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An Investigation of the Impact of Derivative Use on the Risk and Performance of UK Unit Trusts

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Abstract

A popular investment choice for UK investors is unit trusts. This paper examines the impact of derivative use on the risk, performance, and risk management of UK unit trusts between January 1995 and December 1997, extending an earlier US study. Despite the well-documented increased use of derivatives by corporate investors, approximately three-quarters of our UK sample did not use derivatives, consistent with US evidence. The main findings of the paper show that the cross-sectional variability of a number of risk measures tends to be larger for trusts that use derivatives compared with those who do not use derivatives. Derivative use tends to have little influence on performance inferences for the overall sample of trusts but does for some investment sectors of our trust sample. Finally, and in contrast to evidence in the US, trusts that use derivatives tend to have less severe changes in risk due to past performance within a calendar year. The findings have important implications for the existing regulations in the UK on derivative use by unit trusts that prohibit the use of derivatives for speculative purposes and for the large number of individual investors who invest in these trusts.

JEL classification: G23; G18

Keywords: Derivatives; Unit trusts; Performance; Risk

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1. Introduction

Derivatives have expanded the portfolio of investment choices, and their use is growing. An important consideration for individual investment is whether or not to use derivatives. If investors choose to use derivatives they can use them to hedge their position and/or for speculative purposes. For the many individuals in the UK who use unit trusts as a form of investment, these decisions belong to the fund manager. It is therefore very important to consider the impact of this derivative use on the performance and risk of the unit trust. Because the managers of these trusts invest on behalf of the individual investors their use of derivatives is a matter of public interest. In the UK derivative use in these funds is governed by regulators with the intention of ensuring that the managers of these trusts use derivatives for the purpose of "efficient portfolio management," defined as controlling risk, generating additional income, or reducing costs but not for speculation.

There has been a huge growth in derivative markets and derivative use by companies and financial institutions (Grant & Marshall, 1997; Bodnar et al., 1998; and Whidbee & Wohar, 1999). Theoretically, derivative use provides a number of benefits, and it has been suggested that users will improve their performance and lower risk relative to non-derivative users (Allayannis & Weston, 2001 and Guay, 1999). However, with the near collapse of Long-Term Capital Management, the losses incurred by a number of financial institutions, such as Barings, and the widely publicized losses by corporate investors associated with derivative transactions and the subsequent lawsuits (Gibson Greetings and Proctor and Gamble, see McCarthy, 2000), a perception does exist that derivative use is highly risky and regarded as a speculative tool (Koski & Pontiff, 1999).

Unlike this speculative image, finance theory predicts that profit maximizing corporate investors hedge risk exposures in an effort to reduce the costs associated with agency problems between bondholders and shareholders, financial distress, and taxes (Froot et al., 1993, and Mian, 1996). The empirical results on these theories have been mixed, and a number of recent papers are refining the data and samples. Graham and Rogers (Is corporate hedging consistent with value maximization? An empirical analysis, unpublished working paper, Northeaston University, 2000) provide a summary. Nonetheless, there is little prior research about the extent of derivative use in more traditional investment institutions, such as pension funds, mutual funds, and unit trusts. This is an extremely important omission as these funds invest on behalf of a large number of individual investors. Previous research into the derivative use by specific industry groups has provided some significant insights into the motivation for derivative use (Tufano, 1996, and Haushalter, 2000). Consequently, it is important to consider the use of derivatives by financial institutions, which invest funds on behalf of a wide range of investors, especially in the UK where there are a number of regulations on this use.

A recent exception to lack of research in derivative use in financial institutions is a study by Koski and Pontiff (1999), who explore derivative use by United States mutual funds between 1992 and 1994. Using a telephone survey and an examination of fund prospectuses and/or annual report, Koski and Pontiff (1999) found that only a relatively small proportion of US mutual funds (approximately 21%) had used derivatives and that derivative use had little impact on either the cross-sectional risk characteristics or performance of the funds that used derivatives compared to the funds which did not. Koski and Pontiff (1999) also explore the effect of derivatives on the intertemporal relationship between changes in risk and past performance and find that changes in risk are less severe for funds that use derivatives, which they interpret as being more consistent with funds trying to minimize the impact of the cash inflows and outflows on the risk of the fund. This conclusion is based on Brown et al.'s 1996 finding that past performance has a significant impact on changes in mutual fund risk in the next period.

This paper uses a methodology similar to that of Koski and Pontiff (1999) to examine the impact of derivative use by UK unit trusts between January 1995 and December 1997. UK unit trusts are very similar to open-ended US mutual funds. One area of difference is that nearly all unit trusts have a load charge. We consider the three primary areas addressed by Koski and Pontiff (1999), namely, whether derivatives affect the risk characteristics of trusts, their performance, and the intertemporal relationship between changes in risk and past performance.

Further, we contribute to this research in four ways: first, for the first time we investigate the impact of derivative use by UK managed funds; second, at the time of the Koski and Pontiff (1999) study there were no specific US regulations on derivative use, while derivative use by UK unit trusts is regulated; third, we consider a more recent time period than that of the original study to investigate whether the trend in increased derivative use by corporate investors was being mirrored in the mutual fund/unit trust sector (the low numbers of derivative users in Koski and Pontiff 's study may be due to their sample period including two years which would be considered to be at the height of the "derivatives debacles" with controversies such as Bankers Trust), and finally, following Koski and Pontiff (1999) we differentiate our sample of unit trusts based on their investment objective allowing a full international comparison. Since we have no measure of the risk position of the trust using derivatives prior to this use we deal with this issue by grouping the trusts together by their investment strategies.

The next section describes the regulations on derivative use in UK unit trusts. Following this we introduce the data and discuss the sample of unit trusts. Then we describe the methodology used in this paper. Finally, we report the empirical results and provide concluding comments.

2. UK regulations

At the time of the US study the regulatory environment for the funds was their own fund charter detailing specific regulations on derivative use. The only external regulation was in the form of risk disclosure requirements of the Securities and Exchange Commission. Koski and Pontiff (1999) could therefore specifically test whether derivatives were used to hedge or speculate. Regulations have since been imposed in the US, indicating internationally the increasing importance of this issue for regulators with an aim of protecting the interests of individual investors. As in the US, the use of derivatives by UK unit trusts is governed in the fund by the individual trust deed (fund charter in the US). Nonetheless, over the time of this study UK unit trusts have restrictive regulations on derivative use by the single statutory regulatory body the Financial Services Authority (FSA). The regulations governing derivative use are specified by the FSA in the Financial Services (Regulated Schemes) Regulations

1991 (Release 199). This builds on Article 21 of the European Union Directive on Undertakings for Collective Investments in Transferable Securities, which, at paragraph 1, allows member states to authorize the use of derivatives in managed funds.

Part 5 of Section E of the Financial Services (Regulated Schemes) Regulations provides three broad requirements on derivative use by UK unit trusts: the transaction must be economically appropriate for the purpose of "efficient portfolio management," the risk exposure must be fully covered by cash or other property sufficient to meet any obligation to pay or deliver that could arise, and the transaction must have been entered into for one or more of three specific aims (section 5.49–5.51, FSA Financial Services Regulated Schemes Regulations 1991). The specific aims in section 5.50 are that derivatives can be used where they can be reasonably expected to reduce risk or costs or to add to the income or capital of the fund with relatively low risk. The first two aims, together or separately, allow for tactical asset allocation, that is, a switch in the risk exposure through the use of derivatives rather than through sale and purchase of the underlying asset. The final aim states that there is an acceptably low level of risk where the manager reasonably believes that the position takes advantage of pricing imperfections in relation to acquisition and disposal (or disposal and acquisition) of rights in relation to the underlying asset or that the position receives a premium for the writing of a covered call option or a covered put option, even if the benefit is obtained at the expense of surrendering the chance of yet greater benefit.

The regulations define the types of derivatives that can be used as options or futures or an index derivative (section 5.07). This would include hedged option positions such as a covered call and the use of index derivatives as long as the fund has holdings of the underlying equities. Also, funds can use forward transactions with an approved counterparty. There are further regulations on derivative use for futures and options funds, but these were not included in this study. Since the UK regulations are to protect individual investors and are specific in the types of derivatives that can be used and the requirements for cover, the speculative use of derivatives is ruled out. This contrasts with the US where a small number of the derivative users in the Koski and Pontiff (1999) sample report using derivatives only for speculative purposes.

3. Data and sample of trusts

The risk characteristics, performance, and risk-management tests are estimated for each UK trust between January 1995 and December 1997. The initial sample included every trust in the 1997 UK Fund Industry *Review and Directory Handbook* that had a UK equity objective. The UK Fund Industry *Handbook* contains all trusts that are available at that point in time. The UK Fund Industry *Handbook* includes the name of the investment manager of each trust. In summer 1998 a questionnaire was sent out to every investment manager about the extent of derivative use during the past three years in the trusts for which they are responsible. The question asked was whether the trust has used derivatives in the last three years.

There were 359 questionnaires sent out for which there were 94 replies (26.2% response rate). Some questionnaires provided information on more than one trust. Information on derivative use was collected for 109 trusts. Following Koski and Pontiff (1999) monthly

Table 1
Summary statistics of trusts

	Whole sample	User sample	Non-users sample
Mean monthly return (%)	1.4	1.4	1.4
Average annual load charge (%)	4.6	4.6	4.7
Annual charge (%)	1.2	1.1	1.2
Size (£million)	135	133	136
Number of trusts (N)	93	22	71
UK equity income (N)	17	5	12
UK equity growth and smaller companies (N)	47	9	38
UK growth and income (N)	29	8	21

The table provides summary statistics for the sample of 93 unit trusts. The sample of trusts is divided into two groups depending on whether the trust has used derivatives (Users) or are not users of derivatives (Non-users). The table reports the average of the mean monthly return (%) between January 1995 and December 1997 and the average load charge (%), annual charge (%), and size (£m) at September 1996. N is the number of trusts within the different groups. The final three rows report the number of trusts within three investment objective groups and the number that are users and non-users of derivatives. The three investment objective groups are UK equity income, UK equity growth and smaller companies, and UK growth and income.

returns on each trust were calculated for a three-year period between January 1995 and December 1997. A multiyear period was chosen since the incentive-gaming hypothesis of Brown et al. (1996) assumes that changes in risk take place within calendar years. To be included in the tests, we require that trusts have a minimum of 12 return observations. This requirement imposes survivorship bias. However, we only lose two trusts because of this requirement. The other 14 trusts are not included because some managers responded for trusts that do not have UK equity objectives. There were 93 trusts in the final sample.

The monthly returns were calculated from monthly offer prices from Money Management and dividends from the annual *UK Extel Dividend and Fixed Interest Record.* Trust characteristics were collected from the 1997 UK Fund Industry *Review and Directory Handbook.* This included the load charge, annual charge, size, and investment objective as at the end of September 1996. The five investment objective groups are, equity and bonds, equity income, equity growth, growth and income, and smaller companies. The five investment objective groups were combined into three groups. There were very few trusts in UK equity and bond sector and so they were allocated to the UK growth and income sector. Trusts in the smaller companies sector were allocated to the UK equity growth sector because prior to the introduction of a specific smaller companies sector, these trusts belonged primarily to the equity growth sector.

Table 1 presents summary statistics for the sample of trusts. It shows that only a minority of trusts in our sample had used derivatives (23.6%), similar to the findings on the proportion of use in Koski and Pontiff (1999). Consequently, there does not appear to be a significant change in the numbers of unit trusts using derivatives over time for these two different regions, and there seems to be no notable change due to the poor publicity surrounding derivatives in the period of Koski and Pontiff's study. The proportion of trusts using derivatives across the investment objective groups varies between 19.1% (UK equity growth and smaller companies) and 29.4% (UK equity income). This may be partly explained by a lack of suitable individual or index derivative for trusts that invest in smaller companies. The mean values of the monthly returns, load and annual charges, and size show little variation between the two subsamples of trusts. There appears to be no descriptive difference between the two groups of trusts in terms of these characteristics.

Our sample size is smaller than that of Koski and Pontiff. In some of our subsequent tests, we analyzed the results by investment sector; however the number of derivative users within some of the investment sector groups were small, and the lack of consistent significant results means that these results are unreported. The normal caveats apply when dealing with survey data, especially since the UK regulations prohibit use of derivatives for speculation; this may reduce the response rate for trusts concerned about this restriction. We compared the characteristics of the respondents to the managers of trusts that did not respond. We found no significant differences between the two groups in terms of median size, load charge, or annual charge. We therefore have reason to believe that our sample is representative of the population of UK equity unit trusts.

4. Methodology

This section introduces the methodology used to test and evaluate the risk, performance, and risk management of our sample of UK trusts.

4.1. Risk

The paper examines whether there are significant differences between the cross-sectional mean and variance of the various risk measures for the derivative users or non-users. If derivative use has no impact on the risk profile of the trusts, there should be no significant differences between the two groups. Derivative use can have a number of different effects on the risk of a trust, depending on the reason for and type of the derivative used. Some derivative use may make the trust returns more non-normal due to the asymmetric payoff structure in some derivatives, such as an option. This implies that the skewness and excess kurtosis measures of trusts that use derivatives may be different from trusts, which do not use derivatives.

Derivatives can also be used by funds to ensure that they fully track a stock market index. Consequently, since there is widespread evidence that the returns on stock indices are non-normal (with increased skewness and kurtosis), funds that use derivatives to remain fully invested when experiencing inflows of cash should display greater risk in comparison to non-users whose cash position would reduce these risk measures. The following risk measures are calculated for the sample trusts: standard deviation, residual risk, beta, skewness, and kurtosis. The standard deviation, skewness, and kurtosis measures describe the higher moments of the return distribution. The residual risk and beta measures split the total risk into market risk and unique risk, respectively.

4.2. Performance

The performance of the trusts is evaluated using Jensen's measure and the conditional measure of Ferson and Schadt (1996). Evaluating performance when trusts use derivatives is more complicated as Jensen's measure is biased (Leland, 1999). Leland (1999) develops an alternative performance measure that is valid when the fund uses derivatives. The performance of the trusts is also estimated using Leland's (1999) measure. The results were similar to Jensen's measure using a single factor model and so are unreported. Jensen's measure can be estimated from the following regression:

$$r_{it}=\alpha_i+\sum_{k=1}^{K}\beta_{ik}r_{kt}+\varepsilon_{it} \tag{1}$$

where:

r_{it} is the excess return on trust i in period t,
r_{kt} is the excess return on the kth portfolio in the benchmark for k = 1,. . . . ,K.,
K is the number of portfolios in the benchmark,
ϵ_{it} is a random error term with $E(\epsilon_{it}) = 0$ and $E(\epsilon_{it}r_{kt}) = 0$ for k = 1,. . . . ,K.,
β_{ik} coefficients are the betas of trust i to each of the portfolios in the benchmark, and
intercept α_i is Jensen's (1968) performance measure.

The null hypothesis of no performance ability is that $\alpha_i = 0$. A positive α_i is usually interpreted as measuring superior performance and a negative α_i reflects inferior performance.

The conditional Jensen measure of Ferson and Schadt (1996) allows the fund betas and factor risk premiums to vary through time. They assume that the fund beta is a linear function of the information variables used by investors to set prices and show that the conditional Jensen measure within a conditional CAPM framework can be estimated from the following regression:

$$r_{it} = \alpha_i + \beta_i r_{mt} + \sum_{l=1}^{L} \delta_{il} r_{mt} Z_{it} - 1 + e_{it} \tag{2}$$

where:

r_{mt} is the excess return on the market index at time t,
z_{lt-1} is the de-meaned lth information variable for l = 1,. . . . . ,L at time t-1,
β_i is the average conditional beta of trust i,
δ_{il}'s are the slope coefficients in the conditional beta function of trust i with respect to the L information variables, and
L is the number of information variables

The additional terms $r_{mt}z_{lt-1}$ capture the covariance between the conditional beta and market risk premiums. The intercept α_i is the conditional Jensen measure which will equal zero if the trust exhibits no abnormal performance. For multifactor models, the conditional Jensen measure is the intercept in the regression of the excess returns of the trust on a constant, the benchmark excess returns, and the products of the information variables with each benchmark portfolio. Performance is evaluated for equally weighted portfolios of trusts that use derivatives and those that do not. If derivative use has no impact on performance, then there should be no significant differences between the two portfolios.

Two alternative factor models were also used. The first is a single-factor model, which uses the monthly excess return of the Financial Times All (FTA) Share index, which is a value-weighted index of the largest companies on the London Stock Exchange. The second model is a three-index one based on Elton et al. (1993). This is a three-index model that uses the monthly excess returns on the FTA index, the FT UK small stock index, and the UK government bond index. The monthly return on a 30-day UK Treasury bill is used as the risk-free asset. The information variables used to estimate the conditional performance measure are similar to those of Ferson and Schadt (1996) and Ferson and Warther (1996). They include the lagged dividend yield on the FTA index and the lagged one-month risk-free return. All of the data are collected from Thomson Financial Datastream (a source of a wide range of international information on equities, options, and macroeconomic series).

4.3. Risk management

Koski and Pontiff (1999) propose the following regression specification to explore the effect that derivative use has on the relationship between the change in risk and past performance. The risk measures used are standard deviation, beta and residual risk.

$$\Delta Risk = \alpha + \beta_1 \mathrm{D} + \beta_2 \mathrm{Perf} + \beta_3 \mathrm{D}^* \mathrm{Perf} + \beta_4 \mathrm{Lagrisk} + \epsilon_i \tag{3}$$

where:

Risk is the change in the risk variable between the second six months and the first six months of the year,

Perf is the performance of the trust in the first six months of the year,

Lagrisk is the risk of the trust in the first six months of the year. The Lagrisk variable is included in the regression due to the mean reversion in the estimated risk measures,

D is a dummy variable which equals one if the trust uses derivatives and zero otherwise (additional dummy variables for investment objective groups and time period are also added and are included to control for changes in risk across investment objective groups and over given time periods),

Coefficient $\beta 1$ measures the relationship between the change in risk of the fund and derivative use,

Coefficient $\beta 2$ captures the relationship between the change in fund risk and prior performance,

Coefficient $\beta 3$ measures the marginal impact that derivative use has on the relationship between past performance and changes in risk, and

Coefficient $\beta 4$ measures the relationship between the changes in risk and risk in the prior period.

Under the null hypothesis that derivative use has no impact on the relationship between changes in risk and past performance, this implies $\beta_3 = 0$. The motivation for exploring this is that Koski and Pontiff (1999) argue that fund managers may use derivatives to manage the relationship between changes in risk and past performance for two alternative reasons. Brown et al. (1996) document a negative relationship between past performance and changes in risk within calendar years (Busse 2001 has questioned this, showing the negative relationship disappears when daily returns are used to estimate variance). Brown et al. (1996) attribute this to the compensation structure for fund managers that arises from the need to perform well in the widely published fund performance league tables. Therefore funds change their risk levels in response to prior performance to maximize the probability of doing well in the performance league tables at the end of the year. This is called the incentive-gaming hypothesis. Koski and Pontiff (1999) argue that if this is the reason for the negative relationship between past performance and changes in risk, then there should be a stronger relationship between past performance and changes in risk for funds which use derivatives since derivatives are a cost-effective way to change the risk profile of the fund.

The second reason that Koski and Pontiff (1999) argue that changes in risk may be negatively related to past performance is the influence of cash flows. Funds with good prior performance may be reluctant to trade immediately when new cash flows arrive in the fund. Edelen (1999) documents that liquidity trading (due to the impact of cash flows) tends to reduce fund performance. Sirri and Tufano (1998) find that new cash flows into US mutual funds tend to go primarily into funds with good past performance. This can result in a buildup in the fund's cash flows and as a consequence reduce the risk of the fund. In contrast, funds with poor performance may face cash outflows due to investor redemptions and may decide to borrow rather than engaging in liquidity trading to meet the redemptions. This results in the fund risk increasing after poor performance. Koski and Pontiff (1999) argue that fund managers can use derivatives to minimize the effect of cash flow changes on the relationship between performance and changes in risk. This implies that the relationship between changes in risk and prior performance will be weaker for those funds that use derivatives

Eq. (3) is estimated by pooled cross-sectional regression using Weighted Least Squares (WLS). This is a two-stage process. The residuals from the first stage Ordinary Least Squares regression are used to calculate the residual standard deviation for each trust. The inverse of the residual standard deviation is used as the weights in the WLS regression. This deals with the heteroskedasticity that is specific to each trust.

5. Empirical results

5.1. Risk

Derivative use can change the risk profile of the trust, depending on the initial risk strategy, the type of derivative used, the reason for the use, and the overall influence of the regulations. Table 2 presents the results of the cross-sectional distribution of the five risk measures for the two groups of trusts (users and non-users of derivatives). It includes the mean and standard deviations of the risk measures and the 10 and 90 percentiles. The 't' test examines the hypothesis that the difference between the average risk measures of the two groups equals zero (the non-parametric Mann-Whitney test of the medians was also estimated and since these provided the same inferences they are unreported, but are available from the authors on request). The F test examines the hypothesis that the cross-sectional variance of the different risk measures for the two groups are equal to each other.

Table 2
Cross-sectional distribution in risk measures between users and non-users of derivatives

Panel A	Users sample mean	Non-users sample mean	't' statistic	Users sample σ	Non-users sample σ	F statistics
Std. deviation	0.003	0.027	1.59	0.027	0.005	27.33*
Skewness	−0.186	−0.062	−1.13	0.626	0.382	2.68*
Kurtosis	1.88	0.471	2.52*	3.900	1.520	6.56*
Beta	0.675	0.688	−0.25	0.245	0.196	1.55
Residual risk	0.025	0.019	1.36	0.030	0.008	14.05*

Panel B	Users sample 10%	Users sample 90%	Non-users sample 10%	Non-users sample 90%
Std. deviation	0.0196	0.0867	0.0225	0.0344
Skewness	−0.977	0.424	−0.447	0.335
Kurtosis	−0.591	8.829	−0.696	1.985
Beta	0.27	0.921	0.429	0.918
Residual risk	0.009	0.085	0.01	0.031

Panel A presents the cross-sectional mean and standard deviation of six risk measures estimated between January 1995 and December 1997 for two groups of trusts. The two groups are those that use derivatives (Users) and those that do not use derivatives (Non-users). The 't' test examines the hypothesis that the difference between the mean rick measures of the two groups equals zero. The F test examines whether the variance of the risk measures between the two groups are equal to each other. Panel B includes the 10 and 90 percentiles of the cross-sectional distribution in the risk measures of the two groups.

* Significant at 5%. Number of users = 22, number of non-users = 71.

Table 2 shows that there tends to be few significant differences between the cross-sectional mean risk measures for the two groups of trusts. The only significant difference is between the mean kurtosis of the two groups. The mean kurtosis is significantly greater for those trusts that use derivatives than for those that do not. This is consistent with the view that derivative use can increase the non-normality of trust returns or are used to invest in a volatile stock index.

In contrast to the inferences of the differences between the cross-sectional mean risk measures, there are many significant differences between the cross-sectional variation of the risk measures between the two groups. The cross-sectional standard deviations of the various measures are larger for trusts that use derivatives compared to those that do not use derivatives for all of the five risk measures. The F test rejects the hypothesis that the cross-sectional variance of the risk measures between the two groups are equal to each other for the standard deviation, skewness, kurtosis, and residual risk measures.

A comparison of the 10 and 90 percentiles between the derivative users and non-users highlights where the greater cross-sectional variability for derivative users is concentrated. For the standard deviation risk measure, it is the 90 percentile figures where there are substantial differences between users and non-users. This implies that derivative users tend to have a greater concentration of high-risk trusts. With the skewness and kurtosis measures, there are greater differences between the two groups in the 10 percentile (skewness) and 90 percentile (kurtosis). Derivative users have a greater concentration of trusts with negative

Table 3
Derivative Use and Performance

Sample	Jensen measure		Ferson and Schadt measure	
Whole sample	FTA	3-Index	FTA	3-Index
Users sample (n=22)	0.147	0.075	−0.047	0.061
Non-users sample (n=71)	0.134	0.143	−0.064	0.102
Difference	0.017	−0.067	0.017	−0.041

The table reports the performance (monthly %) of equally weighted portfolios of trusts sorted as to whether they use derivatives (Users) or do not use derivatives (Non-users) between January 1995 and December 1997. The performance of the trusts is calculated by using the Jensen (1968) measure and the conditional Jensen measure of Ferson and Schadt (1996). Two alternative factor models were used; the first is a single factor model, which uses the monthly excess return of the Financial Times All Share Index (FTA). The second factor model is a three-index one based on Elton et al. (1993). This three-index model uses the monthly excess returns on the FTA index, the FT UK small stock index, and the UK government bond index. The difference portfolio is long in the portfolio of trusts that uses derivatives and short in the portfolio of trust that does not. The results are reported for the overall sample and the three investment objective groups. The 't' statistics were corrected for heteroskedasticity using the method of White (1980) but are unreported.

*Significant at 5%.

skewness and positive excess kurtosis. This implies that some of the trust returns of derivative users have more weight on downside returns and more extreme returns. This result is interesting because it appears that derivative use does not tend to reduce risk compared to non-users for some trusts. However, this result could indicate the derivatives themselves are being used to increase the risk of the funds due to the payoff structures or the use of derivatives to invest new cash in the stock index which itself has significant risk. This may be possible under the UK regulations as these derivatives are permitted and the aims are stated in general terms.

5.2. Performance

This subsection explores the impact that derivative use has on trust performance. Table 3 reports the performance measures of the equally weighted portfolios of trusts. The 't' statistics are corrected for heteroskedasticity using White (1980) and are unreported to conserve space. The difference portfolio is long in the portfolio of trusts that use derivatives and short in the portfolio that does not use derivatives. The results are reported for the whole sample of trusts.

Table 3 shows that for the overall sample, derivative use has no significant influence on the performance of the trusts. This is the same finding as that of Koski and Pontiff (1999), which may indicate that the restrictive UK regulations do not appear to be making a difference. The performance on the difference portfolio is statistically indistinguishable from zero and is economically fairly small using either the unconditional or conditional Jensen measures.

5.3. Risk management

The final issue examined is Koski and Pontiff's (1999) hypothesis that derivative use may affect the intertemporal relationship between changes in risk and past performance. The

Table 4
Tests of changes in risk and past performance within a calendar year

Performance Measure	Independent variable			
	D	*Perf*	*D**Perf	*Lag Risk*
Median				
Δ Std deviation	0.000(0.22)	0.045(8.89)*	−0.038(−6.34)*	−0.987(−116.27)*
Δ Beta	0.03(1.94)	1.99(8.14*)	−1.80(−7.24*)	−1.02(−158.19*)
Δ Residual risk	−0.001(−0.95)	0.073(9.59*)	−0.054(−6.93*)	−0.972(−152.13*)
Group				
Δ Std. deviation	−0.001(−0.65)	0.016(3.33*)	−0.009(−1.55)	−0.986(−106.31*)
Δ Beta	0.01(0.51)	1.22(4.95*)	−1.15(−3.84*)	−1.05(−82.17*)
Δ Residual risk	0.001(0.74)	0.010(0.96)	0.003(0.22)	−0.985(−60.48*)
FTA				
Δ Std. deviation	−0.000(−0.36)	0.044(8.85*)	−0.038(−6.01*)	−0.990(−102.95*)
Δ Beta	0.01(0.46)	2.17(8.14*)	−2.08(−7.1*)	−1.02(−91.52*)
Δ Residual risk	0.000(0.21)	0.067(8.62*)	−0.051(−6.03*)	−0.978(−125.51*)

The following regression specification is used to explore the effect that derivative use has on the relationship between the change in risk and past performance. The risk measures used are standard deviation, beta, and residual risk.

$$\Delta\text{Risk}=\alpha+\beta_1\text{D}+\beta_2\text{Perf}+\beta_3\text{D*Perf}+\beta_4\text{Lagrisk}+\varepsilon_i$$

The pooled cross-sectional regression in is estimated by WLS. The change in risk is measured as the difference between the risk measures in the two six-month sub-periods within a calendar year. The table includes the estimated slope coefficients and 't' statistics (in parentheses) for four of the independent variables. *D* is a dummy variable which equals one if the trust uses derivatives and zero otherwise; *Lag risk* is the value of the risk measure in the first six months. *Perf* is the performance of the trust in the first six months of the year. Performance is measured in three ways. The cumulative six-month return less the median six-month return across all trusts (*Median*), less the group six-month return (*Group*) and the FTA six-month return (*FTA*).

* Significant at 5%.

pooled cross-sectional regression in Eq. (3) is estimated by WLS. Past performance is measured by the cumulative six-month return of the trust less three alternative benchmarks. The first is median six-month return across all trusts. The second is the six-month return of an equally weighted portfolio of trusts of the investment objective to which the trust belongs. The third is the six-month return of the FTA index. Table 4 reports the estimated coefficients and corresponding 't' statistics.

Table 4 shows that there is a significantly positive relationship between past performance and changes in risk. This is the case for all risk measures when performance is measured either relative to the median return or the FTA return. When performance is measured relative to the group return, the positive relationship is not significant for residual risk. The positive relationship implies that trusts with better interim performance tend to increase risk more than trusts with poorer interim performance. A recent study by Chen and Pennacchi (Does prior performance affect a mutual fund's choice of risk? Theory and further empirical evidence, unpublished working paper, University of Illinois, 1999) argues that the relevant concern of the manager is the extent to which the fund's portfolio deviates from the benchmark (tracking error). As a result losing funds may attempt to increase tracking error volatility rather than the overall risk of the fund. The tests were repeated for risk measured by the standard deviation of the market-adjusted returns of the trusts where the return of the FTA index is subtracted from the trust's return. Similar results were found.

The coefficient on the interaction of derivative use and past performance is significantly negative for all three-risk measures when performance is measured either relative to the median return or the FTA return. This implies that the positive relationship between past performance and changes in risk is significantly weaker for trusts that use derivatives. However, the significant negative relationship disappears for the measures of total risk and residual risk when performance is measured relative to the group return. The results suggest that derivative use does have a significant effect on the relationship between changes in risk and past performance especially when risk is measured by market risk. This is consistent with Koski and Pontiff's (1999) argument that derivatives can be used to minimize the influence of cash flows on performance and changes in risk.

The finding of a positive relationship between past performance and change in risk is contrary to the incentive-gaming and cash flow hypotheses. Why would winners increase their risk more than losers and why would derivative use lessen this impact? One possible explanation is the time period considered in this study. Karceski (2001) argues that fund managers particularly aspire to perform well in the performance rankings relative to their peers in bull markets. This situation arises because aggregate cash flows into mutual funds depends strongly on stock market performance (Warther, 1995) and most of the new cash flows into winning funds (Sirri and Tufano, 1998). In addition, it is clear that high beta stocks tend to outperform low beta stocks in bull markets. Karceski (2001) argues that the rewards to doing well are greater in the bull markets, and this leads fund managers to favor high beta stocks. The 1995–1997 period is a major bull market in the UK, and a large influx of aggregate cash flows into unit trusts. The annual excess returns on the FTA index are 14.9% (1995), 9.58% (1996), and 14.57% (1997). The aggregate net new investment into unit trusts is £7,016m (1995), £10,192m (1996), and £10,175m (1997) (Unit Trust Yearbook, 1999). Large inflows of cash into winning funds can reduce fund performance (Edelen, 1999). Trust managers who are interim winners may worry that increased cash flows during the year may hurt their calendar year return performance; they may increase the risk of the trust to enhance returns to offset the impact of cash flows on return performance. Trusts that use derivatives are more able to manage the impact of cash flows into the portfolio. However, it could also be suggested that a bull market was prevalent at the time of Koski and Pontiff's (1999) study; therefore there may be other reasons for this contrary finding.

6. Conclusions

UK unit trusts are an important source of investment for individual investors, and they are protected by UK regulations that attempt to ensure that the managers of these trusts use derivatives solely for the purpose of "efficient portfolio management." This paper explores the impact of derivative use by UK unit trusts on the risk characteristics, performance and risk management of the trusts. Similar to the findings of Koski and Pontiff (1999) on US equity mutual funds, we found that three quarters of unit trusts do not use derivatives. There are three main findings from the study. The first is that derivative use does have a significant effect on the risk profile of the trust for the whole sample of trusts. Although derivative use tends to have little impact on the mean risk measures between the groups of trusts which use derivatives and those which do not, trusts that use derivatives tend to show substantially more variation in most risk measures across trusts. This result is surprising, given the regulations on derivative use by UK unit trusts; however, the general nature of the aims of these regulations may allow some flexibility.

Despite the potential for derivatives to improve portfolio performance due to lower costs, which the UK regulation specifically suggest, the second main finding is that derivative use appears to have little influence on the risk-adjusted performance of the trusts using the whole of sample of trusts. The third main finding is that within a calendar year, trusts that use derivatives appear to have less significant changes in risk due to past performance than trusts that do not. This impact is strongest with the beta risk measure that suggests the use of index-based derivatives. An interesting finding is that changes in risk are significantly positively related to past performance. It is possible that the results are due to rising market conditions over the period of this study. We suggest that future research into the effect of derivative use by financial institutions including unit trusts considers the type of derivative used, the notional amount, and a more detailed consideration of the investment objective.

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References

Allayannis, Y., & Weston, J. (2001)., The use of foreign currency derivatives and firm market value. *The Review of Financial Studies, 14* (1), 243–276.

Bodnar, G. M., Hayt, G. S., & Marston, R. C. (1998). 1998 Wharton survey of derivative usage by US non-financial firms. *Financial Management, 27* (4), 70–92.

Brown, K., Harlow, W. V., & Starks L. T. (1996). Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry. *Journal of Finance, 51,* 85–110.

Busse, J. A. (2001). Another look at mutual fund tournaments. *Journal of Financial and Quantitative Analysis, 36,* 53–73.

Edelen, R. M. (1999). Investor flows and the assessed performance of open-end mutual funds. *Journal of Financial Economics, 53,* 439–466.

Elton, E. J., Gruber, M. J., Das, S., & Hlvaka M.. (1993). Efficiency with costly information: A reinterpretation of the evidence. *Review of Financial Studies, 6,* 1–22.

Ferson, W. E., & Schadt, R. W. (1996). Measuring fund strategy and performance in changing economic conditions. *Journal of Finance, 51,* 425–461.

Ferson, W. E., & Warther, V. A. (1996). Evaluating fund performance in a dynamic market. *Financial Analysts Journal, 52,* 20–28.

Financial Services Authority. (1991). *Financial Services (Regulated Schemes) Regulations* (Release 199), London.

Froot, K. A., Scharftstein, D. S., & Stein J. C. (1993). Risk management: Co-ordinating corporate investment and financing policies. *Journal of Finance, 48,* 1629–1658.

Grant, K., & Marshall, A. P. (1997). Large UK companies and derivatives. *European Financial Management, 3* (2), 191–208.

Guay, W. R. (1999). the impact of derivatives on firm risk: An empirical examination of new derivatives users. *Journal of Accounting and Economics, 26,* 319–351.

Haushalter, G. D. (2000). Financing policy, basis risk, and corporate hedging: Evidence from oil and gas producers. *Journal of Finance, 55* (1), 107–152.

Karceski, J. (2002). Returns-chasing behavior, mutual funds, and beta's death. *Journal of Financial and Quantitative Analysis,* in press.

Koski, J. L., & Pontiff, J. (1999). How are derivatives used? Evidence from the mutual fund industry. *Journal of Finance, 54*(2), 791–816.

Leland, H. E. (1999)., Beyond mean-variance: Risk and performance measures for portfolios with non-symmetric return distributions. *Financial Analysts Journal, 54,* 27–36.

McCarthy, E. (2000). Derivatives revisited. *Journal of Accountancy,* May, 35–43.

Mian, S. L. (1996). Evidence on corporate hedging policy. *Journal of Financial and Quantitative Analysis, 31,* 419–439.

Money Management, *Financial Times Business Limited* (Periodical), London.

Sirri, E. R., & Tufano, P. (1998). Costly search and mutual fund flows. *Journal of Finance, 53,* 1589–1622.

Tufano, P. (1996). Who manages risk? An empirical examination of risk management practices in the gold mining industry. *Journal of Finance, 51,* 1097–1137.

UK Extel Dividend and Interest Record. (1997–1999). London: Extel Financial.

UK Fund Industry. *Review and Directory Handbook,* 1997. London: Professional and Business Information Publishing Limited.

Unit Trust Yearbook. (1997). London, Financial Times Business Limited.

Unit Trust Yearbook. (1999). London, Financial Times Business Limited.

Warther, V. A. (1995). Aggregate mutual fund flows and security returns. *Journal of Financial Economics, 39,* 209–235.

Whidbee, D. A., & Wohar, M. (1999). Derivative activities and managerial incentives in the banking industry. *Journal of Corporate Finance, 5,* 251–276.