial liberation, liquidity, end-of-the-month and end-of-the-year-effects. The effects of these he argued may seem more pronounced in these economies which may result in the rejection/acceptance of a should-be-accepted or rejected results" and thus, if the efficient market hypothesis is defined as market efficiency, where stock prices are representative of all available information, then it would seem self-evident that an underdeveloped market, such as Nigeria, would not represent the ideal testing conditions for the hypothesis and indeed, it could be strongly inferred that the hypothesis could only exist in a well-developed and regulated capital market, such as the NYSE, LSE or indeed HKEX. As further discussed by the author below, another core tenet of the efficient market hypothesis is the "filter rule" which is based on recent price movements. As filter rules are designed to catch significant trends in securities prices, either up or down, the investor should buy when the price rises above a given proportion above a recent trough or in the case of falling markets, sell when the price falls below a given proportion. In theory, the transaction costs associated with this strategy would outweigh any subsequent gain over a buy and hold strategy. The second element around costs associated with the two opposing strategies lies within the fees levied on investors. Thus, the general inferences of the funds industry seem to gage that passive funds are cost effective and generate returns in line with the efficient market. However, recent articles have begun to argue this point. Most notably, Robert Pozen of Harvard Business School argues that "the costs of index funds are much higher than generally perceived, because index funds increase market volatility and risk…" and "the active versus passive debate

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[11] NWIDOBIE, BMN, 2014. THE RANDOM WALK THEORY: AN EMPIRICAL TEST IN THE NIGERIAN CAPITAL MARKET. Asian Economic and Financial Review, [Online]. 4, 12, 1840-1848. Available at: http://www.aessweb.com/pdf-files/aefr-2014-4(12)-1840-1848.pdf [Accessed 15 July 2018].

needs to be reframed to include both the direct expenses paid by the investors in each type of fund"[12].

Up to this point in the literature, we have reviewed the debate between active and passive investment management, with credible reasoning and evidence for falling on either side of said debate. The author then explored the fundamentals of the efficient market hypothesis, mainly in the weak and semi-strong form. The author was able to then draw linkages between the active vs passive debate and the efficient market hypothesis as also noted in the introduction. However, before we accept these linkages as "fact", the author will once more, and finally, explore if these linkages are credible. The journal, Global Equity Strategy, published an article in July 2006, referenced by Montier in "Behavioural Investing" published 2007, argues that the "occasionally, the underperformance of fund managers vs [passive] is trotted out as evidence of the [efficient market hypothesis]. However, this confuses absence of evidence with evidence of the absence". The articles main argument is that due to the rise in passive investment (at the time of publishing 30% of the market, as of late 2017, 50% of the market) and in effect, the mass injection of liquidity in markets, passive investments are creating a liquidity bubble which rewards stocks listed on markets that indices track, without said stocks having sufficient scrutiny over the efficient capital usage made from said passive investments. This non-reviewed usage of capital ultimately increases the worth of said stocks and thus passive funds must investment further amounts to ensure their investments are not deviating from that of the index they track. In theory, this bubble will inevitably burst, should the passive market fall out of favour. This article then, in effective, infers that active investment creates individual value via selection, while passive investment, by necessity, drives further passive investment.

In seeking to set the authors research apart from the field at large, the author has found very little study with regards the active vs passive debate in one, a UCITS context and two, an Irish context. This lack of research would appear to be unwarranted as Ireland is a primer

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[12] Pozen & Hamacher, RP & TH, 2015. as the death knell of active management been rung too soon?. Financial Times, 1 February 2015. 1.

investment fund location for UCITS as "Ireland stands out as the European domicile of choice. Ireland is an established investment fund centre and major UCITS domicile with global reach and an unrivalled UCITS offering in terms of regulatory, tax, depositary and client servicing considerations"[13]. Furthermore, Ireland currently sits as the most popular domicile for European based exchange traded funds, with over 50% of the market as of March 2018. And the second most popular domicile for UCITS as a whole, slightly behind Luxembourg[14]. Accordingly, the author will aim to focus the research paper on Irish domiciled UCITS. As these numbers will likely continue to grow due to Brexit and regulatory convergence both in the EU and US, this study could prove to be valuable for future retail investors in either active, passive or indeed hybrid UCITS.

In summary, the author is presented with a question. "Are actively managed UCITS better at outperforming passively managed UCITS or is the opposite true?" This has led the author to explore the debate for and against the motion, and indeed, if some form of hybrid strategy is ultimately the most beneficial for investors. The author has reviewed the above question and while doing so, raised questions and similarities regarding the efficient market hypothesis. From a theoretical viewpoint, there are linkages and arguments for this hypothesis, and thus the passivist position would appear self-evident. However, no true argument has one side, and thus through further research, the author explored the idea that perhaps the reasoning and linkages are not as strong as first thought and ultimately, that sets the research, identification of methodology, testing and analysis the author proposes to undertake, as something very interesting, with wide ranging ramification for either position.

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[13] Irish Funds, if, (2018). WHY IRELAND: Excellence, Innovation, Reach. In Irish Funds Annual Global Funds Conference. Dublin, 17 May 2018. Dublin: Irish Funds. 8.
[14] Irish Funds. 2018. Facts & Figures. [ONLINE] Available at: https://www.irishfunds.ie/facts-figures. [Accessed 14 July 2018].

Research Question

"A quantitative assessment of the Actively vs Passively managed debate, framed within the context of the Efficient Market Hypothesis"

The research question aims to examine Irish domiciled, European focused fixed income UCITS in a comparative manner. The author wishes to examine the above by asking a number of questions (see below) which will accurately help the author in achieving the goals as set out by the research question. Namely, quantitatively assessing both management styles, using the EMH as a guiding tool for the basis of examination as noted in the literature review above. As noted below, this basis is either very direct (E.g. Filter rule tests) or slightly opaquer (E.g. yield analysis). Some of the tests are set out to remove error, via removing direct comparisons. This is done by applying a buy and hold strategy to an active UCITS and examining if this strategy would've outperformed the actual strategy of the UCITS.

Question 1). Does an actively managed fixed income UCITS portfolio outperform a comparable passively managed fixed income UCITS portfolio?

- Is the NAV appreciation greater for active or passive?

Question 2). Does the Efficient Market Hypothesis hold true with regards the active vs passive debate?

- Would a buy and hold strategy out perform a "Filter rule" strategy?

Question 3). Do the actively manged fixed income UCITS provide better protection and conversely, better returns with regards Yield sensitivity?

- Which style of UCITS is more sensitive to Euro area yield curves? And does this sensitivity assist in the preservation of investor capital. I.e. NAV?

Additional possible sub-objective:

Should the author uncover any quantitative observations that do not prescribe to any form of normality or otherwise cannot be explained via conventional knowledge on the prescribed topic, the author will aim to explore this observation(s) and report any findings. All of course dependant on the author having sufficient capacity.

Access to data and method of comparison:

The author seeks to use a standardised tool of measurement between the two opposing management styles and accordingly, the data (NAV or Net Asset Value) required will need to be of sufficient quality. The author has thus chosen to examine only those UCITS which are publicly listed on exchanges and thus the available weekly NAVs will be obtainable either directly from the exchange they are listed on or an aggregation source such as Bloomberg. This requirement for public listing acts as a form of quality control as the validation has been completed by the various listing agents and fund administrators. As a second form of comparative validation, the NAVs taken will be from accumulating share classes within the UCITS, as to remove any modelling considerations vis-à-vis dividend payments, which can act to lower the NAV of the UCITS artificially.

The author is satisfied that the above will ensure a standardisation across the data to ensure the comparative results generated are of the highest standard. In order to ensure the UCITS being compared are of an analogous nature, the author has set the qualifying criteria as follows:

- The UCITS must be publicly traded on an exchange;
- The UCITS must invest predominantly in fixed income instruments (at a minimum 70% of targeted Net Asset Value);
- The UCITS must have a European focused fixed income strategy;
- The UCITS must be Irish domiciled (I.e. authorised/approved by the Central Bank of Ireland);
- The UCITS must have a Euro denominated, accumulating share class; and

- The UCITS must either be actively managed or passively managed and the number of active vs passive UCITS under consideration must be equal.

All of the above criteria must be met to be considered by the author's selection.

Methodology

"A quantitative assessment of the Actively vs Passively managed debate, framed within the context of the Efficient Market Hypothesis"

In real terms, the research intends to determine if actively or passively managed fixed income UCITS provide greater net asset value returns over their counterpart, and in doing so provide linkages to the efficient market hypothesis, either in favour or against, as discussed in the author's literature review. The author will aim to achieve this determination and decision regarding the EMH in a quantitative manner, by which the author will compare and contrast a selection of UICTS who meet strict criteria including asset class selection, country of domicile and focus of strategy. The selected UCITS will present similar compositions in all but strategy. I.e. active vs passive. The total net asset value at the starting period of the research for each UCITS will not be significant, as the appreciation of the net asset value as a percentage of the initial value over the course of research is, in the author's opinion, the most valuable metric. I.e. to what percentage has the investor's holding grown. The data on each UCITS will ideally be retrieved from Bloomberg, however, should issues arise via this method, the author will elect to contact the listing exchange (a criterion of selection) for the relevant net asset value data. This piece of research will prove beneficial for academics in the pursuit of further understanding of the efficient market hypothesis and retail investors, who will be able to determine the most financially prudent means of investing.

Research Philosophy and Approach:

"Positivist researchers believe that they can reach a full understanding based on experiment and observation. Concepts and knowledge are held to be the product of straightforward experience, interpreted through rational deduction"[15]. As per the research question in relation to this undertaking, the Author, with support from the literature review and contemporary study, believes he can achieve "full understanding based on experiment and

observation" due to the quantitative nature of this research. This belief in the quantitative method, and thus positivist research style is further explained through the testing methodology and modelling, further described below. The counter to this research philosophy is the Interpretivist philosophy which can be defined as "Much of the value of interpretivist research is derived from phenomenology and hermeneutics, and it is also derived from data that is emergent only after the application of an interpretivist method for example. Therefore, to evaluate these interpretations, it is important to explore the constructs of the interpretivist paradigm"[16]. This style of research does not fit with the proposed research design and thus, would not be an appropriate pursuit in achieving the research objectives. Accordingly, and as defined by Ryan above, the Positivist style is clearly ideal for a research undertaking such as the author's. Indeed, from readings on the topic, the author can summarise the aims of the research as wanting to objectively compare and contrast two styles of variables and leave little in the way of interpretation via the implementation of a ridged, rational, rules-based and transparent approach to research methodology, modelling and testing. Thus, and as noted above, the Positivist research philosophy is core to the author's quantitative research undertaking.

Research Design:

In no uncertain terms, the research intends to determine if actively or passively managed fixed income UCITS provide greater net asset value returns over their counterpart. As determined within the literature review, the underlying tests of the efficient market hypothesis can provide us with a framework for this comparison of returns. The author has already determined, with academic support, that the research to be carried out is quantitative in nature. This quantitative choice will provide a definitive answer to the research question, leaving little in the form of ambiguity. The author has decided to draw influence in design of the analysis, as undertaken in the back testing of the "little book" by

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[15] Ryan, ABR, 2006. Post-Positivist Approaches to Research. Researching and Writing your Thesis: a guide for postgraduate students, [Online]. 1, 1, 13. Available at: http://eprints.maynoothuniversity.ie/874/ [Accessed 3 August 2018].
[16] Travis, JT, 1999. Exploring the Constructs of Evaluative Criteria for Interpretivist Research. Curtin University of Technology, [Online]. 1, 1, 1037-1045. Available

Joel Greenblatt, in "Behavioural Investing". The comparison of returns for two opposing portfolios is rather simple, as one will have appreciated to a greater percentage than the other, or indeed, simply protected investor capital to a greater extent. It is thus inferred that the observations of data will be refined into returns and an active vs passive portfolio will be constructed, weighting appropriate to the capitalisation of the individual UCITS. Once a determination is made, regarding returns, the difference in returns will be examined to identify if said returns are significantly different, via T-tests (as discussed below). This first firm of testing will provide the core answer to the research question. The simplicity of this test cannot be understated, as it is the test's best asset. The approach undertaken will effectively be imagining two monetary amounts of equal value, invested at the outset of the observable period and liquidated at the conclusion of the observable period. The returns generated by each portfolio will be compared, with the greater value providing the best returns for an investor. Secondly, each set of returns will be isolated, and the statistical difference calculated to determine if there is a significant difference in said returns. The final element of this test will conclude with an analysis of variance or an "ANOVA". This test takes the full set of results for actives funds, passive funds and finally a joint portfolio of both styles of funds to determine if there is a statistic difference between both active and passive portfolios and each of the variable sub-sets. This first set of testing and modelling will provide an answer to Question 1, as noted above.

The next element of research design relates to financial modelling and is linked to the second question the author wishes to answer. In order to determine if a practical linkage can be made to the efficient market hypothesis, the author intends to build a financial model to simulate a buy and hold strategy vs a filter rule strategy. Due to the nature of this testing, both active and passive funds will be examined as a cumulative model, as the testing is relative to a filter-rule test, rather than an individual comparison between active and passive funds. In many ways however, the testing carried out above in respect of active vs passive funds should already have this element imbedded. Active funds buy and sell portfolio holdings, while passive funds await rebalancing to buy or sell. Thus, this testing will isolate the gains, or indeed losses, to be made from this strategy. Once again, a stepped

at:https://pdfs.semanticscholar.org/0c15/7cab3f9de057201e0bfbbe3feecfc870f0b3.pdf?_ga=2.108046466.10 41737774.1533302352-767445795.1533302352 [Accessed 3 August 2018].

methodology will be applied. Using the returns derived above, and more clearly in the data and criteria and validity sub-section, the author will create a model which tracks the returns of each fund within the portfolio. This model will be designed with a 50-basis point or 0.50% tolerance. This, in effect, means that If the portfolio falls 0.5% in value, an auto "sell" is triggered, with the subsequent "buy" only materialising once the portfolio has returned to the previous highest net asset value. As noted within the literature review section, the author wishes to make this form of testing as applicable as is possible and will according incorporate a transaction cost representative of the market, thus eliminating any allegations of unrepresentativeness. Accordingly, a transaction cost of 100-basis points or 1%[17] will be applied to all "buy" or "sell" transactions on the portfolio. With the adjusted results determined via the filter-rule, these will be compared against the pure hold strategy, often referred to as a "long only strategy". This second form of modelling and subsequent testing will provide an answer to Question 2, as noted above. In respect of this testing and modelling, the author has once again, drawn influence from contemporary studies for design. Upon research, the author determined that a suitable methodology could be found in the Public Library of Science journal on the efficient market hypothesis, the author's scrutiny of said piece proved fruitful in determining that the methodology was robust and intuitive with regards a variety of variable factors "Both training and testing period contain price movements in trend or sideways. Therefore, it is expected that the rules that perform relatively well in both types of markets (trending and sideways) will obtain good results in both periods"[18]. Thus, the author can be confident the financial model will derive the requested results with relative ease and certainty of results.

The final design stage and testing in relation to the author's research is concerned with the differing yield sensitivities between active and passive UCITS funds. The author would theorise that from readings on the area of yield sensitivities that as passive UCITS are generally bound to a rebalancing timeframe of either one week, one month, semi-annual, etc. and thus do not have the ability to react to yield changes for the benefit of the

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[17] morningstar.com. 2005. Bond Trading Transaction Costs. [ONLINE] Available at:
http://news.morningstar.com/classroom2/course.asp?docId=5383&page=5. [Accessed 2 August 2018].
[18] Ioana-Andreea & Mihai-Cristian, IAB & MCD, 2013. An Algorithm for Testing the Efficient Market Hypothesis. The Public Library of Science journal, [Online]. 1, 1. Available at:
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0078177 [Accessed 2 August 2018].

investors. This lack of yield sensitivity would also be applicable for market shocks which are often delivered through geo-political news or economic indicators "Economic announcements are a vital source of information for market participants, containing important news that spills over internationally across markets. Many U.S. announcements, for example, significantly affect yields in the German note markets. In fact, U.S. economic news is found to have a direct and large effect on German yields within an hour of its release"[19]. Noting the linkage between these elements, active UCITS funds have full flexibility to adjust their holdings for maximum gain or indeed, from a preservation of capital perspective when faced with unexpected market movements or shocks. This element of the research sits nicely between an argument for and against the efficient market hypothesis. I.e. do the transaction costs of adjustment, remove the value of flexibility when faced with market movements, and indeed, does the inflexibility of a passive UCITS funds protect from over corrections in the market or leave t susceptible to loss via rigidity. This research will be undertaken by first using the Pearson Correlation Coefficient, as described below, to support the author's inference that a changing yield curve has a proportional effect on the fixed income funds, both active and passive, with the variables being the active or passive portfolio and Euro area yield curve values. Once this is determined, the author will modify the first form of modelling to derive the returns used in this test. The second form of modelling will then also be amended to observe the effects on the funds during yield curve adjustments and other forms of market shocks and instability within the euro area. The author will then finally view observe these periods and report all findings in order to provide an answer to Question 3, as noted above.

Data Criteria and Validity:

"Bloomberg's influence on the financial marketplace cannot be underestimated. While there are some alternatives–more on that in a moment–the Bloomberg terminal has been described as the "lifeblood" of banks, investment management companies, trading and brokerage houses and financial consultants." (Pike, 2015, Volume 32, Issue 5, Information

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[19] Goldberg & Leonard, LG & DL, 2003. What Moves Sovereign Bond Markets? The Effects of Economic News on U.S. and German Yields. Current Issues: IN ECONOMICS AND FINANCE, [Online]. 9, 9, 6. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=683269 [Accessed 2 August 2018].

Today) As noted above, the data will be sourced and accumulated from Bloomberg. Once the UCITS have been selected, as per the criteria listed in the research question section, the author will extract and refine a number of active and passives fixed income funds to create a useable data library. The refinement process will be a rules-based, stepped process, with a ridged methodology. The author will first determine the examinable period and ensure all data points span this period. Secondly, the author will select funds which meet the criteria listed in the section above. Thirdly, the author will retrieve the net asset value of accumulating, euro denominated share classes within said funds. This third element should act as a further criterion, as distributing share classes do not reinvest gains, and thus the net asset value can remain stationary, which can thus make returns more difficult to measure and value. Fourthly, the author will refine the daily net asset values into monthly net asset values, due to fixed income being a relatively stable asset class and finally, the author will select the most appropriate fund's share classes from the refined listed, based on the validity criteria in the section above, which in effect, should ensure the data being compared, both active and passive, are of an equal basis. The appropriateness will effectively be a comparison of fund focus and strategy. Effectively, the author will match active and passive pairs. E.g. matching a European fixed income corporate index tracking (passive) fund with a European fixed income corporate bond (active) fund, which have similar maturity, yield, etc. requirements. As the quote above suggests, the service is the "lifeblood" or financial markets. In this way, the author can be assured that the data retrieval process will only yield that of the highest quality data for use in this research undertaking. Should any issues arise via this method, the author will elect to contact the listing exchange on which the UCITS is listed, a criterion of Fund selection. As these exchanges are regulated entities, the data provided should also be of the highest standard, however, should the author be forced to utilise this route, a validity test will be carried out for prudence. This test includes randomly selecting dates within the data ("x") and comparing that with the published corresponding data point ("y") and thus ("x" = "y") will yield a successful data validity test.

Data Analysis:

In order to perform the testing, as described in the research design, the author will use a variety of analytical equations to implement and enact the research design used to determine and answer the research question, as noted above. The equations and formula listed within this section are not intended to be an exhaustive list, moreover, the author merely intends to give an indication of what the reader may expect in terms of analysis. E.g. Descriptive Statistics, Inferential Statistics and indeed, an Analysis of Variance.

$$\overline{x} = \frac{\Sigma x}{n}$$

Equation 1. Sample Mean

The mean forms the very average of the UCITS data, which is critical to every other equation, however, do not underestimate what the mean can tell us about the data set in its own right.

$$S = \sqrt{\frac{\Sigma(x-\overline{x})^2}{n-1}}$$

Equation 2. Sample Standard Deviation

This equation will be used to calculate the Sample Standard Deviation. This will allow us to determine how spread the data set is, in relation to the mean of the portfolio sample.

$$S^2 = \frac{\Sigma(x-\overline{x})^2}{n-1}$$

Equation 3. Sample Variance

The sample variance is a critical element for working out the standard deviation as well as analysing the portfolio variance which will be used to determine the outcome of the author's research,

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (x)^2][n\Sigma y^2 - (y)^2]}}$$

Equation 4. Pearson Correlation Coefficient

The Pearson Correlation Coefficient is used to determine the percentage change in the movement of one set of data, and what percentage of that change can be attributed to another set of data, with Y being the Independent variable and X being the Dependant variable.

$$\frac{I^2}{I^1}$$

Equation 5. Difference for Return

While generally a very simple equation, the change from one point to another cannot be understated within the context of UCITS and general data processing and analysis of any sample of data. Without this Equation, simply put, no analysis can take place.

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

Equation 6. T Statistic for Single Sample T Test

The t statistic is used in determining the population mean from a sampling distribution of sample means if the population standard deviation is unknown. As per other equations, the mean of the data is needed as well as standard deviation.

$$F = \frac{MSSB}{MSSW}$$

Where

$$MSSB = \frac{\sum_{g \in G} n_g (\bar{x} - \bar{x}_G)^2}{k-1} \qquad MSSW = \frac{\sum_{g \in G} (x - \bar{x}_g)^2}{n-k}$$

Equation 7. F Statistic for ANOVA

An F statistic is used as a point of reference under the null hypothesis. The F statistic is calculated by dividing the Mean Sum of Squares between the distribution into the Mean Sum of Squares within the distribution. This F statistic will allow the author to determine if two or more samples are different from one another. I.e. A≠B≠C

In the next section, the author will implement the methodology for testing and modelling as described further above.

Analysis & Findings

As is noted in the sections above, the purpose of this research undertaking is to quantitatively assess the Active vs Passive investment management debate. Within this assessment, the author will frame said undertaking within the context of the Efficient Market Hypothesis due to the apparent linkages found within contemporary studies and given fact within the investment industry as a whole, which is effectively summarised as, an advocate for passive investment is also an advocate of the efficient market hypothesis, with the opposite also being true. In this section, the author will thus undertake to conduct testing to answer the research question of this dissertation. This testing will encompass financial modelling, statistical analysis and empirical hypothesis assessment.

As noted in the Data criteria and Validity sub-section of the methodology, the daily returns for the UCITS funds was accessed and downloaded via Bloomberg. The author did not have to resort to using any listed exchanges, however, for the purposes of validity and completeness, the author reviewed a random sample of daily returns, singularly ("X") from Blomberg in line with the records of the listed exchange, singularly ("Y") and found no difference. In effect;

$$X_n = Y_n$$

The data in respect of the Euro Area five-year Instantaneous Forward Yield Curve, was mined from the European Central Bank website directly, and thus no validity testing was undertaken. This yield curve data will be used in the third testing set. All of the above daily net asset value data was then refined into monthly figures. I.e. the last traded closing price for any given month over the intended observable period, January 2005 through to June 2018. This refinement ensured the author was using data of comparable time frames and quality, which in turn assures of the reliability of the intended results. Due to the large number of share classes within these fixed income UCITS funds, the author applied the necessary criteria listed in the sections above. Due to share class launches and closings being rather frequent, the author struggled to satisfy the criteria while also ensuring

sufficient data was accessible. This led the author to adjust the observable period to December 2013 through to June 2018. Microsoft Excel was used for the purposes of refinement and validity scrutiny. Through this refinement, the author had fifty-five monthly returns within the context of two portfolios of seven active and seven passive European focused, fixed income UCITS funds, which all met the validity criteria. Before the author carries out testing in respect of the research question, the data being analysed must first be put into context. The application of various descriptive statistics was undertaken to gain a fuller understanding of the returns of the active and passive portfolios.

	Active Portfolio	Passive Portfolio
(n)	55	55
Final Return	104.91%	50.87%
Average Monthly Fund Return	0.27%	0.13%
Maximum Monthly Loss	-17.20%	-14.38%
Maximum Monthly Gain	15.02%	16.38%
Standard Deviation	6.26%	5.17%
Sample Variance	0.0039	0.0026

As noted in the table above, (n) represents the number of months over the observable period or the number of observations. The active portfolio returned an impressive 104.91% return, with a monthly average return per active fund of 0.27%. The passive portfolio also achieved significant returns in for the form of 50.87%, with an average monthly return of 0.13% per passive fund. These return figures were derived from an initial and equal amount invested, followed by the liquidation of the portfolio on the final date in the observable period. An observation of these statistics also informs a previous element of this research undertaking, in so far as the passive fund has a smaller variance, which in effect indicates the portfolio is less volatile. This indication also carries through to the maximum monthly loss and gain of each portfolio, with the active fund achieving a greater monthly gain as well as a greater monthly loss I.e. higher volatility is found within the active investment portfolio.

	Active Portfolio	Passive Portfolio
Kurtosis	0.594	2.078
Skewness	-0.635	-0.212

The final area of descriptive statistics examined are the kurtosis and skewness of both portfolios. The active portfolio has a kurtosis slightly above the standard normal range, which indicates a close to normal distribution. This close to normal distributions breaks slightly when reviewing the skewness of the active portfolio. The active portfolio is slightly negatively skewed, meaning there is a slightly high amount of smaller to negative returns than positive. When we apply this understanding to the passive portfolio, we see that that the kurtosis is abnormally high, meaning the returns of the portfolio are more concentrated around the 0 mark I.e. the tails of the returns distribution are quite small, and thus the kurtosis is significantly higher than the standard normal distribution. In a similar fashion to the active portfolio, the passive portfolio also demonstrates a negative skewness, however, the skewness is considered to be extremely close to the standard normal distribution, which in effect indicates the returns of very slightly negatively skewed.

	Active Portfolio & Passive Portfolio
Correlation	0.79

Having sufficiently undertaken a review into the returns data, the author felt required to confirm the connectivity of each portfolio to ensure the validity criteria equated to a comparable portfolio of fixed income UCITS funds, with similar strategies and structures, ensuring the comparison of the two investment management styles was a complete study with unrestrained and incontrovertible results with applicable findings for the investment industry and academia alike. This requirement was met via a correlation analysis, as noted above. The results of this analysis confirm the two portfolios are strongly correlated, with the results being greater than 0.7. I.e. a strong correlation can be found between the two portfolios. Having made these determinations and findings, the author feels confident in attempting to answer the research question. Accordingly, over the next 3 sub-sections, the

author will answer each of those problems posed by undertaking the testing and financial modelling as described in the methodology above.

Testing Set One:

The first set of testing is concerned with the determination of which style of investment management provides greater returns for investors. As per the research question section, this test is designed to determine if an actively managed fixed income UCITS portfolio outperforms a comparable passively managed fixed income UCITS portfolio, which in effect asks the question of whether the net asset value appreciation is greater for a portfolio active or passive fixed income UCITS funds. The test began by using the refined monthly net asset values for all funds, followed by deriving their monthly returns over the observable period. The returns were then added to an active or indeed passive portfolio to represent an underlying investment holding. These refined returns are summarised above.

Noting the returns provided by each portfolio, it would seem rather apparent that the active portfolio returns far surpasses that of passive portfolio over the observable period, and indeed, from a monetary viewpoint, this is certainly evident with the final returns for the active portfolio being 104.91% in comparison to the passive portfolio, which had a comparatively modest return of 50.87%. However, the author must determine the question presented in this section, are the returns provided statistically different. This form of analysis is referred to as a hypothesis test, with the hypothesis understood as:

Ho: Active Portfolio Returns = Passive Portfolio Returns

Ha: Active Portfolio Returns ≠ Passive Portfolio Returns

In effect, the null hypothesis states that the returns are not statistically different, while the alternative hypothesis states that the returns are indeed statistically different. In order to carry out this hypothesis or T-Test, the author must first determine if the variances of each portfolio are equal or different. This analysis of variance is used in determining which T-Test is most appropriate. This hypothesis test has the same null and alterative hypotheses, with the difference being in variance, in place of returns. An F-Test was used to determine this, as noted below:

Ho: Active Portfolio Variance = Passive Portfolio Variance

Ha: Active Portfolio Variance ≠ Passive Portfolio Variance

F-Test Two-Sample for Variances

	Active Returns	*Passive Returns*
Mean	0.0190	0.0092
Variance	0.0039	0.0026
Observations	55	55
df	54	54
F	1.46598	
P(F<=f) one-tail	0.08154	
F Critical one-tail	1.57088	

Accordingly, the author fails to reject the null hypothesis is favour of the alternative and furthermore, the author infers that there is no statistical difference between the variance of the active and passive investment portfolios, to a confidence level of 95%. This result is determined by the rationale that the F statistic is less than the F Critical value. In effect, there is insufficient evidence to categorically state the variance of each portfolio is different. This result indicates the author will be using a Two-Sample Hypothesis Test, referred to as a "Parametric" T-Test, with know and equal variances. As above, the author now applies the T-Test with the following results:

t-Test: Two-Sample Assuming Equal Variances

	Active Returns	*Passive Returns*
Mean	0.0190	0.0092
Variance	0.0039	0.0026
Observations	55	55
Pooled Variance	0.0033	
Hypothesized Mean Difference	0	
df	108	

t Stat	0.89766	
P(T<=t) two-tail	0.37136	
t Critical two-tail	1.98217	

Once again, the author fails to reject the null hypothesis is favour of the alternative and furthermore, the author infers that there is no statistical difference between the returns of active and passive investment portfolios, to a confidence level of 95%. Accordingly, there is no statistical difference between the returns of the active and passive portfolio, to a confidence level of 95%. This is determined due to the T statistic being less than the T Critical value. Thus, while the monetary returns associated with the investment in the active portfolio surpass that of the passive portfolio, the author cannot, with any conviction determine which portfolio ultimately provides better and thus greater returns for an investor in fixed income, European focused UCITS funds based on the results and analysis herein.

Testing Set Two:

The second set of testing is concerned with determining the linkages between these two investment management styles and the efficient market hypothesis, in the form of a filer-rule test, as described in the methodology section above. The author constructed a financial model tracking two portfolios containing separate sub-portfolios, passive and active, of which each portfolio had an initial equal value. Two of the sub-portfolios would purse a long-only, buy and hold strategy, while the other two sub-portfolios would apply a filter-rule and thus be actively managed. Using the a 50-basis point negative threshold, the following results were derived from the model:

Active Portfolio	Long-Only	Filter-Rule
Final Net Asset Value	€ 1,529,534.48	€ 1,400,548.18
Total Return	154.50%	141.47%

Passive Portfolio	Long-Only	Filter-Rule
Final Net Asset Value	€538,916.78	€757,379.52
Total Return	54.44%	76.50%

These return figures were derived from an initial and equal amount invested, followed by the liquidation of the portfolio on the final date in the observable period. The filter-rule column applied the reactionary filter to a negative period, representing a decrease in net asset value of 50-basis points or greater. If the portfolio experiences this decrease, the portfolio is liquidated in the following month, until such time as one month of would-be growth has passed, at which point the portfolio is reinvested.

The results here determine that an active filter rule methodology only decreases gains and increases losses from the prospective on an actively managed investment portfolio. This loss of potential returns is due to the potential for missing gains while being divested and the associated costs with divesting and reinvesting, effectively the opportunity and transaction costs. As per the literature review, this argument is used as a proof in supporting the efficient market hypothesis. However, for the second model the filter rule increases the gains and decreases the losses associated with the passively managed portfolio. This result is in direct contradiction to that of the active portfolio. Thus, the author cannot, with any conviction determine if the Efficient Market Hypothesis holds true with regards the active vs passive debate for European focused fixed income UCITS funds, due to the inconclusive nature of the results and analysis herein.

Testing Set Three:

The final set of testing is concerned with linkages between the yield curve and fixed income assets I.e. bonds. The author undertook testing in order to explore if the actively manged fixed income UCITS portfolio, or indeed, the passive managed fixed income UCITS portfolio provides for better protection and conversely, better returns with regards yield sensitivity. Through understanding this relationship, an investor would be informed as to which style of UCITS is more sensitive to Euro area yield curves, and secondly, does this sensitivity assist in the preservation of investor capital. The first element of testing in respect of this

undertaking related to understanding if the yield curve was correlated to the two investment style portfolios. The author thus used a correlation analysis in respect of the Euro Area five-year Instantaneous Forward Yield Curve or "IF5" in connection with both the active and passive portfolio returns respectfully.

Regression Statistics

	Active	Passive
Multiple R	0.1184	0.2309
R Square	0.0140	0.0533
Adjusted R Square	-0.0045	0.0355
Standard Error	0.0627	0.0507
Observations	55	55

As we can see from the correlation analysis, the correlation of the active returns to the change in the IF5 yield curve proved to be extremely weak, as demonstrated by the Multiple R figure. This in tern is compounded by the R Square figure, which in effect determines that the linkage between a movement in the IF5 yield curve, has almost no effect on the returns of the active portfolio. This thread is carried forward in the analysis of the passive portfolio's correlation analysis. Again, the Multiple R figure indicates a slightly higher, but ultimately a week correlation in respect of the IF5 yield curve. Moreover, while the R Square figure is slightly higher again, however, the movement in the IF5 yield curve has a very minimal impact in respect of the passive portfolio returns. The disconnect between these sets of data is most poignant when displayed visually.
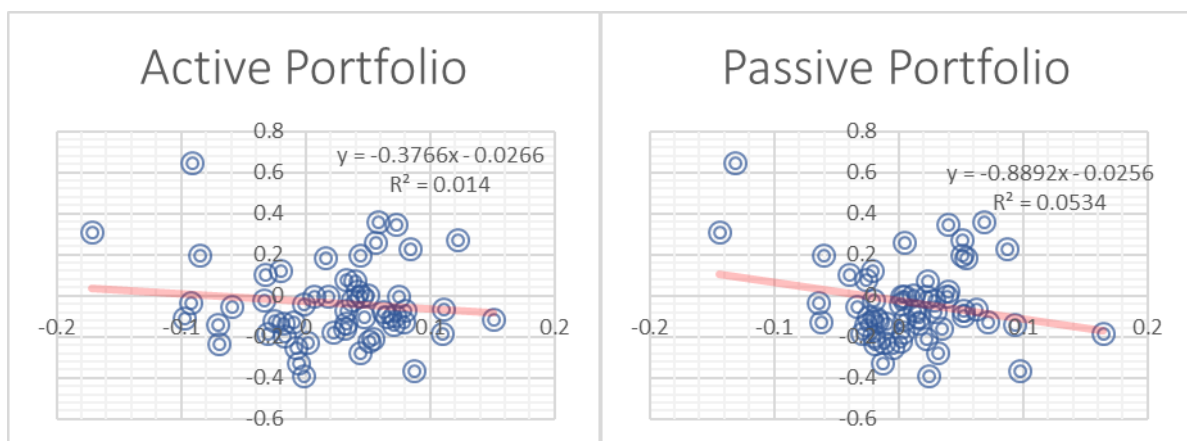
The graphs here show the IF5 on the Y axis and the returns of each portfolio on the X axis. The author decided not to pursue this testing further, owing to a key underlying principle of this analysis not being true. I.e. a change in the IF5 yield curve, should result in an appropriate change in the returns of a Euro denominate fixed income portfolio. In the data provided over the observable period, this is not the case.

Quantitative Observations on the Results & Analysis:

In summary, the author set out to implement the methodology of this research undertaking, which was guided and influenced by the literature review. The undertaking of this research set out to understand and implement a "quantitative assessment of the Actively vs Passively managed debate, framed within the context of the Efficient Market Hypothesis". This assessment was refined into three core questions, which if answered, would provide for said quantitative assessment. The author accumulated data in line with the methodology and refined and explained said data for the context of this proposed testing, which would enable the author to answer these research questions. The author then tested and analysed the data in line with those tests and drew conclusions based on the results provided. However, these observations and results need context and examination. Accordingly, the author will interrogate the results provided in each of the three testing sets, as noted above.

The first testing results provide a direct assessment and retort to the research question. This first set of testing was concerned with whether an active or passive portfolio would provide for greater returns. From a monetary standpoint, the active portfolio did provide for a greater final return, however, when we review the data behind this testing, we see that the standard deviation was higher than the average monthly returns, which in effect means the results could have just as easily been inverted to a situation where the passive portfolio outperformed the active portfolio in monetary terms. Ultimately, after undertaking a hypothesis test to determine if the returns were statistically different, the author was not in a position to reject the null hypothesis in favour of the alternative. I.e. the returns of each portfolio where not statistically different. In respect of framing this test within the efficient market hypothesis, and as per the literature review, the passive portfolio represents a belief in the hypothesis, while the active portfolio represents a disbelief in the hypothesis.

Accordingly, the test was inconclusive in that regard. I.e. while the active return was greater, the means were not sufficiently dissimilar and accordingly, the author cannot advocate for one portfolio over the other.

The second testing set provides an interesting result in respect of the efficient market hypothesis. This test aimed to determine if a buy and hold strategy, in effect, the efficient market hypothesis, would outperform a filter-rule portfolio with all associated transaction costs, in effect, a rejection of the efficient market hypothesis. The results proved to be rather fascinating, if at first review, slightly deceptive. When these two styles were applied to the active portfolio, the buy and hold strategy outperformed the filter-rile strategy by some 13.03%. When applied to the passive portfolio, the reverse was true. The filter-rule strategy outperformed the buy and hold strategy by 22.06% While this result would appear to be at odds with the efficient market hypothesis, the active portfolio would seem to confirm the hypothesis in this test. However, the active portfolio has already been actively managed and thus the author infers that this management has already applied a form of filter-rule to the portfolio. Moreover, the testing undertaken by the author simply added a level of fees and transaction costs, already found within the portfolio. Furthermore, when this model was applied to the passive portfolio, which is unmanaged, the returns proved greater. Accordingly, the author can state that the modelling implemented here has sufficient data to add as a proof against the efficient market hypothesis. In effect, the filter-rule strategy, regardless of costs, provides for better returns, in comparison to a purely passive strategy.

The final testing set was concerned with the linkage between the Euro area yield curve and the subsequent impact of a changing yield curve on the returns of both the active and passive portfolios. Once this linkage had been established, the author would then create a model to determine which investment management style provided greater protection in respect of a negative yield curve shift. As noted, the first test to determine the correlation of the yield curve and the portfolios, failed to prove even a weak correlation. This surprised the author, as the price of bonds (fixed income, of which these portfolios are made up of) derive

their value from three core areas; changes in yield, coupon income and the pull to par effect. The results of the correlation analysis ultimately determine that for these portfolios, the impact of a change yield curve is negligible. Which in effect, infers that these portfolios are dominated by coupon income and pull to par effect. While this result stopped the author's ability to answer the third research question, the inference from these results are something very interesting indeed. The author would thus suggest that a naïve investor's expectation could be that using a long/short trading strategy in synthetic fixed income positions could be used to hedge against interest rate risk. In economic theory, this hedging strategy would work due to the apparent linkages between yield and interest rates, however, this strategy would ultimately fail for these portfolios, due to the extremely weak correlation. This would result in the investor paying premiums on the synthetic hedging position, without receiving the intended protections.

In the next section, the author will discussion the research undertaking and findings in the context of the literature review, contemporary study and the real-world implications to be found from this dissertation.

Discussion

The author's findings in respect of the testing and analysis undertaken in this dissertation provide an interesting and introspective insight into the active investment management vs passive investment management debate and thus by association and influence on said testing, the efficient market hypothesis. The broad results of the testing were found to be inconclusive, if slightly boarding on a rejection of the efficient market hypothesis and thus an endorsement of the active investment management style over that of the passive. This rejection of the hypothesis is notable in testing set one, which determined that active investment management provided a better level of monetary return, however, the overall monthly returns were too similar statistically to that of the passive, to determine that the active UCITS funds outperformed that of the passive UCITS funds. In testing set two, the author found through financial modelling that an active, momentum-based trading strategy would outperform that of a buy and hold strategy. I.e. passive. The final testing set was inconclusive in respect of the research question. The author, while exploring how these results fit within the established literature will now explain and provide rationale as well as speculation in respect of why these results sway towards the active style, if ever so slightly. This exploration of the results will also consider and interpret the impact on relevant stakeholders as well as possible new insights provided by said results, within the debate.

The analysis, results and findings of this research undertaking add what has been added before in the context of the active vs passive debate, that is, inconclusive results in respect of which side of the debate is ultimately correct. However, the results do confirm elements within the literature review. It is asserted by Aliaga-Díaz of Vanguard that the passive investment style represents a broad market view. Through following this logic, the author determined that a passive holding is then representative of a form of risk management. The results of the analysis of passive funds ultimately confirmed this viewpoint as the volatility of these funds were lower, albeit not statistically different, than that of the active funds. Another tenant of the debate is argued by Malkiel in the journal of Economic Perspectives and states that active funds cannot provide greater returns without assuming greater levels of risk. The literature around this debate would appear to be self-evident as per Aliaga-

Díaz's statement vis-à-vis risk management, however, when undertaking a review of the resents, the author also testing the variances I.e. volatility of each portfolio and could not confirm that the variances of each portfolio were statistically different. And thus, the active portfolio did provide greater monetary returns, with seemingly equal levels of risk.

The author thus infers that while the testing was statistically inconclusive, the practical elements and results found within the analysis and modelling do favour the active investment management style and thus would seem to reject the efficient market hypothesis. However, when reviewing previous studies of the hypothesis, the author has failed to categorically reject said hypothesis. An example of such a failure to reject can be found in testing set one. This test which was designed to determine if active or passive investment styles would provide better returns. As noted in the literature review, the idea of a passive fund which tracks the broad market, represents the idea of a "random walk" with an active portfolio I.e. one which selects its underlying fixed income based on fundamentals and technical analysis representing an afront to the "random walk" theory. The Asian Economic and Financial Review journal documents a similar test in relation to testing set one. The model was designed to determine if fundamental analysis outperformed a passive investment which represents the broad underlying market. While the journal article concludes that no such random walks exists, the author failed to reach the same determination and in effect, failed to confirm a selection strategy outperforms the broad market.

The testing results also provided new insights and a fascinating new viewpoint into the metrics of testing the filter-rule. In summary, the filter-rule divests when the portfolio falls by a certain percentage and re-invests after a period of would be growth exceeds a certain percentage. This strategy is also referred to as a momentum strategy within the investing sphere. This filter-rule is an afront to the efficient market hypothesis which states the transaction costs and missed gains will result in an underperformance against a buy and hold strategy. Under the research design, the author tested this element of the efficient market hypothesis in the context of both an active and passive portfolio, testing in each case which strategy provides a greater return. In the case of the active investment

management portfolio, the buy and hold strategy I.e. the hypothesis, provided greater returns. In the second case and conversely in relation to the passive investment management portfolio, the filter-rule test provided greater returns I.e. a rejection of the hypothesis. In seeking to understand these results, the author has formed a theory in relation to testing for a filter-rule. The theory states that a filter-rule will only provide greater returns, so long as the portfolio under examination is not simultaneously actively managed. This theory thus argues that actively managing a portfolio where the underlying exposures are already actively managed creates an additional layer of fees and a lag in recognising under and over performance. The cost element of this theory is quite simple; however, the lagged element requires an introspective review. The author infers that an active manager is effectively reviewing the same signals an active investor is reviewing, however, the difference becomes pronounced when the author links an underlying to said signals. An active manager is thus assessing impacts, etc. regarding the underlying of each investment fund within the portfolio and secondly, the collection of fixed income assets making up each overall fund. The active investor is merely reviewing the impacts, etc. associated with the portfolio and thus, a decline at the portfolio level at a certain timepoint has already been adjusted for by the investment manager in each underlying and consequently, by the time the active investor has adjusted their position, the risk to portfolio declining further has already been mitigated and hence, the active investor has a lag in respect of additional gains and losses.

The results and implications of this research undertaking can be viewed as something very interesting, when taken in context of what was thought to be a certainty. This debate of not only active and passive investment management styles, but also of the efficient market hypothesis are often framed within the context of U.S domiciled equity stocks listed on large exchanges (NYSE, FTSE et al). The author's research focused on Irish domiciled, European focused fixed income UCITS funds. This differential in asset class and domicile provides results and findings within a largely unexplored area. This unknown element in most notable in the context of the third testing set, as noted above. Conventional wisdom would deem that using a long/short strategy on fixed income to hedge against interest rate risk would be a smart bet. However, the findings of the third test set determined through inference that the hedging strategy would fail, due to the uncorrelated nature of European focused fixed

income funds, and thus through refinement, European fixed income assets, and the euro area yield curve. This result would appear to be contrary to U.S focused fixed income, which has a strong correlation to the U.S yield curve (Bloomberg Market Concepts) and thus this new development questions the differing relationship between the driving factors of fixed income, in respect of their domicile and focus. I.e. do European fixed income have a higher correlation in respect of bond price to coupons or pull to par then U.S fixed income? The author thus determines, through strong conjecture, that the fixed income assets, which are the underlying of the UCITS funds under examination do not derive their price, and are thus not affected, by changes in the euro area yield curve. This discovery may however have a rational reasoning behind it. During the observable period, the European Central Bank engaged on an aggressive bond buying, quantitative easing program. This, almost guarantee of purchase, drove the demand for fixed income assets to be artificially high. With the lack of demand, UCITS whose prime objective is to invest in euro area fixed income assets, were directly competing within market participants, which led to a trickle-down demand for fixed income which perhaps didn't have the same high rating as the originally targeted bonds and thus traded below par I.e. their true value. When these bonds matured, the holders experienced a pull to par effect, whereby the principle returned to the fund was higher than the purchase of said bond. Thus, the value of the bonds may have laid in the pull to par effect, rather than the would be assumed Euro area yield curve. The author can make no comment in relation to how coupons affected or indeed, would have affect the underlying bonds value.

The author is hopeful that the results and inferences of the dissertation will aid investors, market participants and academia in accessing and understanding, what could be considered as a previous grey area of investment understanding and behavioural finance, within the context of using the hypothesis as a guide in an individual's and collective's investment decisions, market participants understanding, and the practical elements learnt from the results and findings. The author feels the impact of this study will be most felt by individual investors. By applying the "winning" methodology in respect of the filter-rule, investors can expect to increase returns by some 20%, within the context of a fixed income

asset class portfolio. This methodology should not prove difficult for even a retail investor, as the UCITS funds within the passive portfolio were daily traded, and thus provide a high-level of liquidity, with a relatively low bid/ask spread I.e. the difference between the purchase and sale price of an underlying share within the fund. The author also infers that academia, who often cite the efficient market hypothesis as a cornerstone of behavioural finance within the economic discipline will benefit from the results of this analysis and research. This undertaking adds to a diverse and well-studied area, with the differential centred on the fixed income asset class and euro focused nature of the underlying to the UCITS funds. Finally, the testing is also reasonable to repeat from an unlearned student and thus should assist from a teaching standpoint in respect of quantitative analysis. The author however suspects that the results and analysis herein will not assist in determining or evolving the opinion of market participants. As stated at the outset of this dissertation "Increasing numbers of clients will realise that in toe-to-toe competition versus near-equal competitors, most active managers will not and cannot recover the costs and fees they charge" (Ellis, 2017). I.e. a divided market in respect of opinion vis-á-vis the active vs passive debate and moreover, the efficient market hypothesis. The debate will continue with those active investment proponents championing the relevant results of testing set two, while the passive advocates will point to the lack of a conclusive difference in returns therein testing set one. Indeed, no debate within finance is as actively contested, with this dissertation merely adding another viewpoint, to an almost un-settleable argument. Within the next section, the author will conclude the research undertaking, and provide an introspective review of what has been achieved, and furthermore, what can be done to enhance future research.

Conclusions and Recommendations

This research undertaking set out to explore two differing styles of investment management and the proponents of said styles. Once an understanding had been established, the author aimed to quantitatively evaluate each style. Accordingly, and through the review of literature on said topic, a linkage to a behavioural finance theory was continually made in the debate of active investment management and passive investment management. The behavioural finance theory, or hypothesis as referred to herein, is the Efficient Market Hypothesis. The hypothesis effectively determined that an advocate of passive investment, is an advocate of the hypothesis, with the opposite being true. I.e. active investors dismiss the hypothesis as erroneous. The author then determined to test in order to observe which investment style provided the better investment proposition for a retail investor and consequently, whether the efficient market hypothesis proved true in the case of a passive mandate or false, in the case of an active mandate. Ultimately, and as discussed in the section above, the author found in favour of the active debate over the passive, albeit not as convincingly as one would've hoped. The research area of active and passive investment, with subsequent links to the hypothesis is one which is well-studied. The author set out to diversify this topic by amending the asset class and domicile distinction under review, which added a unique evaluation of the debate and hypothesis. Over the course of the research and testing, the author exposed himself to each argument, and through this undertaking has gained a better understanding of financial markets and the investment cultures that drives said markets, either positively or negatively.

The results of the quantitative testing proved marginally in favour of an active investment mandate. This marginality is derived from testing set one, which found that while actively managed investment funds provided greater returns, the returns where not statistically different from that of passive returns, and testing set three, which the author will discuss below. The choice to undertake this research and testing in a positivist, deductive and ultimately quantitative manner was the correct decision prior to this dissertation based on literature and in the author's justification and explanation of the results, continues to be the correct method of exploration. The author wished to have a larger observation period which would provide for greater diversity of data, however, due to the issues around longevity of share classes and in order to meet the qualifying criteria, this observation period was

reduced. Accordingly, the author would implore that any individual wishing to expand upon this research should to do by exploring the relationship pre-financial crisis, to act as a direct comparison to this research undertaking.

A recommendation for further testing occurred to the author while implementing testing set three, as denoted in the Analysis and Findings section. The author found that neither the active or indeed passive fixed income portfolios were correlated to the instantaneous 5-year forward Euro yield curve. The author found this development extremely intriguing and attempted to provide rationale in respect of the non-linkage. However, this non-correlation and rationale provided were speculation based on a preconceived understanding of how fixed income assets are priced. Therefore, the author would suggest for further research and study, a quantitative assessment into how fixed income assets are priced, with a focus on yields, coupons and the pull to par effect, as explained above, be undertaken. The author estimates that pull to par is having a greater impact due to the quantitative easing programme by the European Central bank, which was in full affect over the observable period for this undertaking. Accordingly, this new observation has presented itself as a very compelling discovery, with possible wide-ranging ramifications in our understanding of fixed income securities.

The research undertaking will benefit any of those who wish to gain a greater understanding of investments, financial markets, the differing nature of statistical return verses absolute return and more generally, the two options of investment management available for those persons. The research is aimed at academics and industry professionals alike. Moreover, this aim was intertwined into the very testing methodology used by the author. Indeed, while wishing to make the testing as applicable as possible in the true investment world, the author accounted for transaction costs and front running within the construction of portfolios used for comparison. However, this strive for real-world application was always framed within a healthy respect for academia, and thus adequate yield was given to literature on the topic, as well as testing in a scientific manner. This academic pursuit and respect for the scientific method was most notable in the failure to reject two hypothesises, even though a monetary difference was found.

As noted in the discussion piece, the industry and thus, market participants will either use this research to further cement their advocacy for active investment management and the potential gains it can bring, while those whom already believe in the passive investment argument will dismiss the research on the basis of a perceived lack of statistical differentiation. Thus, the author wishes that this research undertaking will be read by those whom are starting into a wonderfully exciting career in financial markets, as it provides a backdrop into one of the most passionately contested debates in finance and investment.

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