EQUITY FUND FLOWS AND PERFORMANCE AROUND ECONOMIC RECESSIONS

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Abstract. The relation between net fund flows and performance is examined around the two most recent U.S. economic recessions for U.S. equity funds. Post-recessionary period net fund flows are positively (negatively) correlated with absolute (peer-relative) performance for the Early 2000 recession, and with absolute and peer-relative performance for the Great Recession (the most recent one) according to non-parametric measures. Empirical copulas in the extreme left tails indicate a positive dependence for the Early 2000 Recession, and independence for the Great Recession between performance and net fund flows.

JEL classification: G11, G01

Key words: mutual funds, net fund flows, performance, economic recession, copulas

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1. INTRODUCTION

The literature reports an asymmetric relationship between performance and net fund flows. The relationship is positive for outperformance and net fund flows, implying that investors chase winners (Sapp and Tiwari, 2004). In contrast, values in the far left tail of the performance distribution have little impact on net fund flows (Ippolito, 1992; Sirri and Tufano, 1998). In other words, investor demand for additional mutual fund investments is inelastic to performance below a certain minimum threshold. Lynch and Musto (2003) explain this phenomenon by investor perceptions that bad and very bad returns signal a potential change in strategy, hence the magnitude of their difference has little predictive power.

Each of the last two decades has experienced an economic recession that has impacted fund performance and possibly the relation between net fund flows and performance conditioned on the state of the economy. Given that the literature has not sufficiently addressed the nature of this relationship to date, the primary purpose of this paper is to examine the relationship between recessionary period fund performance and subsequent non-recessionary period net fund flows for U.S. equity mutual funds around the two most recent U.S. economic recessions. This allows us to address two related questions. First, are subsequent non-recessionary period net fund flows to equity funds related to their absolute and/or objective-adjusted[1] (henceforth relative) return performances during recessionary periods? Are funds that are able to outperform peers

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[1] Hereafter, we use "objective-adjusted", "peer-relative" and "relative" interchangeably to indicate that the variable is adjusted for the investment objective benchmark.

during economic recessions able to attract more net cash flows during subsequent economic "good times"?

We conjecture that absolute and relative returns are the only variables observed and used by fund investors through updated factsheets made available to them on a monthly or quarterly basis. We focus on these variables because fund investors are much less likely to resort to sophisticated (risk-adjusted) estimation methods for fund performance when making their fund allocation decisions.

We study the relationship between performance and net fund flows (henceforth, the "two variables") over their whole distributions, and over their lower and upper tails separately. The dependence between variables is examined via correlations and the copulas method. The linear correlation measures (parametric and non-parametric) provide a first assessment of the relationship (if any) between the variables. Since "copulas contain all the information about the dependence structure of a vector of random variables" (Rodriguez, 2007, p. 403), we invoke a normal joint distribution assumption between these two variables and simulate bivariate Gaussian copulas. Then, we relax the normality assumption and use the non-parametric method to estimate empirical copulas. We also estimate empirical survival copulas to cover the right tails of the distributions of the two variables.[2]

This paper contributes to the literature by examining the behavior of net fund flows and fund performances around two recent economic recessions in the U.S. Previous papers study the relations between current fund flows and future fund performance (Gruber, 1996; Zheng, 1999), or the reverse relationship by controlling for certain variables such as participation costs (Huang *et al.*, 2007) or management changes

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[2] See Genest *et al.* (2009) for a review of the literature on the use of copulas in finance.

(Chevalier and Ellison, 1999). To our knowledge, the dependence between these two variables has not been studied using the copulas method, especially around "economic recessions", where the ability of funds to weather adverse economic conditions may be rewarded in subsequent non-recessionary periods through increased net fund flows.

Our major findings show significant differences between both covered recessionary periods and between both return and fund flows measures. First, the Early 2000 Recession yields a positive correlation between during-recessionary period absolute returns and post-recessionary period absolute fund flows and a negative linear dependence between objective-adjusted variables, suggesting that higher performance during downturns is rewarded by subsequent higher money flows on an absolute basis and that investors direct less new cash to outperformers on a peer-relative basis. On absolute and relative bases, performance positively impacts post-Great Recession fund flows according to the non-parametric measures. Second, extreme left and right regions of the tails of the peer-relative distributions are associated with negative dependence for both recessionary periods. Median Gaussian copulas for the absolute variables show a positive (negative) dependence in the 1% left (right) tail for the Early 2000 Recession. The right and left 1% tail dependence for the Great Recession is positive. Empirical copulas in the extreme left tail exhibit a positive dependence for the Early 2000 Recession and independence for the Great Recession between performance and new cash. Third, survival copulas show an overall positive dependence on an absolute basis and a negative dependence on an objective-adjusted basis in the right region. Fourth, our initial findings are robust to the use of estimated *Student* copulas between bootstrapped

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variables instead of Gaussian copulas and the choice of the announcement date that a recession has begun instead of the official date of the recession.

The remainder of the paper is organized as follows. The sample, data and some summary statistics are presented in the next section. The test methodology used herein is described in section three. Section four presents and analyzes the empirical results. Section five concludes the paper.

2. SAMPLE, DATA AND SAMPLE CHARACTERISTICS

The paper examines the relation between absolute and relative net fund flows and return performance for U.S. equity funds with Lipper objective codes around two U.S. economic recessions officially identified by the National Bureau of Economic Research (NBER).[3] They are the Early 2000 economic recession that covered the eight-month period of March 2001 to November 2001 and the Great Recession that covered the 18-month period of December 2007 to June 2009. A fund is excluded from each recession-specific sample if: (1) monthly returns and Total Net Assets (TNA) are not available for the fund around the specific economic recession, and (2) the class of assets invested in by the fund is not equity. To ensure that only equity funds are included in the sample and to avoid any selection errors embedded in the original data source, we only include the funds whose equity holdings exceed 75% of their portfolio holdings.

The monthly fund flows are calculated using monthly TNA and returns data obtained from the CRSP survivor-bias-free U.S. mutual fund database.[4] Dates are also subject to verification since some inconsistencies have been detected; e.g., incoherence

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[3]A recession is bound by a peak and a trough in economic activity. According to the NBER dating committee, these turning points are determined using four broad indicators: industrial production, real manufacturing and retail trade sales, real personal income less transfer payments, and payroll employment.

[4] Specifically, $Fund\ Flow_t = \left[TNA_t - TNA_{t-1}(1+r_t)\right]/TNA_{t-1}$, where TNA_t is the total net assets at the end of month t; and r_t is the monthly return for month t.

between inception (call) and attrition (end) dates. Interpolation is used when TNA information is missing but monthly values are reported around the missing month. The redundancy problem in the sample is eliminated by constructing a size-weighted return of different classes of shares of funds when they are associated with a unique portfolio.[5] The TNA are needed to construct the benchmarks in order to calculate the objective-adjusted performance and fund flows.

The sample of equity funds is subdivided into 12 categories of fund objectives according to various combinations of capitalization (large, mid, small, and multi) and value (growth, core and value) following the Morningstar categorization.[6] Objective-adjusted (relative) returns and fund flows are obtained by first constructing size-weighted portfolios of mutual funds in each of the 12 categories of investment styles without requiring included funds to have survived the recession or to have been operating prior to the recession. The monthly return or net fund flows of the matched size-weighted portfolio is then subtracted from the corresponding return or net fund flows for the subject fund. The final sample of 4766 funds consists of 417 small-growth, 470 small-core, 214 small-value, 382 mid-growth, 270 mid-core, 140 mid-value, 646 large-growth, 727 large-core, 394 large-value, 450 multi-growth, 298 multi-core and 358 multi-value funds.

Table 1 reports the summary statistics for monthly returns and fund flows around both recessions (events). Dispersions of returns (absolute and relative) for the pre- and

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[5] Each portfolio in the CRSP database, whether associated or not to a different class of shares for the same underlying portfolio, is assigned a unique identifier. The portfolio mapping is available as of year 2003; hence all cases prior to this date are not subject to the size-weighting treatment. The effect of this treatment will be tested in a subsequent version of this paper.

[6] The exact Lipper objective codes corresponding to the sub-sample selection criteria are the following : LCVE (Large-Value), LCCE (Large-Core), LCGE (Large-Growth), MCVE (Mid-Value), MCCE (Mid-Core), MCGE (Mid-Growth), SCVE (Small-Value), SCCE (Small-Core), SCGE (Small-Growth), MLVE (Multi-Value), MLCE (Multi-Core) and MLGE (Multi-Growth).

post-Early 2000 Recession are significantly higher than those prevailing during the recession. They are not significantly different for the Great Recession. The skewness of absolute returns is statistically higher and positive post-Great Recession than pre- and within-recessionary periods (p<0.001), but statistically unchanged around the Early 2000 Recession. For relative returns, the skewness and kurtosis are not statistically different between the three periods for both recessions. For the Early 2000 Recession, absolute (relative) returns of the large-growth funds show a substantial change in kurtosis from period to period, moving from 17.25 (9.22) to 60.15 (35.90) and decreasing back to 8.92 (5.99) subsequently.[7]

[Please place Table 1 about here]

Among the second through fourth moments, only the pre- and post-event skewness measures of absolute fund flows are significantly different (lower and negative) than for the recessionary periods. The objective-adjusted fund flows yield a different interpretation. The Early 2000 Recession yields a significantly higher standard deviation (263.69% and 118.65% respectively) and kurtosis (61.10 and 13.27 respectively) pre- and post-event; and higher positive skewness measures post-event (1.72). The fund flows around the Great Recession exhibit higher standard deviations (339.40%) and less prevalent extreme values (5.29) post-event.

The left percentiles of the absolute within-recessionary period net fund flows are significantly higher than their post-recessionary period counterparts for both recessionary periods ($-10.43 million versus $-184.64 million for the Early 2000 Recession and $-115.83 million versus $-221.88 million for the Great Recession), accompanied with a

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[7] For the sake of brevity, results of subsample characteristics are not reported in the paper but are available upon request.

different pattern for the left percentiles of returns (-3.24% versus -5.67% for the first recession and -5.08% versus 0.44% for the second recession). The resulting inference is that the most risk-averse investors react to a downturn in the form of massive post-recessionary period share redemptions, when the poor fund performance becomes more extreme in the Early 2000 Recession and improves in the Great Recession. The objective-adjusted variables do not show any significant difference between the left percentiles of fund flows, and exhibit substantial changes in returns (-2.41% versus -3.64%) around the Early 2000 Recession. In contrast, there are significant changes in the left percentile of objective-adjusted fund flows ($-413.13 million versus $-1053.47 million) and not their returns (-1.86% versus -1.50%) during the Great Recession.

The 99% percentile of absolute fund flows for the within-Early 2000 Recession of $177.25 million is significantly higher than its subsequent post-recessionary period values. In contrast, there is no significant change in the 99% percentile of absolute returns (1.71% versus 1.88%). Nevertheless, the 1% right tail of the objective-adjusted fund flows for the within-Early 2000 Recession of $82.09 million is significantly lower than its post-recession value ($407.07 million), even though the objective-adjusted returns for the same distribution region are not statistically different (2.17% versus 2.21%). This outcome suggests that volatility during the downturn causes greater positive extremes in fund flows on an absolute basis, because of the greater level of risk attached to mutual fund investment. Even with an unchanged performance post-recession, depressed investor sentiment leads to lower extreme net flow levels post-recession. On an objective-adjusted basis, the net fund flow extreme levels are higher but not accompanied with higher adjusted returns. The sample shows that growth-oriented funds are the most

representative of this phenomenon with a change in objective-adjusted fund flows from $106.88 to $697.61 million and returns from 1.90% to 2.34% from the within to the post-recessionary period.

Around the Great Recession, the 99% percentile absolute net fund flow decreases significantly from $151.24 million to $54.89 million while the absolute returns increase from -0.62% to 6.83%. Objective-adjusted variables for the Great Recession show muted changes. This result shows how investors shaped their behavior differently in the late versus early 2000 recession. Even with a significantly higher performance, the eroded confidence of mutual fund investors kept the extreme new cash levels from flowing to equity mutual funds following the more recent recession.

Table 1 shows that absolute fund flows during the Great Recession are as volatile and more leptokurtic (81.15 versus 62.46) and less positively skewed (3.56 versus 6.64) compared to their counterparts during the Early 2000 Recession. Absolute returns dispersion, asymmetry and the prevalence of extreme values are not statistically different from one recession to the other. Nevertheless, for the Early 2000 Recession, objective-adjusted returns reflect higher volatility (0.83% versus 0.57%) and objective-adjusted fund flows reflect higher skewness (0.97 versus -1.56) and kurtosis levels (8.50 vs 5.79) than for the Great Recession. Therefore, on an objective-adjusted basis, more return variability is associated with unchanged fund flow volatility but increased higher-order moments.

3. METHODOLOGY

Correlations between event mean returns and post-event mean fund flows are measured using three metrics. While the Pearson correlation is an effective way to

represent comovements between variables if they are linked by linear relationships, it may be severely flawed in the presence of non-linear links. In order to test whether the relationship between performance in recessionary periods and net cash flows in the following recovery periods is robust regardless of the method utilized to measure co-movements, we examine non-parametric dependence measures. We estimate Spearman's rho and Kendall tau, which do not depend on the marginal probability distributions (Cherubini *et al.*, 2004).

As a further check, we examine the relationship between recessionary period performance and subsequent recovery period net fund flows using copulas. This enables us to tackle the problem of specification of marginal univariate distributions separately from the specification of the comovement and dependence of the variables. For this reason, copulas are also called dependence functions (Deheuvels, 1978). The use of copula functions enables us to capture non-linear relationships among variables, if any.

We estimate copulas on bootstrapped variables by sampling with replacement over 1000 paths. We begin with the Gaussian copula to determine the characteristics of the relationship between returns and net fund flows. With Gaussian copula, we can preserve the dependence structure typical of a multivariate normal distribution by modifying only the marginal distributions, which can be allowed to display skewness and fat-tail behavior consistent with the observed data.

According to Skalar's theorem, any joint probability distribution can be written in terms of a copula function taking the marginal distributions as arguments and, conversely, any copula function taking univariate probability distributions as arguments yields a joint distribution. Therefore, in order to estimate empirical copulas, we compute

the empirical joint distributions (i.e. their joint cumulated frequencies). All estimations are based on means of recession-period returns and post-recession-period net fund flows over time periods of equal length.

We determine level curves (1%, 5%, 50% and 75%) corresponding to the joint cumulative distributions. We consider the theoretical Fréchet bounds for level curves by estimating those corresponding to extreme cases of independence and perfect dependence; namely, product, minimum and maximum copulas (Fréchet, 1935, 1951; Hoeffding, 1940). For the 1% level, we superpose the following curves:

(1) Perfect positive dependence or comonotonicity

$$\left\{ (x, y) : \min(F_1(x), F_2(y)) = 1\% \right\}$$

(2) Perfect negative dependence or countermonotonicity

$$\left\{ (x, y) : \max(F_1(x) + F_2(y) - 1, 0) = 1\% \right\}$$

(3) Independence

$$\left\{ (x, y) : F_1(x)F_2(y) = 1\% \right\}$$

(4) Empirical: as translated by the couples (x,y)

$$\left\{ (x, y) : F(x, y) = C(F_1(x), F_2(y)) = 1\% \right\}$$

where x refers to means of returns during recessionary period

   y refers to means of fund flows subsequent to recessionary period
   $F(x, y)$ refers to the joint cumulative distribution function of x and y
   $F_1(x)$ refers to the marginal distribution function of x
   $F_2(y)$ refers to the marginal distribution function of y
and C refers to the copula relating x and y such as :
   $C(v, z) = \Pr(U_1 \le v, U_2 \le z)$
where U_1 and U_2 are standard uniform variables
   $v = F_1(x) \quad and \quad z = F_2(y)$

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We also estimate survival copulas, which are defined as follows:

$$\overline{C}(v, z) = v + z - 1 + C(1 - v, 1 - z)$$

When computed at $(1 - v, 1 - z)$, we obtain the probability for two standard uniform variates with copula C that are greater than v and z respectively:

$$\overline{C}(1 - v, 1 - z) = \Pr(U_1 > v, U_2 > z)$$
$$= \overline{F}(F_1^{-1}(v), F_2^{-1}(z))$$
where $\overline{F}$ is the complement to F

As defined above, the survival copula represents the joint survival probability of two variables beyond thresholds x and y. The objective is to examine the relationship between recessionary-period performance and post-recessionary period net cash flows in the upper tail.

4. EMPIRICAL RESULTS

Based on Table 2, the three correlation measures for the absolute variables are positive but only significant for the Early 2000 recession. In contrast, the three sets of correlations between within-recessionary period relative performance and post-recessionary period net fund flows are significant but negative for the Early 2000 recession and positive for the Great Recession. The Early 2000 Recession results are driven by the small-core, large-growth, multi-growth and multi-value funds, whereas the Great Recession results are driven by multi-growth funds.

[Please place Table 2 about here]

These results are only suggestive for a number of reasons. First, the correlations are based on the whole distributions, and idiosyncrasies associated with either recession can provide different inferences. Second, the Great Recession was much longer than the

Early 2000 recession (18 versus 8 months), which could have affected the perceptions of investors and their sentiments. A behavioural argument to this disparity between the two examined recessionary periods is that investors regained an appetite for risk by the end of the Great Recession and re-injected cash in the mutual fund industry given the perception that the downturn had ended and financial markets were in recovery. The median relative return for the Early 2000 Recession of 0.01%, which is statistically higher than -0.06% for the Great Recession homolog, suggests either a change in investor sentiment or a substantial difference in the tail-dependence between performance and fund flows (see Table 1). We now examine the latter conjecture.

Table 3 and figure 1 report on the distributions of Gaussian copulas between bootstrapped recession period returns and post-recession period fund flows. Based on the relative variables, the median copulas for the 1% left and right tails are significantly different for both recessions with a lower negative value for the left tail for the Early 2000 recession and for the right tail for the Great Recession. For the absolute variables, similar comparisons for each considered quartile-tail produce similar results in terms of significance. While the left tail median copulas are positive for both recessions, those for the right tails are negative for the Early 2000 Recession and positive for the Great Recession.[8]

[Please place Table 3 and Figures 1 & 2 about here]

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[8] Given that the within-recessionary average performance and post-recessionary period fund flows do not follow normal marginal distributions, we estimated *Student* copulas between bootstrapped variables. The outcomes are qualitatively similar to the outcomes using Gaussian copulas. The left-tail median copulas are positive for absolute variables and both crises, whereas the right-tail median copulas are negative for the Early 2000 Recession and positive for the Great Recession. Relative variables show negative dependence, on average, at the 1% left and right tails for both recessions.

Figure 3 shows the cumulative joint distribution functions of returns and net fund flows, and the level curves for copulas at values of 1%, 5%, 50% and 75% for both recessions. At low probability levels, there are irregularities in the empirical joint distributions, whereas the shape of the level curves is closer to normal distributions at higher levels. For absolute (objective-adjusted) monthly during-recessionary period returns lower than -1% for the Early 2000 Recession, there is a 1% probability that post-recession period monthly fund flows will be lower than $-100.85 million ($-82.18 million). The impact of such negative absolute (objective-adjusted) monthly performance is accompanied by fund flows less than $-218.80 million ($-60.86 million) for the Great Recession.

[Please place Figure 3 about here]

The survival copulas analysis shows that there is 1% probability that post-recessionary period fund flows will be higher than $-130.94 million ($-6.00 million) when absolute (objective-adjusted) monthly during-recessionary period returns are higher than -1% for the Early 2000 Recession. In the Great Recession, the associated fund flows amount to $-214.99 ($-120.88) million. The 32% percentile of absolute returns corresponds to the 2nd percentile of net fund flows during the Early 2000 Recession, and the 75th percentile of absolute returns corresponds to the 2nd percentile of net fund flows during the Great Recession. The relationships between the two variables differ for objective-adjusted returns. Specifically, the 3rd percentile of objective-adjusted returns matches the 24th percentile for net fund flows for the Great Recession, and the 9th percentile of objective-adjusted returns associates with the 19th percentile of net fund flows for the Early 2000 Recession. Given this separation between joint and marginal

distributions, we draw two inferences: first, the absolute and objective-adjusted variables exhibit different relationships, and the relationships for the Early 2000 Recession and Great Recession are significantly different.

Figure 4 depicts the copulas and survival copulas at 1% superposed with the Fréchet bounds and independence curves. For absolute returns, the empirical copulas at the 1% level are significantly far from the so-called bounds and from the independence curve for the Early 2000 Recession. The empirical absolute variables infer a positive relationship between during-recessionary period absolute returns and post-recessionary period net fund flows at the tail. This result differs for the Great Recession where the data show independence between absolute-return performance and net fund flows. For the objective-adjusted variables, the empirical copulas at 1% are significantly different from perfect concordance (but not from independence) for the Great Recession. In contrast, the empirical 1% level curve for the objective-adjusted variables lies between perfect positive correlation (p-value<0.001) and independence (p-value=0.03) for the Early 2000 Recession.

[Please place Figure 4 about here]

Survival copulas at the 1% level for the absolute variables are significantly far from the bounds and independence curve (p-value<0.001), which indicates a positive relationship between during-recessionary period returns and post-recessionary period fund flows. This result is found for both recessions separately. For the objective-adjusted variables in the Great Recession, the survival rate curve at 1% is significantly away from the bounds (p-values<0.001) but not significantly distinct from the independence curve

(p-value=0.89). The corresponding result differs for the Early 2000 Recession, where the relationship is significantly negative (see Table 4).

[Please place Table 4 about here]

Based on the copulas between absolute variables at 1% for the different categories of funds for the Early 2000 Recession, there is a positive dependence between during-recessionary period returns and post-recessionary period net fund flows for core funds (except those that are large) and value funds (except those that are small). Growth funds do not show a consistent relationship, since the relationship is positive for small and medium funds, not existent for large funds, and negative for not-size-sorted funds.[9] The large and multi-cap funds and the value funds in the two remaining size categories yield independence for the Great Recession. In contrast, the relation is negative for small and medium, growth and core funds. On an absolute basis, only large- growth and core funds and small-value funds exhibit a similar independent relationship around both recessions. The sign of the relationship changes from positive to negative for small and medium, growth and core funds from the Early 2000 Recession to the Great Recession, and disappears for the other categories of funds.

The relationships between the objective-adjusted variables for the Early 2000 Recession show that small and medium funds yield positive dependence when holdings are in the growth and core category, but do not exhibit dependence when funds are invested in value funds. Not-size-sorted funds yield three types of relationships: negative for growth, positive for core and no relationship for value funds. For the Great Recession, only small-value, multi-cap- value and core funds maintain the same type of relationship as for the Early 2000 Recession. The relationships for small growth and core funds turns

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[9] When p-values are not mentioned, we implicitly mean that they are lower than 0.05.

from positive to negative, and that for medium growth and core funds turns from positive to no relationship (see Table 4).

Finally, the survival copulas for the absolute variables for the Early 2000 Recession exhibit a positive dependence except for small- and medium-value funds. The relationships based on the Great Recession are positive except for small-value, mid- core and value, and multi-cap- growth and core funds which exhibit independence. Based on the survival copulas and using objective-adjusted variables for the Early 2000 Recession, all core funds as well as small-growth, large-value and multi-value funds exhibit positive relationships. For the Great Recession, only small-, mid- and large- growth funds keep the same relationships of respectively positive, none and negative. Also, independence is exhibited by all but multi-cap core funds and all but mid-value funds.

5. ROBUSTNESS TESTS

In this section, we conduct robustness tests for the relationships between performance in bad times and fund flows in subsequent good times. Instead of considering the official dates of the beginning and end of each recession, one could claim that the announcement dates may have more impact on investor demand for mutual funds. The Business Cycle Dating Committee members of the National Bureau of Economic Research meet regularly in order to determine the trough or the peak in business activity of the US economy. Consequently, the committee publishes a report about the dates of turning points in the US economy. For the Early 2000 Recession, the peak was announced in November 2001 and the trough was announced in July 2003, changing the duration of this event from 8 months to 20 months. For the Great Recession, the peak was announced on December 2008 and the trough was announced on September

2010, changing its duration from 18 months to 19 months. All these findings are untabulated but are available upon request.

For both recessions, dispersions of post-crisis absolute fund returns are significantly higher than their within-recessionary period homologs. The skewness of absolute returns is statistically higher and positive post-Great Recession than for the pre- and within-recessionary period (p-value=0.02), but statistically unchanged around the Early 2000 Recession (as reported earlier using the official dates). For relative returns, the skewness and kurtosis are not statistically different between the three periods for both recessions.

For both measures of fund flows and both events, the dispersion of net fund flows is significantly higher post-recessionary period than within, as was reported earlier for the official dates. Skewness of absolute fund flows is lower and negative post-Early 2000 Recession than within-recessionary period, but unchanged elsewhere. Kurtosis post-recessionary period is unchanged for the Early 2000 Recession (absolute and relative), but significantly exceeds its counterpart within the most recent recession (absolute and relative).

The left percentiles of the absolute post-recessionary period net fund flows are unchanged relative to their within-recessionary period homologs for both events, whereas the left percentiles of absolute returns increase substantially around recessions (p-value<0.001). This result confirms the inelasticity of demand at the far left of the distribution of returns documented in the literature. Nevertheless, objective-adjusted variables show that the left percentiles of within-recessionary period fund flows are higher than their post-event counterparts for both recessions (p-value=0.05 for each

event). The left percentile of objective-adjusted returns follows the same pattern in the Great Recession only.

The right percentile of absolute fund flows and returns for both recessions are significantly lower than their subsequent post-recessionary period values. Although there is no significant change in the right percentile of objective-adjusted fund flows, the corresponding percentile of returns decreases around the Early 2000 Recession (p-value=0.05). The Great recession relative variables follow the same pattern as the absolute ones.

Absolute and relative fund flows post-Great Recession are more volatile (548.72 versus 21.36), more negatively skewed (-8.48 versus -4.56) and more leptokurtic (208.89 versus 80.91) than their counterparts in the post-Early 2000 Recession. Absolute returns reflect higher volatility during the Great Recession (1.03% versus 0.59%), a lower and negative skewness (-1.20 versus 0.42) and a statistically similar kurtosis (4.67 versus 4.12) than their counterparts in the Early 2000 Recession. The second and third moments of objective-adjusted returns follow the same pattern, but the prevalence of extreme values is significantly lower in the Great Recession compared to the Early 2000 one (4.97 versus 5.78).

Parametric correlations between during-recession performance and post-recessionary fund flows are not significant for the sample as a whole. Non-parametric correlations are positive and significant with objective-adjusted variables or the Early 2000 Recession and with absolute variables for the Great Recession. When we consider the subcategories of funds, we find that with absolute variables, the three sets of correlations are significantly positive for large-core and multi-value funds in the Early

2000 Recession. With objective-adjusted variables for the same event, parametric and non-parametric correlations are positive and significant for mid-core, large-growth and core, multi-growth and core funds, but negative for small-growth funds. For the second crisis, there is no instance where all sets of correlations are significant. With absolute variables, the Spearman and Kendall measures are significantly positive for small-value, large-growth and multi-value funds. With objective-adjusted variables, large-growth funds keep the positive correlations with respective p-values of 0.04 and 0.05, but multi-value funds show negative correlations with respective p-values of 0.01 and 0.02.

The median of Gaussian copulas for the 1% left tail is significantly lower (higher) around the Early 2000 Recession compared to the Great Recession with (relative) absolute variables. The 1% right tails do not show any difference between the two events and are significantly positive.

The empirical copulas at the 1% level show that absolute (relative) returns lower than -1% are associated with net fund flows lower that -0.07 million (-18.09 million) dollars for the Early 2000 Recession and lower than 0.72 million (-147.69 million) dollars for the Great Recession. The survival copulas analysis for when returns are higher than -1% shows that there is a 1% probability that post-recessionary period absolute (relative) fund flows are higher than -1.02 million (-14.23 million) dollars for the Early 2000 Recession and 5.32 million (-573.88 million) for the Great Recession.

The positive dependence between within-recessionary period absolute returns and post-recessionary period fund flows for the Early 2000 Recession is consistent with the outcome of the analysis using the official economic trough and peak dates. This relationship is driven by growth-oriented, as well as mid- and multi-value funds. Also,

the independence between both variables for the Great Recession confirms the results found with the initial period delineations. This relationship is driven by mid- and large-growth funds.

We find the same relationships as found earlier using the relative variables. For the Early 2000 Recession, the results are driven by small-growth, mid-core, large-core, multi-growth and multi-value funds. For the Great Recession, the results are driven by mid-growth, mid-value, large-growth and multi-growth funds.

Survival copulas at the 1% level for the absolute variables indicate a positive dependence between within-recessionary period returns and subsequent fund flows for both recessions. Although the sign of the relationship remains the same with relative variables for the Early 2000 Recession, the right-tail dependence fades in the most recent recession. This independence is driven by small-value, mid-growth, mid-core, large-core, large-value and multi-value funds.

6. CONCLUSION

We studied the relationship between performance and net fund flows for U.S. equity mutual funds for both the Early 2000 Recession and the Great Recession. We used the copulas method in order to examine the dependence in the tails of distributions in order to draw inferences about whether or not the behavior of new cash inflows subsequent to such downturns is significantly related to fund performance during such turmoils.

The triggers of each recession differed. The Early 2000 Recession stemmed from the dissipation of the price bubble for high-tech stocks. The Great Recession was more

global since it was triggered to a large extent by excessive non-transparent securitization of mortgage debts which ultimately affected real estate markets and the banking system.

For the Early 2000 Recession, there is a positive correlation between during-recessionary period absolute returns and post-recessionary period absolute fund flows and a negative linear dependence between objective-adjusted measures of these variables. Higher absolute fund performance during this economic downturn is subsequently followed by higher money flows. In contrast, investors seem to direct less new cash to outperformers after this recession when the assessment is on a peer-relative basis. For the Great Recession, the non-parametric absolute and relative relationships between these two variables are positive and significant but the parametric linear relationships are not significant.

At the tails of the distributions of peer-relative variables, extreme left and right regions exhibit negative dependence for both recessions. Median Gaussian copulas for the absolute variables show a positive dependence in the 1% left tail for the absolute variables for both recessions, and negative and positive dependence in the 1% right tail for the Early 2000 Recession and Great Recession, respectively. Empirical copulas show a positive dependence in the extreme left tail for the Early 2000 Recession, due primarily to value and core funds when measured on an absolute and objective-adjusted basis, respectively. The Great Recession is characterized by the independence of fund performance and subsequent fund flows, driven primarily by value funds for absolute measurements and medium funds for relative measurements. The survival copulas show an overall positive dependence on an absolute basis (including the upper tails), and a

negative dependence in the right region driven primarily by growth funds for the objective-adjusted measurements.

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Table 1. Summary statistics for the monthly returns and net fund flows for the sample of U.S. equity mutual funds

The table reports the 1st, 5th, 50th, 95th and 99th percentiles of monthly returns and net fund flows, and the standard deviation, skewness and kurtosis of each distribution. All returns statistics are in percentages, and fund flows are in millions of U.S. dollars. The pre- and post-event statistics are calculated over the same number of months as the corresponding event for the sake of comparability. Peer-adjusted variables refer to fund returns or fund flows minus the corresponding returns or fund flows for a size-weighted portfolio of the funds with the same investment objective. "Early 2000 Recession" stands for the economic recession starting March 2001 and ending November 2001. "Great Recession" stands for the economic recession starting December 2007 and ending in June 2009. All the p-values for Jarque-Bera tests for the normality of the return and fund-flow series are close to zero (<0.001).

		1%	5%	50%	95%	99%	Std Dev	Skew	Kurtosis
Absolute Monthly returns	Pre-Early 2000 Recession	-9.36	-4.67	-0.78	2.33	3.31	2.37	-1.34	8.36
	Pre-Great Recession	-2.26	-0.63	0.66	1.55	2.25	0.74	-1.64	11.11
	During-Early 2000 Recession	-3.24	-2.21	-0.66	0.94	1.71	1.01	-0.76	9.58
	During-Great Recession	-5.08	-3.32	-2.00	-1.22	-0.62	0.73	-1.63	10.54
	Post-Early 2000 Recession	-5.67	-3.98	-1.98	0.31	1.88	1.44	0.36	7.53
	Post-Great Recession	0.44	0.86	2.01	4.85	6.83	1.37	1.13	6.84
Absolute Monthly Fund Flows	Pre-Early 2000 Recession	-188.71	-34.09	-0.04	16.68	57.14	42.18	-7.67	91.49
	Pre-Great Recession	-179.97	-43.49	-0.24	20.99	112.86	47.03	-6.60	99.53
	During-Early 2000 Recession	-10.43	-1.19	0.95	47.91	177.25	35.30	6.64	62.46
	During-Great Recession	-115.83	-33.97	-0.21	30.83	151.24	44.34	3.56	81.15
	Post-Early 2000 Recession	-184.64	-42.08	-0.31	10.80	62.07	41.07	-6.39	83.12
	Post-Great Recession	-221.88	-84.70	-1.78	13.05	54.89	44.50	-2.92	32.38
Peer-adjusted Monthly Returns	Pre-Early 2000 Recession	-4.27	-2.32	0.03	2.53	4.16	1.54	-0.22	7.70
	Pre-Great Recession	-1.86	-0.80	-0.02	0.66	1.42	0.51	-0.85	9.21
	During-Early 2000 Recession	-2.41	-1.29	-0.01	1.28	2.17	0.83	-0.93	10.55
	During-Great Recession	-1.86	-0.88	-0.02	0.68	1.15	0.57	-2.29	21.65
	Post-Early 2000 Recession	-3.64	-2.14	-0.14	1.43	2.21	1.09	-0.79	9.06
	Post-Great Recession	-1.50	-0.79	-0.07	0.75	1.46	0.54	0.51	17.56
Peer-adjusted Monthly Fund Flows	Pre-Early 2000 Recession	-71.73	-9.53	82.89	281.98	1940.00	263.69	6.96	61.10
	Pre-Great Recession	-104.67	-4.14	61.64	232.46	438.77	152.30	8.42	117.68
	During-Early 2000 Recession	-167.08	-166.60	-74.90	-8.88	82.09	55.18	0.97	8.50
	During-Great Recession	-413.13	-389.36	2.37	96.71	193.56	138.29	-1.56	5.79
	Post-Early 2000 Recession	-148.35	-84.59	50.71	219.85	407.07	118.65	1.72	13.27
	Post-Great Recession	-1053.47	-1037.57	4.93	157.05	210.74	339.40	-1.81	5.29

Table 2. Non- and parametric correlation measures between within-recessionary period returns and post-recessionary period fund flows

	Early 2000 Recession						Great Recession					
	Pearson	*p*	Spearman	*p*	Kendall	*p*	Pearson	*p*	Spearman	*p*	Kendall	*p*
Absolute Variables												
All	0.09	0.00	0.22	0.00	0.14	0.00	0.01	0.81	0.06	0.03	0.04	0.04
Small-Growth	0.12	0.05	0.19	0.00	0.12	0.00	-0.09	0.26	-0.13	0.11	-0.09	0.08
Small-Core	0.02	0.74	0.09	0.14	0.06	0.00	-0.07	0.33	-0.16	0.03	-0.11	0.03
Small-Value	0.03	0.77	0.12	0.16	0.09	0.00	-0.09	0.45	0.02	0.84	0.01	0.88
Mid-Growth	0.18	0.00	0.24	0.00	0.16	0.00	0.05	0.60	0.12	0.20	0.08	0.23
Mid-Core	-0.05	0.50	0.19	0.02	0.12	0.00	-0.07	0.50	0.11	0.26	0.07	0.28
Mid-Value	-0.13	0.25	0.13	0.25	0.09	0.00	0.36	0.01	0.38	0.00	0.28	0.00
Large-Growth	0.04	0.44	0.10	0.04	0.06	0.01	0.03	0.66	0.15	0.05	0.09	0.07
Large-Core	-0.04	0.41	0.09	0.04	0.06	0.00	-0.03	0.63	-0.06	0.37	-0.04	0.37
Large-Value	0.09	0.15	0.10	0.12	0.07	0.00	-0.01	0.92	-0.02	0.81	-0.01	0.79
Multi-Growth	0.00	0.97	0.18	0.00	0.12	0.00	0.05	0.60	0.25	0.01	0.18	0.00
Multi-Core	0.08	0.28	0.13	0.07	0.09	0.00	-0.02	0.84	0.04	0.71	0.02	0.71
Multi-Value	0.16	0.01	0.20	0.00	0.13	0.00	0.03	0.77	0.20	0.07	0.12	0.11
Objective-Adjusted Variables												
All	-0.12	0.00	-0.05	0.01	-0.03	0.01	0.04	0.11	0.11	0.00	0.07	0.00
Small-Growth	-0.01	0.91	-0.01	0.87	0.00	0.91	-0.14	0.08	-0.10	0.22	-0.06	0.23
Small-Core	-0.17	0.01	-0.15	0.01	-0.10	0.02	-0.03	0.65	-0.10	0.17	-0.07	0.16
Small-Value	-0.01	0.94	-0.03	0.76	-0.02	0.79	-0.03	0.83	0.11	0.35	0.08	0.30
Mid-Growth	-0.02	0.75	-0.07	0.28	-0.05	0.27	0.10	0.29	0.12	0.20	0.09	0.17
Mid-Core	0.00	1.00	0.04	0.59	0.03	0.57	0.06	0.55	0.12	0.21	0.08	0.24
Mid-Value	0.05	0.65	0.09	0.42	0.06	0.45	-0.29	0.03	-0.22	0.10	-0.15	0.12
Large-Growth	-0.10	0.03	-0.16	0.00	-0.11	0.00	-0.35	0.00	0.03	0.64	0.03	0.59
Large-Core	-0.04	0.37	-0.10	0.03	-0.06	0.03	-0.18	0.01	-0.05	0.44	-0.04	0.41
Large-Value	0.00	0.99	0.02	0.80	0.01	0.82	-0.13	0.11	-0.10	0.23	-0.06	0.26
Multi-Growth	-0.37	0.00	-0.21	0.00	-0.13	0.00	0.32	0.00	0.25	0.01	0.18	0.01
Multi-Core	-0.08	0.27	0.02	0.80	0.01	0.81	-0.17	0.08	0.09	0.37	0.06	0.38
Multi-Value	0.14	0.02	0.16	0.01	0.11	0.01	-0.11	0.34	-0.02	0.88	-0.02	0.77

Table 3. Bootstrapped Gaussian copulas for during-recessionary period returns and post-recessionary period fund flows

In this table, '1% Left-tail' stands for the first percentile of the distribution of returns.

	1% Left-tail	5% Left-tail	10% Left-tail	10% Right-tail	5% Right-tail	1% Right-tail
Absolute Variables						
Early 2000 Recession (March 2001-November 2001)						
min	-0.30	-0.14	-0.10	-0.13	-0.08	-0.72
1st Qrtl	-0.10	-0.06	-0.05	-0.08	-0.02	-0.40
median	0.15	0.01	0.00	-0.06	0.00	-0.28
3rd Qrtl	0.40	0.06	0.02	-0.04	0.03	-0.13
max	0.74	0.34	0.17	0.04	0.15	0.17
Great Recession (December 2007-June 2009)						
min	-0.49	-0.09	-0.15	-0.21	-0.24	-0.61
1st Qrtl	0.05	-0.01	-0.07	0.06	0.09	-0.11
median	0.14	0.02	-0.05	0.11	0.14	0.02
3rd Qrtl	0.31	0.07	-0.03	0.14	0.18	0.23
max	0.81	0.24	0.04	0.39	0.42	0.95
Objective-adjusted Variables						
Early 2000 Recession (March 2001-November 2001)						
min	-0.62	-0.43	-0.28	-0.13	-0.22	-0.56
1st Qrtl	-0.28	-0.23	-0.14	-0.05	-0.08	-0.11
median	-0.16	-0.17	-0.09	-0.02	-0.05	-0.02
3rd Qrtl	-0.09	-0.11	-0.05	0.00	-0.02	0.05
max	0.26	0.14	0.08	0.10	0.09	0.37
Great Recession (December 2007-June 2009)						
min	-0.97	-0.20	-0.13	-0.36	-0.54	-0.81
1st Qrtl	-0.61	-0.11	-0.06	-0.13	-0.28	-0.38
median	-0.01	-0.08	-0.03	-0.08	-0.21	-0.23
3rd Qrtl	0.10	-0.03	0.00	-0.03	-0.13	-0.07
max	0.79	0.18	0.17	0.11	0.07	0.31

Table 4. Dependence between within-recessionary period fund returns and post-recessionary period fund flows

This table is a recap of the signs (+ or -) of the relationship between the variables, if any, or independence (Ø), for the whole sample as well as fund categories, assessed at the 1% level of significance for the copulas and survival copulas analyses.

	Early 2000 Recession		Great Recession	
	Absolute variables	Objective-adjusted variables	Absolute variables	Objective-adjusted variables
COPULAS: 1% level				
All	+	+	Ø	Ø
Small-Growth	+	+	-	-
Small-Core	+	+	-	-
Small-Value	Ø	Ø	Ø	Ø
Mid-Growth	+	+	-	Ø
Mid-Core	+	+	-	Ø
Mid-Value	+	Ø	Ø	-
Large-Growth	Ø	Ø	Ø	+
Large-Core	Ø	Ø	Ø	-
Large-Value	+	+	Ø	-
Multi-Growth	-	-	Ø	Ø
Multi-Core	+	+	Ø	+
Multi-Value	+	Ø	Ø	Ø
SURVIVAL COPULAS: 1% level				
All	+	-	+	Ø
Small-Growth	+	+	+	+
Small-Core	+	+	+	Ø
Small-Value	-	-	Ø	Ø
Mid-Growth	+	Ø	+	Ø
Mid-Core	+	+	Ø	Ø
Mid-Value	Ø	Ø	Ø	-
Large-Growth	+	-	+	-
Large-Core	+	+	+	Ø
Large-Value	+	+	+	Ø
Multi-Growth	+	-	Ø	Ø
Multi-Core	+	+	Ø	-
Multi-Value	+	+	+	Ø

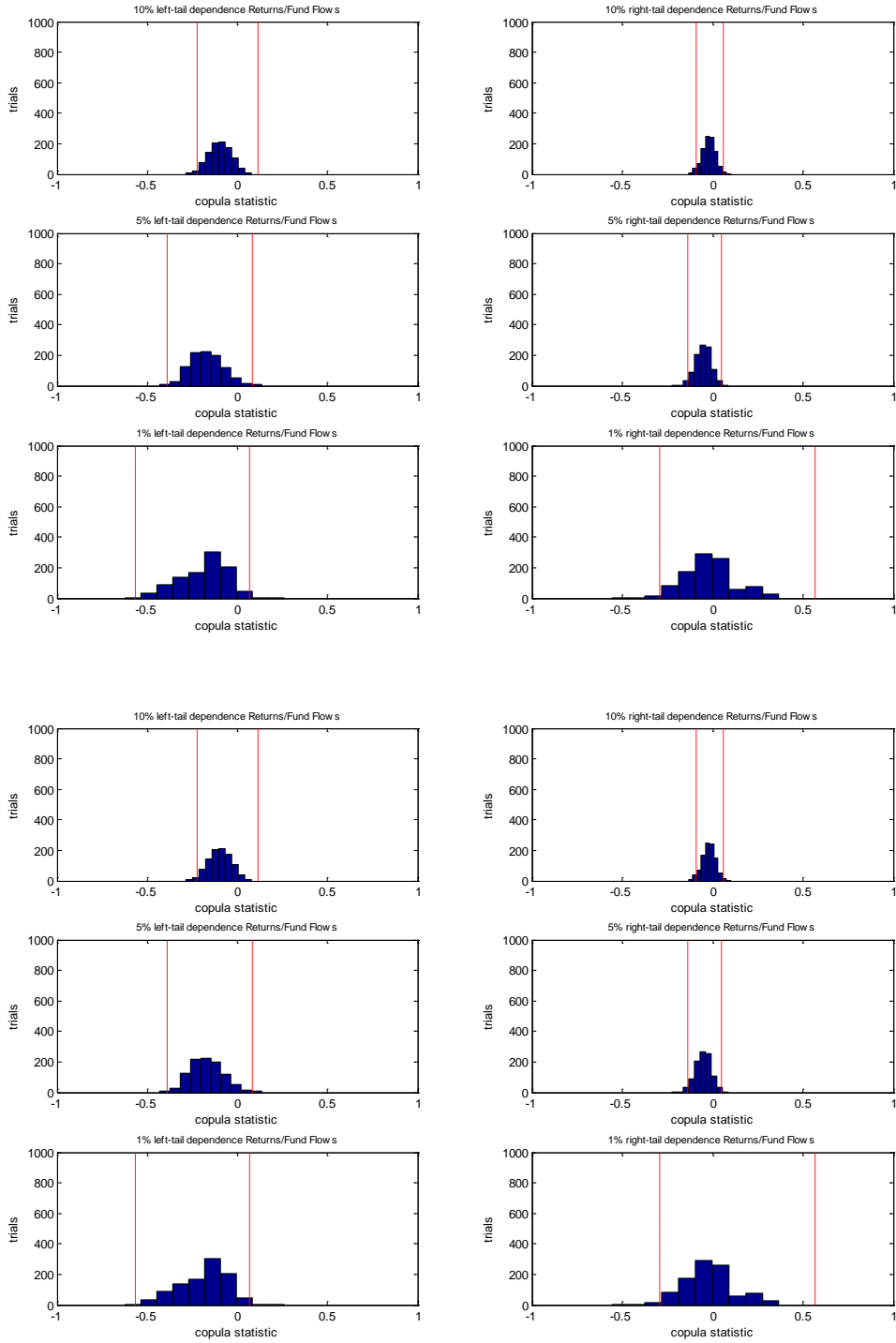**Figure 1. The distribution of copulas around the Early 2000 Recession**

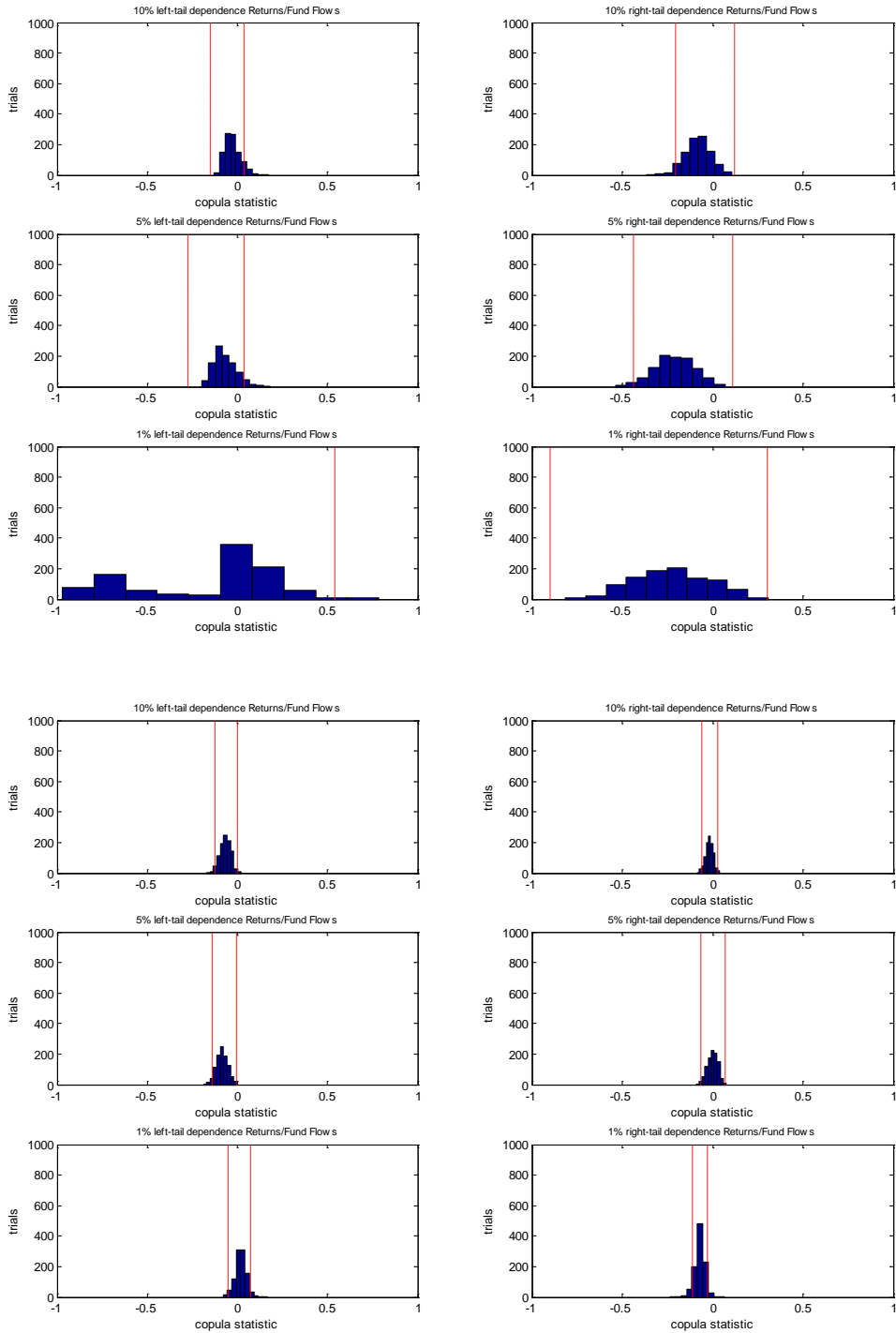**Figure 2. The distribution of copulas around the Great Recession**

Figure 3. Joint cumulative distribution functions

This set of figures shows the cumulative distribution functions of absolute and objective-adjusted monthly returns and fund flows around the Early 2000 Recession (Dot-Com Crisis) and Great Recession (Subprime Crisis) as well as the associated level curves at the 1%, 5%, 50% and 75% levels, for the whole sample of U.S. equity mutual funds. "In-Ret" refers to within-recessionary period returns and "Post-FF" refers to post-recessionary period fund flows.
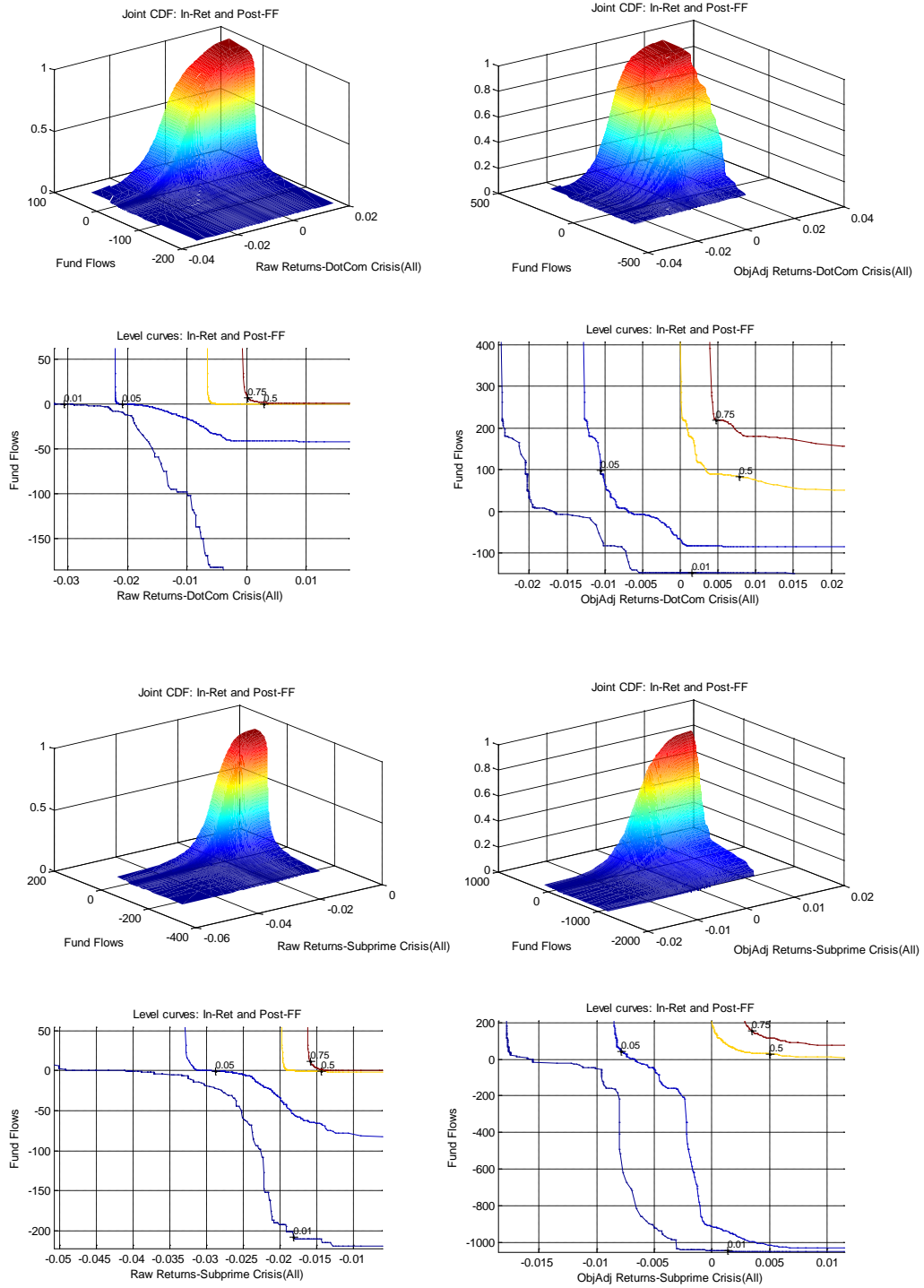
Figure 4. Level curves for the copulas and survival copulas

This set of figures shows level curves at 1% for copulas and survival copulas of absolute and objective-adjusted variables around the Early 2000 Recession (Dot-Com Crisis) and Great Recession (Subprime Crisis). Each quadrant shows Fréchet bounds as well as the empirical curves at the 1% level for the whole sample of U.S. equity mutual funds.