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Accounting for Skewness in Performance Evaluation of Brazilian Mutual Funds

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ABSTRACT

The Sharpe Ratio is probably the most widely known and used performance measure for mutual fund evaluation. However, it is based on the mean-variance theory and thus it is valid either for Normal returns or for quadratic utility functions. It does not take into account skewness of returns' distributions. If we consider investors with negative skewness aversion, it is interesting to have a measure that goes beyond mean-variance. Koekebakker and Zakamouline (2009) propose a measure called ASSR (Adjusted for Skewness Sharpe Ratio) that generalizes the Sharpe ratio, accounting also for the skewness. However, the ASSR may result in imaginary numbers under certain conditions. In fact, in our sample many funds got imaginary numbers for the ASSR. Thus, we propose a new measure that does not have to deal with imaginary numbers, but maintains the main features of the original measure of Koekebakker and Zakamouline. We use the new measure to rank Brazilian Fixed Income and Multimarkets funds. Results show a very low ranking correlation between the new measure and the Sharpe Ratio, suggesting that skewness is an important issue when analyzing Brazilian mutual funds.

Key words: Sharpe Ratio, Skewness, Performance Evaluation.

JEL classification: G11

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1. Introduction

Numerous performance measures have been proposed in the literature to assess active fund managers. The Sharpe Ratio is probably the most widely known and used. But this is an adequate measure of performance evaluation if either investor believes that risk can be properly measured by standard deviation, or if returns have nice symmetric distributions like the Normal. However, many Brazilian mutual funds have distributions with non-Normal shapes.

Literature shows that assets and portfolios returns' distributions may be non-Normal, usually with fat tails and negative skewness. We can identify two reasons for this non-normality. One reason is that individual assets available have themselves non-Normal distributions. This is the case of Brazilian market. Thus, when we combine non-normal assets in the portfolio, the resulting return will be also non-Normal. The other reason is the use of derivatives, which can be used to change the portfolio leverage or to add negative skewness. These strategies are often blamed to be a "Manipulation" of the Sharpe Ratio. The work of Goetzmann et al. (2007) analyzes several manipulation strategies of traditional measures such as the Sharpe Ratio.

Several authors have proposed measures that go beyond the mean-variance world. This is the case Hodges (1998), Keating and Shadwick (2002), Goetzmann et al. (2007) and Koekebakker and Zakamouline (2009). The later proposes a measure that generalizes the Sharpe Ratio to account for skewness. Assuming that investors are not neutral to skewness, their measure penalizes returns with negative skewness.

However, they make a derivation that leads to a performance evaluation index that may result in imaginary numbers under certain conditions. In our work, we discuss their derivation and propose a new measure. We argue that an appropriate measure for ranking funds would be based on the risky asset allocation weight derived by their model. This new measure is more appropriate since it does not have to deal with imaginary numbers, but maintains the main features of the original measure of Koekebakker and Zakamouline. Then we evaluate empirically the effects on the ranking of Brazilian Fixed-Income and Multimarkets funds when we use this new measure and the traditional Sharpe Ratio.

The fund industry has grown very much in recent years in Brazil (Alves Junior, 2003) due to the growth of institutional investors as pension funds, changes in the regulation framework and economic development, among others factors. The literature of funds performance in Brazil is very concentrated in Equity Funds and there are few papers about Multimarkets and Fixed-Income funds. So, we expect also to contribute for the debate about performance measures in the Brazilian Mutual Fund Industry, using a measure that goes beyond the mean-variance. The ultimate choice of performance measure will depend on the Brazilian Fixed-Income and Multimarket Funds investors' preferences. Almeida (2004) evaluates investors' preferences in Brazilian funds using panel data. He concludes that returns are negatively correlated to skewness. So, there is a premium for funds with negative skewness. Funds with negative skewness have a higher downside risk and ask for a higher return. Based on this result, we can say that Brazilians are not neutral to skewness of returns distribution, and thus measures of performance that consider not only mean and variance but also others properties of distribution should be studied and used. A performance evaluation measure that deals with standard deviation as the only risk measure does not get investors' preferences in a fair basis.

Section two of this paper presents a brief literature review. Section three discusses the work of Koekebakker and Zakamouline (2009) and proposes a new index that takes skewness into account in a more appropriate way. In the fourth section we present a summary of returns' data. In section five we show results of this new performance evaluation index when applied to

Brazilian mutual fund data, and compare with Sharpe Ratio results. Section 6 concludes the paper.

2. Literature Review

Silva Junior (2004) describes the investment process with several steps including strategic asset allocation in benchmark selection, active management, guidelines and performance reports. Performance reports are an important task in the investment process, since it helps a better understanding on the risk-return relationship. It helps asset allocation risk budgeting, strategies, managers' evaluations etc. Silva Junior (2004) splits performance reports in three complementary blocks. The first one is the return calculation report. Despite the fact that several measures could be used, generally speaking returns calculations follow CFA (Chartered Financial Analysts) institute standards using time weighted returns. Another block in performance reports is performance attribution, where we can identify sources of returns and we may attribute each source for the strategies managers have used. Finally, we have performance evaluation that is related to return adjustment based on the risks incurred by managers.

In fact performance evaluation has many roles in the investment process. It is intrinsically associated to the asset allocation due to the fact that the strategic asset allocation must reflect investors' risk preferences. Risk budgeting also needs a good understanding of performance evaluation. Several managers decide their risk budget process in a maximization of a performance evaluation measure, as we can see in Dinking at al. (2007). Performance evaluation numbers are also used for selection and assessment of external portfolio managers. Géhin (2004) shows some factors that may influence performance evaluation steps like data quality, survivorship bias, instant history bias, funds' size, funds' age, market factors, returns probability distribution etc. In fact, rankings also depend on the kind of measure we use.

Performance evaluation must be risk-adjusted, and traditional measures are based on a mean-variance framework as the Sharpe Ratio, Jensen's Alpha, Treynor Ratio etc. Some variations of these approaches are used as we can see in Elton, Gruber and Blake (2003) where they use a multi-index performance measure to evaluate incentive fees for mutual funds. Recently, there is a growing literature on performance evaluation that tries to take into account higher moments of distribution and not only mean and variance. We see two reasons for the emergence of these measures: first, there is a new paradigm of investors' perception of risk that goes beyond simply the variance; and second, many asset return's distributions have actually non-Normal distributions. The first reason is linked to the increasing use in the last 15 years of a number of risk measures that focus on the left tail of return's distribution, such as Value at Risk (VaR) and Expected Shortfall.

Many researches replace standard deviation in the Sharpe ratio by risk measures that focus on the left tail of distributions. Sortino (1991) replaces the standard deviation by the downside deviation. Dowd (2000) uses the Value-at-Risk (VaR) measure instead of standard deviation. Stutzer (2000) proposes the Stutzer index, which is based on the assumption that investors want to minimize the probability of underperforming a specific benchmark. Keating and Shadwick (2002) introduced the Omega Ratio that is defined as the ratio of the gain relative to a given threshold to the loss with respect to the same threshold. Grava and Siqueira (2003) evaluate Brazilian mutual funds using a price of volatility, given by the coefficient of a GARCH-M model.

Portfolios and funds return's distributions are actually not normally distributed. Hedge funds are an example of odd-shaped distributions that deviate substantially from normality (see, for example Malkiel and Saha, 2005). Nevertheless, Sharpe Ratio and similar measures are

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commonly used to evaluate and rank hedge funds. Cerny (2003) proposes a generalized Sharpe Ratio that according to him provides a consistent ranking of investment opportunities even when asset returns are highly non-Normal. Returns' distribution of a fund may be non-Normal simply because fund's holdings contain assets with non-Normal properties. However, several papers have argued that hedge fund managers use strategies trying to manipulate Sharpe-like performance measures. Goetzmann et al. (2007) describe three general strategies for manipulating a performance measure. The first strategy is the manipulation of the underlying distribution in order to influence the measure. The second strategy is the dynamic manipulation that induces time variation into the return distribution to influence measures that assume stationarity. The last strategy is a kind of dynamic manipulation that focuses on inducing estimation error.

In fact, major papers in the recent performance measurement literature tries to capture skewness of returns distributions. This literature argues that investors are not neutral to skewness and so there is a premium associated to skewness. Many approaches are derived from utility functions that take into account investors' preference to higher moments of returns distributions. A very interesting example is the work of Koekebakker and Zakamouline (2009). Based on the Generalized Sharpe Ratio of Hodges (1998), they propose two performance measures, one general performance measure taking into account only skewness and other taking into account both Skewness and Kurtosis. The first one take into account skewness preferences in investment decisions and derive the Adjusted for Skewness Sharpe Ratio (ASSR). Despite the very comprehensive nature of this measure it has a major drawback: it may generate complex numbers in some cases. Thus, comparison of different measures is not possible in these cases.

Koekebakker and Zakamouline (2009) also propose a measure that takes into account both Skewness and Kurtosis, the Adjusted for Skewness and Kurtosis Sharpe Ratio (ASKSR). However, the closed-form formula for this measure has to be derived considering a specific distribution. They give an example using a Normal Inverse Gaussian (NIG). Thus, given the estimated parameters of the NIG, the ASKSR can be calculated using a formula. The problem with this approach is the estimation procedure that may have problems of convergence, high sensibility to initial parameters choices, especially when the amount of data available is small.

Goetzmann et al. (2007) present numerical simulations of manipulation strategies for several performance measures like Sharpe Ratio, Jensen's Alpha, Treynor Ratio, Appraisal Ratio, Sortino and Van der Meer Ratio (1991), Sortino, Van der Meer and Plantinga (1999) ratio, and the timing measures of Henriksson and Merton (1981), and Treynor and Mazuy (1966). Manipulations generate statistically and economically significant better portfolio scores even though all of the simulated trades can be carried out by an uninformed investor. Goetzmann et al. (2007) suggest a manipulation-proof performance measure (MPPM) that has four properties: i) produce a single valued score with which to rank each subject; ii) score's value should not depend on portfolio's size; iii) an uninformed investor cannot expect to enhance his estimated score by deviating from the benchmark and at the same time informed investors should be able to produce higher scoring portfolios by using arbitrage; and iv) the measure should be consistent with standard financial market equilibrium conditions.

Despite all variety of measures, Eling and Schuhmacher (2007) analyze and compare 13 different performance measures for a set of hedge fund returns and conclude that all these performance measures produce similar rankings. They use the following measures: Sharpe Ratio, Treynor, Jensen's Alfa, Omega Ratio, Sortino Ratio, Kappa 3, the upside potential ratio, the Calmer Ratio, the Sterling Ratio, the Burke Ratio, the excess return on Value at Risk, the conditional Sharpe Ratio, and the modified Sharpe Ratio. However, it is worth to mention that

recent measures like the MPPM and ASSR were not considered in this study. In fact, they have used measures that have a very similar nature and form, i.e., expected return divided by a risk measure.

Berk and Green (2004) discuss an interesting puzzle in the performance evaluation literature: the evidence of no persistence in performance would imply that superior performance is attributable to luck rather than differential ability across managers. But they argue that this implication would be troubling from an economic point of view since there are reward for superior past performance and investors devote considerable resources to evaluate past performance of managers. According to the author's model there is competitive provision of capital by investors to mutual funds, there is differential ability to generate high average returns across managers, but decreasing returns to scale in deploying these abilities and there is learning about managerial ability from past returns. Some authors as Oliveira (2005) identify that in a quarterly horizon there is performance persistence in the Brazilian Multimarket Fund Industry. The issue of ranking funds and persistence is a very important one. Lynch and Musto (2003) state that the literature documents a convex relation between past returns and fund flows of mutual funds. Many authors argue that it is difficult to assess the estimation error associated with each measure. The work of Eid Jr. and Rochman (2005) evaluates some performance index based on a bootstrap procedure to assess the estimation risk. Martins (2006) also considers a bootstrap technique to assess estimation error in performance evaluation of mutual funds.

In fact there is no consensus in performance evaluation approaches for ranking funds. Measures will outcome different results that should be carefully interpreted by investors. It does not seem an appropriate decision rely in a single measure to decide in what fund you will invest your money. So, it is necessary to understand performance measurement theory, indexes strengths and weaknesses, and investors' preferences regarding risks and returns.

3. A Performance Measure

Koekebakker and Zakamouline (2009) consider an investor who wants to allocate his wealth between a risk-free and a risky asset. According to their model returns follow a stochastic process as:

$$x = \mu \Delta t + \sigma \sqrt{\Delta t}\, \varepsilon \qquad (1)$$

where μ and σ are mean and volatility of the risky asset returns per unit of time Δt, and ε is a stochastic error term.

Risk free asset returns are modeled as:

$$r_f = r \Delta t \qquad (2)$$

where r is the risk-free interest rate per unit of time.

Investors have a wealth of ω and invest a into the risky asset and the remaining in the risky free asset. After Δt, investors' wealth is:

$$\tilde{\omega} = a\left(x - r_f\right) + \omega\left(1 + r_f\right) \tag{3}$$

The investor's expected utility **E** is a function of investor's wealth, returns and the amount invested in risky assets and in the risk-free asset:

$$\mathrm{E}\left[U\left(\tilde{w}\right)\right] = \mathrm{E}\left[U\left(a\left(x - r_f\right) + w\left(1 + r_f\right)\right)\right] \tag{3}$$

Koekebakker and Zakamouline (2009) solve the problem of utility maximization with an application of a Taylor series expansion for $U\left(\tilde{\omega}\right)$ around $\omega\left(1 + r_f\right)$. They truncate the Taylor expansion in a way to consider moments up to the skewness of the return distribution and disregard all the higher moments of the distribution. Thus, the solution for the utility maximization gives the amount we should invest in the risky-asset (a):

$$a = \frac{SR}{\gamma\sigma\sqrt{\Delta t}}\left(1 + \frac{bS}{2}SR\right) \tag{4}$$

where SR is the Sharpe ratio, S is the skewness of probability distribution of returns, γ is the Arrow-Pratt measure of absolute risk aversion and b is the investor's preferences to skewness parameter.

Since we have the solution for a, Koekebakker and Zakamouline (2009) shows that it is possible to express the (approximate) maximum expected utility in terms of the Sharpe ratio adjusted for skewness preferences:

$$E\left[U\left(\tilde{\omega}\right)\right] \approx U\left(\omega_r\right) + \frac{U'\left(\omega_r\right)}{\gamma}\frac{1}{2}SR^2\left(1 + \frac{bS}{3}SR\right) \tag{5}$$

According to Koekebakker and Zakamouline (2009) equation (6) suggests that for any investor the higher the value of

$$SR^2\left(1 + \frac{bS}{3}SR\right) \tag{6}$$

the higher the expected utility. They argue that in the case the risky asset represents a portfolio of several assets and the investor faces the problem of choosing an optimal portfolio mix, the investor's alternative objective is to maximize the quantity given by (6). So, Koekebakker and Zakamouline (2009) proposed the Adjusted for Skewness Sharpe ratio:

$$ASSR = SR\sqrt{1 + \frac{bS}{3}SR} \tag{7}$$

It is worth to mention that equation (5) shows the utility function for a combination of the risky asset with the risk-free asset. If the risky asset has a negative excess expected return, the solution provided by (4) gives a negative allocation, i.e., to short-sell the risky asset. For instance, a fund with a high negative Sharpe ratio (and additionally negative skewness) may improve utility function in equation (5) because the model will short-sell this fund, and obviously it does not mean that this fund manager is good. The utility of risky assets with negative excess expected return risky assets comes from the fact that one could short sell it and invest in the risk-free asset. This would make sense for ETFs (Exchange-Traded Funds), indexes with future contracts, or any asset with a liquid repo market.

This kind of situation occurs also with the Sharpe Ratio. As pointed out by Sharpe (1994), strategies with positive Sharpe Ratio should be held long, and strategies with negative Sharpe Ratio should be held short. In a situation of negative excess returns, the higher is the volatility the higher (less negative) is the Sharpe Ratio. The problem of comparing funds with negative Sharpe Ratio, which occurs often in bear markets, has been discussed in the literature (see for example Scholz and Wilkens, 2005). Despite this controversy it does not mean that Sharpe ratio and derived measures are not suitable to measure the ability of active fund managers. We need only to be careful with results. In fact we have to keep in mind that higher Sharpe ratios are better than lower even in a bearish market, since we can combine risk free asset and the market portfolio in an optimal way.

Although both Sharpe Ratio and ASSR suffer similar interpretation problems when excess returns are negative, there is an additional problem with ASSR. Note that equation (7) may generate imaginary numbers if the expression inside the square root is negative. In fact it does happen in our sample. The imaginary numbers may occur if the Sharpe Ratio is negative and the skewness positive, or vice-versa. Therefore, problems with the ASSR are not restricted to bear markets. It may occur an imaginary ASSR even with, for instance, a big positive Sharpe Ratio and a slightly negative Skewness.

For solving the problem of negative numbers inside the square root of equation (7) we suggest using a performance measure that comes from equation (4), which is the allocation of the risky asset. Then we would have no problems with imaginary numbers. Since all funds will have the same parameter γ, we suggest for ranking managers the following index (Adjusted for Skewness Performance Index – ASPI) that comes from equation (4):

$$ASPI = \frac{SR}{\sigma\sqrt{\Delta t}}\left(1 + \frac{bS}{2}SR\right) \tag{8}$$

So we may rank fund managers in a way similar to the ASSR, but without problems with square roots of negative numbers. Negative skewness is penalized when excess returns are positive as in the ASSR. But how should we interpret negative ASPI? As the index is derived from the allocation of the risky asset, negative numbers mean we should short-sell the fund, in a situation similar to the Sharpe Ratio. As there are constrains to short-sell active managed funds, we should simply not invest in the fund, but rather put the money in the risky-free asset. If we

must choose between two funds with negative ASPI, as it is the case of rankings, we would have the same problem of interpretation that occurs with the Sharpe Ratio. But even in this case the rule is choose the higher ASPI.

The b parameter works exactly as in the ASSR. The higher is b, the higher is the aversion to negative skewness. When b equals to zero, ASPI is indifferent to skewness and is compatible with the use of a quadratic utility function with no penalty for skewness. If we use a CARA (constant absolute risk aversion) utility function, the value of b should be one (Koekebakker and Zakamouline, 2009). For a logarithmic utility, the value of b should be two.

If we use a CARA utility function, the value of b will depend on the relative risk aversion (RRA) parameter. For the Brazilian economy, Nakane and Soriano (2003) estimate values for the relative risk aversion from -0.1 to 4.3. For a RRA equals to one, we would have again b equal to two. If we consider a RRA value of three, b will be 4/3.

4. Data

Data was obtained from Bloomberg and consist of daily Net Asset Values (NAV) of Multimarkets and Fixed-Income Brazilian Mutual funds from years 2003 to 2007, a total of 1255 working days. Classification in Multimarkets and Fixed-Income follows Andima (The National Association of Financial Market Institutions) standards, and fund of funds were excluded to avoid spurious clustering. The Multimarkets is a type of fund in Brazil that has characteristics similar to the international Hedge Funds. The risk-free asset used was the CDI (one-day interbank deposit).

The sample includes only surviving funds, i.e., funds with data for the full period. We excluded from the sample funds that do not have information about the NAV for more than five business days. For the missing days, the NAV was interpolated. We have then 375 funds: 186 Multimarkets and 189 Fixed-Income.

Given these exclusions, our sample of funds has a survivorship bias, i.e., funds that disappeared before the end of the sample were not included. But as our concern is to evaluate the ranking changes as a function of the performance measure, survivorship bias is not a problem. In fact, the only way to compare the performance of funds through a specific time interval is to use only funds alive in the whole period. However, one has to be careful in analyzing the average performance of funds against a benchmark. As funds tend to be closed after negative results, the surviving funds will have an upward bias in their performance compared with the full sample.

5. Results

We calculate ASPI for each fund of the two samples of Brazilian funds with four values to the skewness preference parameter, b. We also calculated Sharpe ratio for each fund of the two samples. Then we estimate the correlation for the results based on the Kendall's Tau Rank correlation. Results are on Table 1. We see that correlation with the Sharpe Ratio is very low, except for the case where $b = 0$ (which means skewness indifference). We can see also that as b increases, the correlation between ASPI and Sharpe ratio decreases.

If we compare our results with those of Eling and Schuhmacher (2007), we see a clear lower correlation in our study. Thus, the choice of Performance Measure actually does matter when we account for skewness.

**TABLE 1 – Kendall's Tau Rank Correlation Matrix**

	ASPI with $b = 0$	ASPI with $b = 1$	ASPI with $b = 4/3$	ASPI with $b = 2$	Sharpe Ratio
Multimarkets					
ASPI with $b = 0$	1	0.66	0.58	0.44	0.64
ASPI with $b = 1$	0.66	1	0.92	0.79	0.51
ASPI with $b = 4/3$	0.58	0.92	1	0.87	0.45
ASPI with $b = 2$	0.44	0.79	0.87	1	0.37
Sharpe Ratio	0.64	0.51	0.45	0.37	1
Fixed Income					
ASPI with $b = 0$	1	0.23	0.17	0.08	0.83
ASPI with $b = 1$	0.23	1	0.93	0.84	0.22
ASPI with $b = 4/3$	0.17	0.93	1	0.91	0.16
ASPI with $b = 2$	0.08	0.84	0.91	1	0.08
Sharpe Ratio	0.83	0.22	0.16	0.08	1

Following pictures show rankings comparisons. Best funds are in the beginning of axes. In the X-axis we show Sharpe Ratio rankings and in the Y-axis we have ASPI rankings. We see it is possible to calibrate investors' skewness preferences with b parameter. Higher negative skewness aversion may be modeled by a higher b.
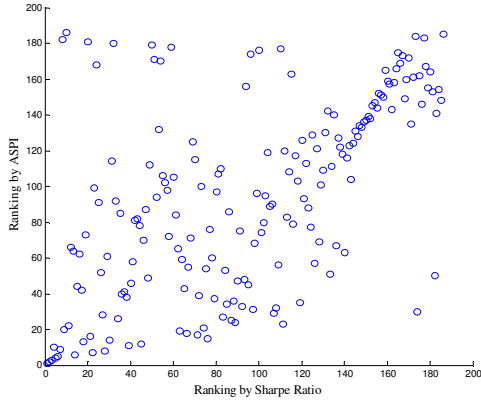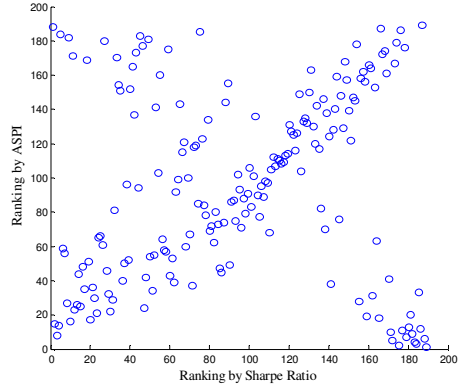
Ranking Sharpe Ratio X ASPI with $b=2$
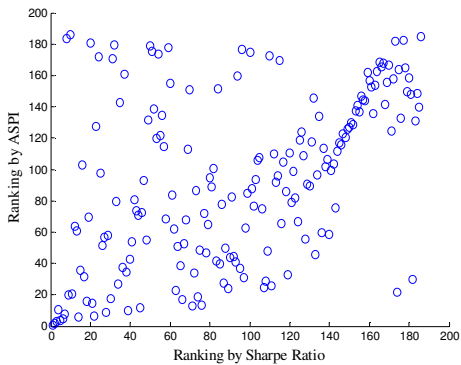
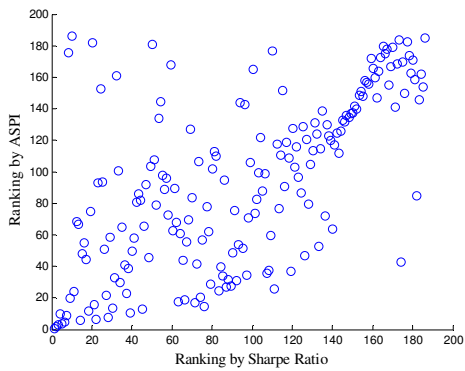Multi-Markets   Fixed Income
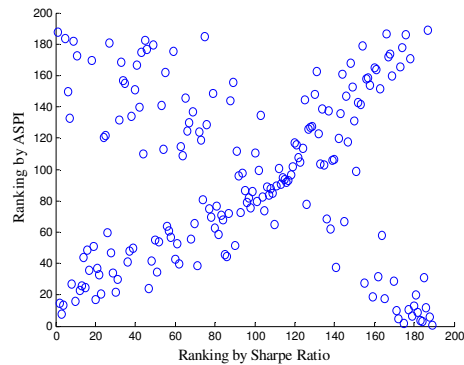
Ranking Sharpe Ratio X ASPI with b=4/3
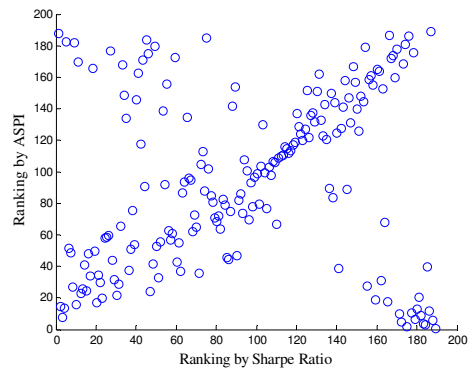

Multi-Markets

Fixed Income

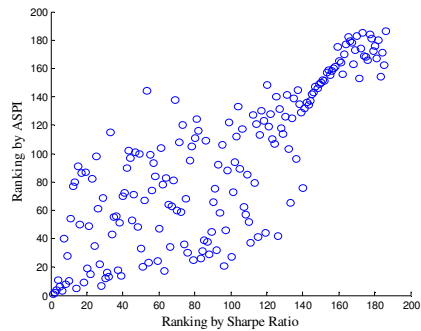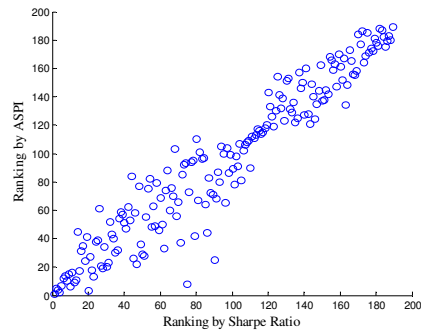# Ranking Sharpe Ratio X ASPI with b=1

Multi-Markets

Fixed Income

Ranking Sharpe Ratio X ASPI with b=0

Multi-Markets

Fixed Income

Graphs show a very spread figure instead of a concentration in the 45º line that should be expected if rankings were similar. Funds that are under the 45º line have been upgraded by the new measure if compared with the Sharpe Ratio. Conversely, Funds that are above the 45º line have been downgraded by the new measure. One interesting analysis is to investigate the statistical characteristics of these funds.

TABLE 2 – Characteristics of Funds well above or under the 45º Line

ASPI with b=1					
	Multimarkets				
	# of Funds	Mean	Std	Skewness	Kurtosis
SR gives Better Rank than ASPI	7	0.0078	0.0056	-2.2464	69.4714
ASPI gives Better Rank than SR	2	-0.0156	0.0241	9.0681	319.4699
Overall Sample	186	0.0138	0.0336	-0.3358	61.3812
	Fixed-Income				
	# of Funds	Mean	Std	Skewness	Kurtosis
SR gives Better Rank than ASPI	6	0.0048	0.0015	-2.6002	70.6551
ASPI gives Better Rank than SR	15	-0.0321	0.0012	6.3231	204.5035
Overall Sample	189	-0.0036	0.0077	-0.0618	199.3851
ASPI with b=4/3					
	Multimarkets				
	# of Funds	Mean	Std	Skewness	Kurtosis
SR gives Better Rank than ASPI	9	0.0072	0.0054	-2.1715	61.7502
ASPI gives Better Rank than SR	2	-0.0156	0.0241	9.0681	319.4699
Overall Sample	186	0.0138	0.0336	-0.3358	61.3812
	Fixed-Income				
	# of Funds	Mean	Std	Skewness	Kurtosis
SR gives Better Rank than ASPI	6	0.0048	0.0015	-2.6002	70.6551
ASPI gives Better Rank than SR	15	-0.0321	0.0012	6.3231	204.5035
Overall Sample	189	-0.0036	0.0077	-0.0618	199.3851
ASPI with b=2					
	Fixed-Income				
	# of Funds	Mean	Std	Skewness	Kurtosis
SR gives Better Rank than ASPI	11	0.0069	0.0052	-1.9667	59.6465
SR gives Better Rank than MPPM	2	-0.0156	0.0241	9.0681	319.4699
Overall Sample	186	0.0138	0.0336	-0.3358	61.3812
	Multimarkets				
	# of Funds	Mean	Std	Skewness	Kurtosis
SR gives Better Rank than ASPI	5	0.0048	0.0013	-2.6972	66.4838
SR gives Better Rank than MPPM	14	-0.0343	0.0012	6.4637	214.7075
Overall Sample	189	-0.0036	0.0077	-0.0618	199.3851

In order to identify and analyze these funds, we calculate for each fund the difference in the ranking with ASPI to the ranking with Sharpe Ratio. We then calculate the standard deviation of these ranking differences and pick up the funds that are over two standard deviations above or

under the mean, i.e., outlier funds that have a Sharpe Ratio ranking much better or much worse than ASPI. For these funds, we calculate the Mean, Standard Deviation, Skewness and Kurtosis of excess returns. Table 2 shows the results. As expected, we see that funds that have been downgraded by ASPI have skewness well more negative than the overall mean skewness of the sample.

Another way to assess the reasons of these differences is to regress the skewness on the Sharpe Ratio and ASPI rankings. The results on table 3 reinforce that the funds who perform better with ASPI have higher skewness, and that the Sharpe Ratio does not account to it.

TABLE 3 – Regression of Skewness on Sharpe Ratio and ASPI Rankings

Equation: Skewness = $\alpha + \beta_1$ SR_Ranking + β_2 ASPI_Ranking					
	α	SR	ASPI	R^2	F Test
Multimarkets	2,3120***	0,0068	-0,0351***	0,248	30,17***
Fixed-Income	11,8247***	-0,3620	-0,1099***	0,371	54,83***
*** Coefficient significant at 1%					

6. Conclusion

This paper proposes and uses a performance evaluation measure that takes into account skewness. This kind of approach may be useful for investors who are averse to negative skewness.

Our measure is based on the ASSR (Adjusted for Skewness Sharpe Ratio) proposed by Koekebakker and Zakamouline (2009). We show that despite the intuitiveness of their measure, it is not suitable for ranking funds due to the possibility of square root of negative numbers in the measure. In fact, this happen several times with our sample of Brazilian funds. Therefore, we argue that an appropriate measure for ranking funds would be the amount of investment their model allocates in the risky asset, based on investors' utility function. We call this new measure Adjusted for Skewness Performance Index (ASPI) and we use it for ranking Brazilian Fixed Income and Multimarkets funds.

Results of ASPI measure for our sample of Brazilian funds show very low correlations with Sharpe ratios rankings. It is clear that when we take into account skewness, rankings may differ very much from traditional approaches. Obviously the choice of this kind of measure depends on investors' preferences for skewness. Those who are very concerned with big losses may adjust their preferences with a parameter that tunes skewness preferences.

There is no consensus in performance evaluation approaches for ranking funds. Measures will provide different rankings that should be interpreted by investors in a very careful way. It seems not an appropriate decision rely in a single measure to decide in what fund you will invest your money. So, it is necessary to understand performance measurement theory, indexes strengths and weaknesses, investors' preferences regarding risks and returns, in order to allocate wealth in an appropriate way.

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