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WILL UCITS FUNDS DOMINATE NON UCITS INVESTMENT FUNDS? A STOCHASTIC DOMINANCE APPROACH

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This study employs stochastic dominance methodology to compare the performance of UCITS (Undertakings for Collective Investment in Transferable Securities, i.e. investment funds that have been established in accordance with UCITS Directive adopted in 1985) and non UCITS investment funds. Based on a sample of 100 UCITS and 100 non UCITS funds, we find that non UCITS bond funds stochastically dominate UCITS bond funds whereas UCITS equity funds dominate non UCITS equity funds. We can infer from this result that risk-adverse investors prefer non UCITS bond funds and UCITS equity funds in order to maximize their expected utility. The UCITS III directive does not encourage risk-adverse investors to choose UCITS bond funds in order to maximize their expected utility.

Keywords: stochastic dominance, investment funds, expected utility

1.0 Introduction

The current regulation on investment funds sets out the ground of an integrated market that eases the international exchanges through European financial markets. This European frame warrants to the investors some useful information related to the costs, risk and performance when selecting investment funds. This ensures that the industry can take advantages of economies of scale and specialization on the unified investment funds market.

The Undertaking for Collective Investment in Transferable Securities (UCITS), first established in 1985 (85/611/CEE Directive) was adopted to unify the fund industry in the European Union (EU). It was hoped that once this legislation would be uniformly established across Europe, cross-border funds distribution could be simplified. Funds that were offered in one EU country could be "passported" into another EU country, under the supervision of the home-country regulator, thereby furthering the EU's goal of a single market for financial services in Europe.

In recognition of the weaknesses of the 1985 Directive, proposals were developed to amend it and more successfully achieve the harmonization of laws throughout Europe. But the second iteration of UCITS was abandoned by the European Commission in 1997 when the Council of Ministers could not reach a common position. In July 1998, the EU Commission published a new proposal, which was drafted in two parts (a product proposal and a service provider proposal), which sought to amend the 1985 Directive. These proposals were finally adopted in December

2001 and are generally referred to as UCITS III. UCITS III consists of the following two directives:

- Directive 2001/107/EC of the European Parliament and of the Council (Management Directive); and
- Directive 2001/108/EC of the European Parliament and of the Council (Product Directive).

The two Directives entered into force in February 2002 and member states had 18 months to transpose the new Directives into their national law. All member states have implemented the Directives by August 2003.

The Management Directive seeks to give management companies a "European passport" to operate throughout the EU and widens their activities. It also introduces the concept of simplified prospectus, which is intended to provide more accessible and comprehensive information in a simplified format to assist the cross-border marketing of UCITS throughout Europe. The primary aim of the Product Directive is to remove barriers to the cross-border marketing of units of collective investment funds by allowing funds to invest in a wider range of financial instruments. Under this directive, it is possible to establish money market funds, derivatives funds, index-tracking funds and funds of funds as UCITS funds.

UCITS III has laid the foundation of a new European legislation i.e. the European passport for funds. Following the creation of this European passport, the European funds universe is divided into two major types of funds: UCITS funds and non UCITS funds. UCITS funds are the funds that comply with the European legislation meaning that on the one hand they have restrictive investment rules such as borrowing limits, concentration limits, and eligible asset types but on the other hand they can benefit from the European passport. Non UCITS funds are funds that are submitted to domestic law rather than EU law: they have no passporting facility for sale in other EU member states but in compensation they have more flexibility in relation to investment and borrowing restrictions.

The current study employs a new methodology to compare the performance of UCITS and non UCITS investment funds. We have analyzed whether a rational investor benefit from any funds to maximize his/her expected utility.

2.0 Data

Our study uses daily return of funds from 3 January 2000 to 30 April 2009. The daily frequency is chosen in order to catch the maximum level of information in the funds behavior. Although there are large differences across European countries, the dominant asset classes of investment are bond and equity. We therefore consider two universes of funds: funds investing in equities and funds investing in bonds. These two classes represent respectively 40% and 37% of the total Asset under Management (AuM) in Europe.

In the universe of funds that currently exist in Europe (36322 funds), we consider funds that exist since the beginning of the study period without any change of investment policy. The second criterion is the availability of published data. The most obvious observable data is the Net Asset Value (NAV) that represents the total value of the fund's assets less its accrued liabilities. We limit the funds universe to the funds which compute and publish their NAV on a daily basis. The third criterion is the size of the funds: we exclude funds with small capitalization. The last criterion is the fund's promoters. We diversify the fund's promoters in order to avoid concentration effect.

The UCITS funds are compared with the non UCITS funds at the same level. Meaning that, we compare the UCITS bond funds with the non UCITS bond funds and the UCITS equity funds

with non UCITS equity funds. We choose 50 UCITS funds and 50 non UCITS funds from each of these two categories respectively as the sample of this study. We name the 50 UCITS bond funds as B1, B2, …, B50 and the 50 non UCITS bond funds as B51, B52, …, B100. Similarly, we name the 50 UCITS equity funds as E1, E2, …, E50 and the 50 non UCITS equity funds as E51, E52, …, E100. We then divide the entire whole sample period into two sub periods: January 2000 – 30 September 2005 (sub period 1) and 1 October 2005 - 30 April 2009 (sub period 2). This is to examine the impact of the full implementation of UCITS III regulations.

Despite the fact that the new Directives had to be implemented and applied in member states before the 13 February 2004; the full implementation of UCITS III can not be uniformly defined throughout all European countries. Following the 05/186 CSSF Circular - defining guidelines of the Committee of European Securities Regulators (CESR) regarding the application of transitional measures resulting UCITS III - all UCITS funds must have a simplified prospectus as from 30 September 2005 at the latest. Knowing that this simplified prospectus is one of the key aspects of the information provided to investors, we choose that date to split our sample.

3.0 Methodology

We suggest using the stochastic dominance (SD) approach for the analysis. Hadar and Russell (1969), Hanoch and Levy (1969) and Rothschild and Stiglitz (1970) introduced SD theory to economics. An advantage of this approach is that it alleviates the problems that can arise if the fund returns are not normally distributed because it utilizes the entire returns distribution. This approach also allows for meaningful economic interpretation of the results based on non-satiation and risk-aversion. SD approach allows investors to appropriately rank fund performance without the need for strong assumptions on investors' utility function or the returns distribution of asset. SD rules offer superior criteria on which to base investment decisions relative to the traditional analysis because the assumptions underlying SD are less restrictive. In addition, SD incorporates information on the entire distribution, rather than the first two moments and requires no precise assessment as to the specific form of the investors' risk preference or utility function (see Taylor and Yoder, 1999).

Recent advances in SD techniques allow the statistical significance of SD to be determined. To date, the SD tests have been well developed, for example, McFadden (1989), Kaur et al. (1994), Anderson (1996, 2004), Davidson and Duclos (DD, 2000), Barrett and Donald (2003) and Linton et al. (2005). The DD test is powerful and less conservative in size (see Tse and Zhang 2004 and Lean et al. 2008). Moreover, DD test allows the series being examined to be dependent. Thus, we choose to use the DD test in this study.

The SD approach had been used in the evaluation of performance of mutual funds since the 1970s. Taylor and Yoder (1999) used the SD approach to compare the performance between load and no-load funds during the 1987 crash. Kjetsaa and Kieff (2003) documented that the SD approach provides a collateral and feasible strategy to reveal relative investment preferences by discriminating among and parsing the universe of mutual fund opportunities. Lately, Gasbarro et al. (2007) utilized the SD approach to compare the performance of 18 country iShares. Wong et al. (2008) used the SD approach to rank the performance of Asian hedge funds.

Essentially, the most commonly-used SD rules correspond with three broadly defined utility functions are first-, second- and third-order SD for risk averters, denoted by FSD, SSD and TSD respectively. Formally, we let F and G be the cumulative distribution functions (CDF) and f and g are the corresponding probability density functions (PDF) of the results of two funds Y and Z respectively with common support of $[a, b]$. Define

$$H_0 = h \text{ and } H_j(x) = \int_a^x H_{j-1}(t)\,dt \text{ for } h = f, g,\ H = F, G \text{ and } j = 1, 2, 3. \quad (1)$$

Fund *Y* would dominate Fund *Z* by FSD if and only if $F_1(x) \le G_1(x)$; by SSD if and only if $F_2(x) \le G_2(x)$; and finally, by TSD if and only if $F_3(x) \le G_3(x)$ for all x and *Y* has higher expected return than *Z*.

Let U be the utility function. Investigating SD among different assets is equivalent to examining the choice of assets by utility maximization.

Theorem 1:

1. All non-satiated investors (prefer more to less) with utility functions that satisfy the condition $U'(x) \ge 0$ will prefer *X* to *Y*, and will increase their wealth and utility by shifting their investments from *Y* to *X*, if and only if $X \succ_1 Y$.
2. All non-satiated and risk-averse investors with utility functions that satisfy the condition $U'(x) \ge 0$ and $U''(x) \le 0$ will prefer *X* to *Y*, and will increase their utility by shifting their investments from *Y* to *X*, if and only if $X \succ_2 Y$.
3. All non-satiated and risk-averse investors with decreasing absolute risk aversion (DARA), such that utility functions that satisfy the condition $U'(x) \ge 0$, $U''(x) \le 0$ and $U'''(x) \ge 0$ (prefer positive skewness), will prefer *X* to *Y* and will increase their utility by shifting their investments from *Y* to *X*, if and only if $X \succ_3 Y$.

The existence of SD implies that the expected utility of the investor is always higher when holding the dominant fund than holding the dominated fund and, consequently, the dominated fund would never be chosen. We note that hierarchical relationship exists in SD (see Levy 1998): FSD implies SSD, which in turn implies TSD. However, the reverse is not true. As such, we only report the lowest dominance order in practice.

For any two funds, *Y* and *Z* with CDFs *F* and *G* respectively and for a grid of pre-selected points $x_1, x_2 \ldots x_k$, the order-*j* DD test statistics, $T_j(x)$ (j = 1, 2 and 3), is:

$$T_j(x) = \frac{\hat{F}_j(x) - \hat{G}_j(x)}{\sqrt{\hat{V}_j(x)}} \quad (2)$$

$$\hat{V}_j(x) = \hat{V}_Y^j(x) + \hat{V}_Z^j(x) - 2\hat{V}_{Y,Z}^j(x),$$

$$\hat{H}_j(x) = \frac{1}{N(j-1)!}\sum_{i=1}^{N}(x - h_i)_+^{j-1},$$

$$\hat{V}_H^j(x) = \frac{1}{N}\left[\frac{1}{N((j-1)!)^2}\sum_{i=1}^{N}(x - h_i)_+^{2(j-1)} - \hat{H}_j(x)^2\right], H = F, G; h = y, z;$$

$$\hat{V}_{Y,Z}^j(x) = \frac{1}{N}\left[\frac{1}{N((j-1)!)^2}\sum_{i=1}^{N}(x - y_i)_+^{j-1}\left(x - z_i\right)_+^{j-1} - \hat{F}_j(x)\hat{G}_j(x)\right]$$

where F_j and G_j are defined in (1). It is empirically impossible to test the null hypothesis for the full support of the distributions. Thus, Bishop et al. (1992) proposed to test the null hypothesis for a pre-designed finite numbers of values *x*. Specifically, the following hypotheses are tested:

$H_0 : F_j(x_i) = G_j(x_i)$ for all x_i, $i = 1, 2, ..., k$; $H_A : F_j(x_i) \neq G_j(x_i)$ for some x_i;

$H_{A1} : F_j(x_i) \leq G_j(x_i)$ for all $x_i, F_j(x_i) < G_j(x_i)$ for some x_i;

$H_{A2} : F_j(x_i) \geq G_j(x_i)$ for all $x_i, F_j(x_i) > G_j(x_i)$ for some x_i.

We note that in the above hypotheses, H_A is set to be exclusive of both H_{A1} and H_{A2}, which means that if either H_{A1} or H_{A2} is accepted, we will not say H_A is accepted. Under the null hypothesis, DD showed that $T_j(x)$ is asymptotically distributed as the Studentized Maximum Modulus (SMM) distribution (see Richmond, 1982) to account for joint test size. To implement the DD test, the test statistic at each grid point is computed and the null hypothesis is rejected if the test statistic is significant at any grid point.

Accepting either H_0 or H_A implies non-existence of any SD relationship, non-existence of any arbitrage opportunity between these two investment funds and neither of these two funds are preferred to one another. However, if H_{A1} or H_{A2} of order one is accepted, a particular investment fund stochastically dominates another fund at first-order. In this situation, arbitrage opportunity can exist and any non-satiated investor will be better off if s/he switches from the dominated fund to the dominant one. On the other hand, if H_{A1} or H_{A2} is accepted for order two or three, a particular investment fund stochastically dominates the other at second- or third-order.

DD test compares the return distributions at a finite number of grid points. Richmond (1982) argued that too many grids will violate the independence assumption required by the SMM distribution while Barrett and Donald (2003) noted that too few grids will miss information of the distributions between any two consecutive grids. Tse and Zhang (2004) suggested that an appropriate choice of k for a reasonably large sample ranges from 6 to 15. To make more detailed comparisons without violating the independence assumption, we follow Fong et al. (2005) and Wong et al. (2008) to make 10 major partitions with 10 minor partitions within any two consecutive major partitions in each comparison and to make the statistical inference based on the SMM distribution for k =10 and infinite degrees of freedom[1]. This allows the examination of the consistency of both magnitudes and signs of the DD statistics between any two consecutive major partitions without violating the independent assumption.

4.0 Empirical Results

4.1 Bond funds

The means and the standard deviations of the returns for all 50 UCITS bond funds and 50 non UCITS bond funds are plotted in Figure 1 and Figure 2 respectively. The figures reveal that the means and standard deviations do not move together. There are three UCITS bond funds and six non UCITS bond funds with large negative return and high standard deviations. In general, the non UCITS bond funds show more volatile pattern than the UCITS bond funds.

[1] Refer to Lean et al (2008) for the reasoning. Critical value is 3.254 for 5% level of significance tabulated in Stoline and Ury (1979).

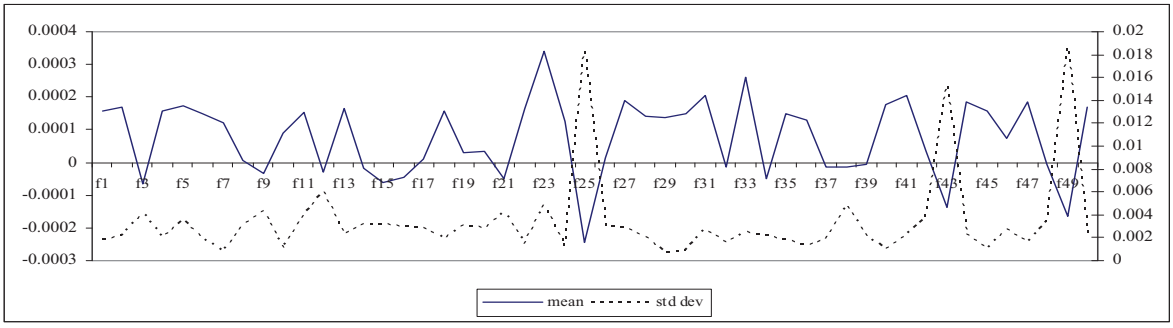

Figure 1: Means and standard deviations of the UCITS bond funds.

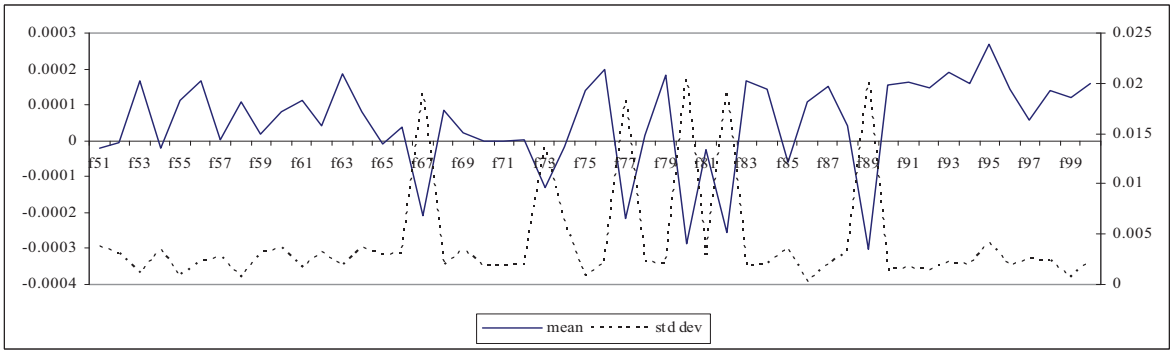

Figure 2: Means and standard deviations of the non UCITS bond funds

We exhibit in Table 1 the summary statistics of the funds for the whole sample period and the two sub periods. The average daily mean return of the UCITS bond funds is higher than the non UCITS bond funds whereas its average standard deviation is smaller for the whole period and sub period 1. In sub period 2, both funds experience negative return and the UCITS bond funds have larger standard deviation than the non UCITS bond funds. Based on the Sharpe ratio[2], the UCITS bond funds perform better than the non UCITS bond funds in the sub period 1 but this situation reverses in the sub period 2. Both funds have negative skewness and large kurtosis inferring that their returns are not normally distributed. To sum up, the UCITS bond funds perform better than the non UCITS bond funds in the sub period 1 but there is no clear conclusion for the sub period 2. Hence, it is difficult to tell whether the UCITS bond funds perform better than the non UCITS bond funds based on these statistics.

Table 1: Descriptive statistics for the UCITS and non UCITS funds

Fund	Mean	Std dev	Sharpe ratio	Skewness	Kurtosis
Whole period					
UCITS bond	7.653×10^{-5}	0.003445	0.05068	-4.8243	182.4862
Non-UCITS bond	5.027×10^{-5}	0.004295	0.05134	-8.6298	341.3593
UCITS equity	-0.000129	0.014390	-0.00886	-0.1901	150.5409

[2] Sharpe ratio = mean/standard deviation.

Non-UCITS equity	-0.000174	0.015418	-0.01096	-1.0621	133.2717
Sub period 1					
UCITS bond	0.000138	0.002682	0.09356	-3.1978	62.0171
Non-UCITS bond	0.000106	0.003857	0.08568	-6.3316	180.0174
UCITS equity	1.402×10^{-5}	0.013113	0.00328	1.4231	64.6945
Non-UCITS equity	-0.000104	0.014239	-0.00623	-0.9140	69.3688
Sub period 2					
UCITS bond	-2.275×10^{-5}	0.003840	0.01245	-2.5224	63.3107
Non-UCITS bond	-3.942×10^{-5}	0.003589	0.02285	-3.4408	67.2523
UCITS equity	-0.000358	0.015556	-0.02188	-1.3780	44.1877
Non-UCITS equity	-0.000287	0.016714	-0.01731	-0.7551	55.1073

We rank each group of funds based on the largest means, the smallest standard deviations and the largest Sharpe ratios. Then, we do the same ranking[3] pairwise SD comparison for the each 'top ten' funds. Specifically, we apply Eq. (2) with the UCITS fund being the first variable (F) and the non UCITS fund being the second variable (G) in the equation. If UCITS fund is preferred to the non UCITS fund, there will not be any significantly positive T_j but there will exist some significantly negative T_j.

The DD dominance results for whole period are summarized in Table 2. For the highest means group, 60% of the funds do not have SD relationship while 3 out 4 pairs show the non UCITS bond fund dominates the UCITS bond fund. For the smallest standard deviations group, there is no SD relationship among 80% of the funds and both remaining pairs show the non UCITS bond fund dominates the UCITS bond fund. For the highest Sharpe ratios group, 40% of the funds have no SD relationship and 4 out 6 pairs with the non UCITS bond fund dominates the UCITS bond fund. Surprisingly, we find that non UCITS bond fund dominates UCITS bond fund with the same ranking comparison. Thus, it is conjecture that risk averters prefer non UCITS bond fund to UCITS bond fund for maximizing their expected utility.

Table 2: Pairwise comparison of the UCITS and non UCITS funds by the DD test.

Ten highest mean		Ten lowest standard deviation		Ten highest Sharpe ratio	
Sample	Decision	Sample	Decision	Sample	Decision
Bond funds					
B23 - B95	ND	B29 - B86	B86>B29	B29 - B86	B86>B29
B33 - B76	ND	B 7 - B58	ND	B40 - B99	B99>B40
B31 - B93	ND	B30 - B99	ND	B30 - B75	ND
B41 - B63	B63>B41	B45 - B55	ND	B 7 - B53	B7>B53
B27 - B79	B79>B27	B40 - B75	ND	B45 - B58	ND
B47 - B56	B47>B56	B10 - B53	ND	B47 - B55	B55>B47
B44 - B83	ND	B36 - B90	ND	B22 - B90	ND
B40 - B53	ND	B24 - B92	ND	B33 - B92	B92>B33
B 5 - B91	B91>B5	B22 - B91	ND	B36 - B63	B36>B63
B 2 - B94	ND	B32 - B61	B61>B32	B24 - B91	ND
Equity funds					
E23 – E99	ND	E31 – E58	E31>E58	E10 – E99	ND
E22 – E73	ND	E10 – E62	E10>E62	E23 – E73	ND
E25 – E53	ND	E 5 – E55	ND	E34 – E53	E34>E53
E10 – E71	E10>E71	E21 – E59	E21>E59	E22 – E71	ND
E34 – E58	E34>E58	E34 – E96	E34>E96	E14 – E58	ND

[3] The UCITS fund with the largest mean is compared to the non UCITS fund with the largest mean; the UCITS fund with the second largest mean is compared to the non UCITS fund with the second largest mean and so on.

E14 – E57	E14>E57	E14 – E85	E14>E85	E25 – E57	ND
E49 – E98	E49>E98	E26 – E92	E26>E92	E49 – E98	E49>E98
E13 – E72	ND	E47 – E98	E47>E98	E13 – E72	ND
E 5 – E96	E 5>E96	E38 – E68	E38>E68	E 5 – E64	E 5>E64
E26 – E64	E26>E64	E49 – E71	E49>E71	E26 – E96	ND

ND means no stochastic dominance between the funds; B63>B41 means B63 stochastically dominates B41 at second order. There is no first order stochastic dominance found between the funds.

Based on the descriptive statistics above, we identify the 'most outstanding funds' with the largest mean or smallest standard deviation or largest Sharpe ratio of each group. B23 is the UCITS bond fund with the largest mean return whereas B29 with the smallest standard deviation and also the largest Sharpe ratio. Similarly, B95 and B86 represent the non UCITS bond fund with the same criteria. For each of this 'most outstanding fund', we then do the pairwise SD comparison with all other funds. Recall that the objective of this paper is to compare the performance/preference between the UCITS funds and non UCITS funds, so we just compare for example B23 with B51, B52, …, B100 respectively and B95 with B1, B2, …, B50 respectively.

Table 3 displays the summary of their DD dominance results for the whole sample period and the two sub periods. Surprisingly, both the largest mean funds (B23 and B95) only dominate minimum number of funds but they are dominated by many funds. For example, B23 is dominated by 28 non UCITS funds but only dominates one non UCITS fund. Contradict to the common belief, the fund with the largest mean may not always preferred by the risk-averse investors for maximizing their expected utility. On the other hand, the smallest standard deviation which also the largest Sharpe ratio funds (B29 and B86) dominate many funds and are only dominated by at most two funds. Hence, we conclude that risk averters and risk-averse investors with DARA who make portfolio choice on the basis of expected-utility maximization will unambiguously prefer B29 and B86 to maximize their expected utility.

Table 3: Summary of the Davidson–Duclos (DD) test statistics

Funds	Dominates				Dominated by			
	FSD	SSD	TSD	Total	FSD	SSD	TSD	Total
Whole period								
UCITS B23	0	1	0	1	0	25	3	28
UCITS B29	0	37	0	37	0	1	0	1
Non UCITS B95	0	2	0	2	0	28	1	29
Non UCITS B86	0	45	0	45	0	0	0	0
UCITS E23	0	2	10	12	0	0	0	0
UCITS E31	0	45	1	46	0	0	0	0
UCITS E10	0	45	0	45	0	0	0	0
Non UCITS E99	0	14	6	20	0	0	2	2
Non UCITS E58	0	23	1	24	0	4	0	4
Sub period 1								
UCITS B23	1	1	0	2	0	14	11	25
UCITS B29	0	25	1	26	0	1	0	1
Non UCITS B95	3	2	0	5	0	19	8	27
Non UCITS B86	0	35	5	40	0	0	0	0
UCITS E23	0	3	9	12	0	0	0	0
UCITS E31	0	48	0	48	0	0	0	0
UCITS E10	0	48	0	48	0	0	0	0

Non UCITS E99	2	26	0	28	0	7	0	7
Non UCITS E58	3	24	0	27	0	7	0	7
Sub period 2								
UCITS B23	0	0	0	0	0	42	0	42
UCITS B29	0	30	0	30	0	2	0	2
Non UCITS B95	0	0	0	0	0	30	0	30
Non UCITS B86	0	44	0	44	0	0	0	0
UCITS E23	0	2	0	2	1	1	0	2
UCITS E31	0	44	0	44	0	0	0	0
UCITS E10	0	1	0	1	0	2	0	2
Non UCITS E99	0	8	3	11	0	0	2	2
Non UCITS E58	0	16	0	16	0	4	0	4

The values indicate the number of funds for each fund dominates or the number of funds that it is dominated by. Note that the reported number of SSD (TSD) excludes the number of FSD (SSD). As hierarchical relationship exists in SD, FSD (SSD) implies SSD (TSD). Thus, the total number is the sum of FSD, SSD (inclusive of TSD) and TSD (exclusive of SSD). For example, B23 is dominated by 25 funds at SSD and 3 funds at TSD (excluding SSD) and thus it is dominated by 28 funds (including both SSD and TSD) totally.

We also find that the dominance of UCITS bond is dominate less than the non UCITS bond funds in total. For example, in the whole period, B23 and B29 together dominate 38 non UCITS bond funds while B95 and B86 together dominate 47 UCITS bond funds. Moreover, the number of non UCITS bond funds that dominate the two UCITS bond funds in total increase from 26 in sub period 1 to 44 in sub period 2. Hence, our SD results show that risk-averse investors would prefer the non UCITS bond funds to the UCITS bond funds for maximizing their expected utility and this preference is more significant in sub period 2 after the full implementation of UCITS III directive.

Interestingly, we find four FSD relationships in sub period 1. They are B23 dominates B60; B95 dominates B3, B9 and B42 respectively. For illustration, we discuss B23-B60 and B3-B95 in details. Table 4 shows that, for B23-B60, none of T_1 is significantly positive with 6% of it to be significantly negative. Similarly, the table displays that for B3-B95, none of T_1 is significantly negative with 21% of it to be significantly positive. These results imply that B23 stochastically dominates B60 whereas B95 stochastically dominates B3 at first order. Thus, the non-satiation investors will increase their expected wealth if they shift their investment from B60 to B23 or from B3 to B95. However, these FSD relationships disappear in sub period 2. As argued by Wong et al. (2008), the FSD should not last for a long period of time because market forces cause adjustment to a condition of no FSD if the market is rational and efficient.

4.2 Equity Funds

We do the same tests and analyses for the equity funds. The means and the standard deviations of the daily return for all 50 UCITS equity funds and 50 non UCITS equity funds are plotted in Figure 3 and Figure 4 respectively. The means and standard deviations can be considered moving in the same direction. Non UCITS funds are more consistent and moving more closely than the UCITS funds except E52 with the lowest mean and highest standard deviation.

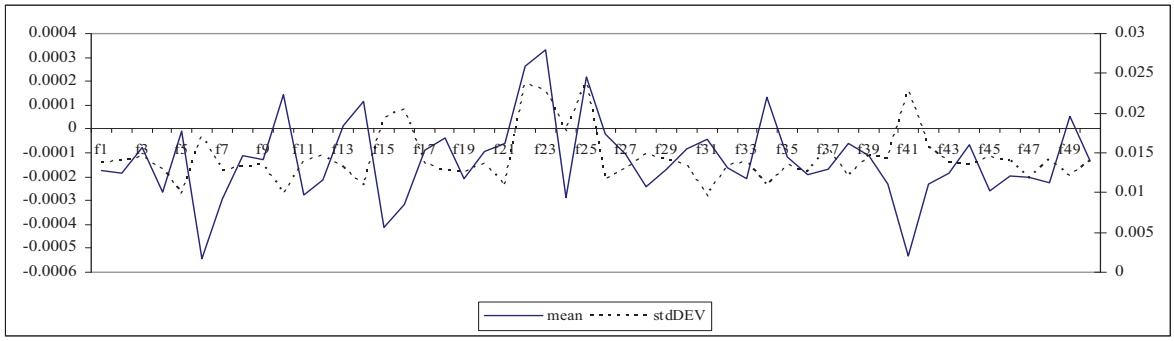

Figure 3: Means and standard deviations of the UCITS equity funds

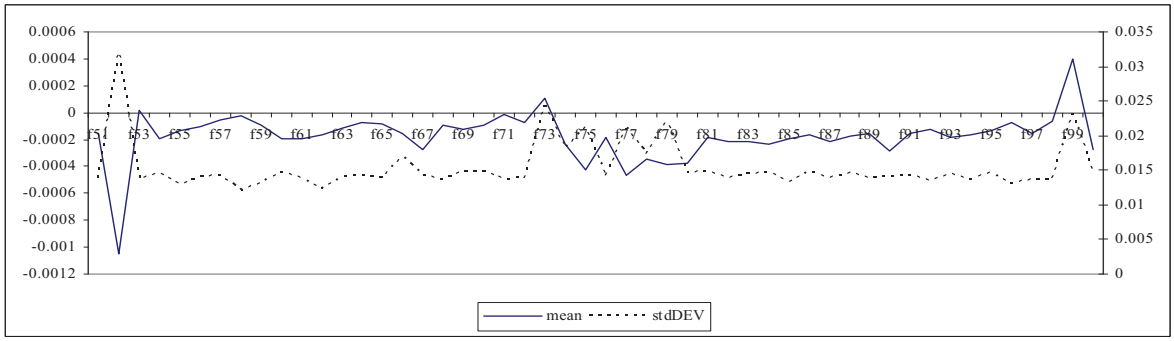

Figure 4: Means and standard deviations of the non UCITS equity funds

Table 1 show that both average daily mean return of the UCITS and non UCITS equity funds are negative. UCITS funds are better performed than the non UCITS funds for the whole period and sub period 1. Furthermore, UCITS funds always with the lower volatility than the non UCITS funds. Although the UCITS funds have positive return in the sub period 1, the return decrease dramatically and become lower than the non UCITS funds in sub period 2. In addition, UCITS funds have a positive and larger Sharpe ratio in sub period 1. Both funds have negative skewness and large kurtosis inferring that their returns are not normally distributed. To sum up, UCITS funds perform better than the non UCITS equity funds in the sub period 1 but there is no clear conclusion in the sub period 2. Hence, it is difficult to tell whether the UCITS funds perform better than the non UCITS funds based on these statistics. Our result is consistent with the PWC report.

The DD dominance results for the 3 groups 'top ten' funds are displayed in Table 2. For the highest means group, 60% of the funds reveal SD relationship with all UCITS equity fund dominates the non UCITS equity fund. For the smallest standard deviations group, all UCITS equity fund dominates the non UCITS equity fund and there is only one pair with no SD relationship. For the highest Sharpe ratios group, 70% of the funds have no SD relationship and the remaining 3 pairs show that the UCITS fund dominates the non UCITS fund. Hence, we conclude that the UCITS equity funds dominate the non UCITS equity funds with this same ranking comparison. This infers that risk-averse investors prefer UCITS equity funds than the non UCITS equity funds to maximize their expected utility.

The 'most outstanding funds' are identified as the same criteria as the bond funds. E23 is the UCITS equity fund with the largest mean return whereas E31 with the smallest standard deviation and E10 with the largest Sharpe ratio. Similarly, E99 is the largest mean return and the largest Sharpe ratio for non UCITS equity funds; E58 is the smallest standard deviation fund. We find from Table 3 that all the three UCITS equity funds do not dominated by any of the non UCITS equity funds for the whole period and sub period 1. E31 and E10 dominate almost all the non UCITS equity funds at second and third orders in the whole period and sub period 1. This result infers that risk averters and risk-averse investors with DARA who make portfolio choice on the basis of expected-utility maximization will unambiguously prefer E31 and E10 to non UCITS equity funds to maximize their expected utilities. However, the number of dominance reduces significantly in sub period 2. In particular, the highest Sharpe ratio UCITS funds, E10 perform very badly, the number of dominance reduces from 48 to 1 in sub period 2. This is because the performances of this fund itself as an individual case. E23 and E31 still maintain their performances in sub period 2 compare to E99 and E58 that decrease 69% and 33% respectively. Moreover, both non UCITS equity funds are dominated by 7 UCITS equity funds in sub period 1 but they are less dominated in sub period 2.

The two most outstanding non UCITS equity funds, E99 and E58 dominates 2 and 3 UCITS equity funds respectively at first order in sub period 1, In particular, E99 dominates E19 and E50; E58 dominates E2, E19 and E50 respectively. For illustration, we discuss E50-E99 and E19-E58 in details. Table 4 shows that, for E50-E99 (E19-E58), none of T1 is significantly negative with 10% (8%) of it to be significantly positive. These results imply that E99 stochastically dominates E50 whereas E58 stochastically dominates E19 at first order. Thus, the non-satiation investors will increase their expected wealth if they shift their investment from E50 to E99 or from E58 to E19. However, same as the bond funds, the first-order dominance disappears in sub period 2.

Table 4: Results of Davidson–Duclos (DD) test for selected pair

	FSD		SSD		TSD	
	$\%T_1 > 0$	$\%T_1 < 0$	$\%T_2 > 0$	$\%T_2 < 0$	$\%T_3 > 0$	$\%T_3 < 0$
B23-B60	0	6	0	39	0	51
B 3–B95	21	0	57	0	52	0
E50-E99	10	0	19	0	34	0
E19-E58	8	0	14	0	17	0

Note: DD test statistics are computed over a grid of 100 on daily fund returns. The table reports the percentage of DD statistics which is significantly negative or positive at the 5% significance level, based on the asymptotic critical value of 3.254 of the studentized maximum modulus (SMM) distribution. T_j is the Davidson and Duclos (DD) statistic for risk averters with j = 1, 2 and 3 defined in Eq. (2) with F to be the first fund and G to be the second fund stated in the first column.

5.0 Conclusion

This paper examines the performance of UCITS funds and non UCITS funds using SD approach. An advantage of this approach is that it alleviates the problems that can arise if the fund returns are non-normally distributed. Our approach also allows for a meaningful economic interpretation

of the results. However, we do not intend to forecast the future returns of any investment funds and their risk profile using past data.

Based on a sample of 100 UCITS funds and 100 non UCITS funds, we find that non UCITS bond funds stochastically dominate UCITS bond funds whereas UCITS equity funds dominate non UCITS equity funds. This result infers that risk-averse investors prefer non UCITS bond funds and UCITS equity funds than their counterpart to maximize their expected utility. The UCITS III directive does not help to increase the preferences of risk-averse investors for choosing the UCITS bond funds to maximize their expected utility.

PWC Survey's on fund managers showing that the fund managers welcome UCITS III directive to marketing their funds and tax issues. However, our results show that from the investors' perspective, they may not fully aware the benefit of UCITS III directive in terms of investor protection with its investment restrictions especially the bond funds.

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