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Abstract

We apply the Quantile Regression Model to observe the rank correlation between bond fund performance and asset, volatility, management fee, Sharpe index and show that fund performance between volatility as a negative significant relationship, implied extreme values have been generated risk coefficient and fund performance change relations. The extreme value of the display the risk coefficient fund performance has changed the relationship, show that enhance the risk coefficient, resulting in lower fund performance, tells us that the mutual fund industry pursuit of short-term fund performance through operating the transition risks lever, but cannot afford a long-term test of the market. Finally, we recommend that the mutual fund industry needs to strengthen risk management professional and pursuit of performance Sustainability.

Keywords: Equity fund, PSTR model, volatility, fund performance

Introduction

In light of the events of the past few years, the environment in which mutual fund operate has become significantly more "risk conscious" and the question of what constitutes effective "risk management" has become a key focus for regulators, legislators and academics. Not surprisingly, therefore, mutual fund seeks to understand better their role in the risk management process.

"Risk" is inherent in the investment management business. In particular, investment managers cannot invest their clients' funds and hope to earn a positive return without taking some measure of risk. In addition, in managing their businesses, investment managers a wide variety of risks, ranging from compliance-oriented risks to reputational risks to risks to the systems they use to run their businesses and beyond. Because risk is at the core of the investment management business, how investment managers choose what risks to take and how they monitor and manage those risks is fundamental to their – and their clients' – success.

The Forum recognizes that the diversity among funds and fund families and the constantly evolving universe of risks in the market make it impossible to develop a "one-size-fits-all" approach to risk governance. Consequently, directors should consider fund size, the assets and number of funds in the fund family, the

structure of management and service arrangements and fees, and the nature of fund investment objectives and strategies, among other factors, to determine whether and to what extent particular principles are applicable and appropriate.

In Taiwan, mutual funds are important investment products. In particular, bond funds are the largest types of mutual funds that the managers of funds offer investors the advantages of diversification and professional assessment for risk on bonds and stocks investment.

However, bond funds focus on pursuing short-term high returns and increasing their scale by investing in structured products with poor liquidity. The problem arises when bond funds allow clients to redeem and take their proceeds the next day, engendering a liquidity divergence between the bond funds' own assets and those offered to clients and increasing the funds' liquidity risks.

Although the local regulation for strengthening bond fund management outlined major management issues, the scarce liquidity resulting from large holdings of structured notes still triggered significant redemptions upon Union Investment Trust and Tai-Yu Investment Trust in Taiwan in July 2004. In order to avoid risk, Taiwan's Financial Supervisory Commission (FSC) decided to carry out a bond segregation policy before the end of 2006. The system split up bond funds into fixed income bond funds and quasi money market bond funds.

Most studies in the bond fund literature focus on funds' performances, credit quality, and value at risk (VaR). Some previous research studies such as Blake, et al. (1993) used linear and non-linear models to examine bond funds' performances. Elton *et al.* (1995) first developed and tested the relative pricing models (based on the Arbitrage Pricing Theory, or APT) to explain the expected returns and performance of bond funds. These two research studies concluded that active funds do not outperform passive benchmarks. Detzler (1999) evaluated the performance of active global bond mutual funds and found no support of superior fund performance net of expenses against a wide range of benchmarks. Some papers used Capital Asset Pricing Model (CAPM) to evaluate the performance of bond funds. Such as Gallagher and Jarnecic (2002) who examined the investment performance of active Australian bond funds and the impact of investor fund flows on portfolio returns. Their paper evaluated the performance of actively managed Australian bond funds, using both unconditional and conditional performance evaluation techniques, and assessed the impact of flow on retail bond fund performances.

Only Morey and O'Neal (2006) examined the portfolio credit quality holding and daily return patterns for bond mutual funds. They found that bond funds on average hold significantly

more government bonds during disclosure than during non-disclosure. Chen *et al.* (2010) considered nine common factors and measured the timing ability and performance of bond mutual funds. They concluded that timing ability generates non-linearity in fund returns as a function of common factors, but there are several non-timing-related sources of non-linearity.

As mentioned above, we aim to look into the effectiveness of mutual fund industry risk management in Taiwan. Hence, the study empirically investigates the effect of the risk management through the ratio test, volatility test, and Quantile Regression Model.

The remainder of the paper is organized as follows. Section 2 takes a brief review of the copula function. Section 3 provides our empirical results. Section 4 is conclusion and remarks.

Brief Review of the Quantile Regression Model

We follow Shu *et al.* (2002) and use the panel data model to estimate the mutual fund performance, where the dependent variable is monthly inflows, outflows, or net inflows of each fund. To explain the relation between fund performance relations, we use several important variables as independent variables, include, fund size (Asset), management fee ratio (Fee), standard deviation of fund returns (Volatility) and the Sharpe_ratio. The regression model is as follows

$$Fund\_Performance_{i,t} = \beta_0 + \beta_1 Asset_{i,t} + \beta_2 Fee_{i,t} + \beta_3 Volatility_{i,t} + \beta_4 Sharpe\_index_{i,t} + e_{i,t} \quad (1)$$

As with any mean-based procedure, the ordinary regression model is sensitive to outliers. Although outliers are occasionally simply miscoded data, at other times missing variables lead to extreme values for the error terms. An obvious example in the case of house price models is remodelling, which is likely to produce an extremely high value for the error terms when it is not observed in the data set. The "quality" variable may also be the source of outliers, Koenker and Bassett (1978) originally proposed the quantile regression approach.

Unlike ordinary least squares, the target for quantile regression estimates is a parameter that is specified before estimation. Let q represent the target quantile. Also, let e_{it} be the residual implied by the econometric model. Quantile parameter estimates are the coefficients that minimize the following objective function:

$$\sum_{e_{it}>0} 2q|e_{it}| + \sum_{e_{it}\le 0} 2(1-q)|e_{it}| \quad (2)$$

At the median, q = 0.5, which implies that equal weight is given to positive and negative

residuals. At the 90th percentile, $2q = 1.8$ and $2(1-q) = 0.2$, which implies that more weight is given to positive residuals – observations with high values for the dependent variable, given the values of the explanatory variables. This result differs from ordinary least squares, in which the *sum* of the residuals equals zero and otherwise there is no constraint on the number of positive residuals.

Each of these studies presents estimated equations with the general form $y_i = \beta_q' x_u + u_{qi}$. Quantile effects have a straightforward missing variables interpretation that follows directly from the hedonic and repeat sales price index estimators.

Empirical Result Analysis

The dataset consists of bond funds that were issued in Taiwan. For the purpose of comparison, the sample period for the study covers ten years, from January 2001 to June 2010. Table 1 presents a total of 32 bond funds' name, their trading code, and their initiation date. The data were obtained from the Taiwan Economic Journal (TEJ) database.

Table 1: Basic descriptions of the bond funds

Code	Name of Bond Fund	Initiation Date	Code	Name of Bond Fund	Initiation Date
UI02	Union Bond	1999/9/30	DF02	The Forever Bond Fund	1996/10/15
TR02	Manulife Wan Li Bond Fund	1999/9/9	JF78	JF (Taiwan) First Bond Fund	1996/10/15
BR02	Primasia Paoyen Bond	1999/9/7	TS06	Shinkong Chi-Shin Fund	1996/9/3
TC18	IBT 1699 Bond Fund	1999/6/7	FP07	Fubon Chi-Hsiang Bond Fund	1996/6/14
CP12	PCA Well Pool Fund	1998/12/23	CA02	Capital Safe Income Bond Fund	1996/5/18
AP02	Manulife Wan Li Bond Fund	1998/11/5	ML04	Prudential Financial Bond Fund	1996/5/17
DS02	Truswell Bond Fund	1998/10/28	YC03	Hua Nan Phoenix Bond Fund	1996/2/6
AI03	PineBridge Taiwan Giant Fund	1998/9/7	CS03	Invesco ROC Bond Fund	1995/11/9
TC02	IBT Ta-Chong Bond Fund	1998/6/22	CI08	HSBC NTD Money Management Fund	1995/11/2
GC02	SinoPac Bond Fund	1998/6/19	IC27	ING Taiwan Bond Fund	1995/10/21
FH02	Fuh-Hwa Bond Fund	1998/5/28	KY02	Polaris De-Li Bond Fund	1995/9/21
JS02	Jih Sun Bond Fund	1997/10/3	PS04	UPAMC James Bond Fund	1995/6/16
NC10	NITC Taiwan Bond Fund	1997/3/7	JF75	JF Taiwan Bond	1995/6/15
YT08	Yuanta Wan-Tai Bond Fund	1997/2/19	NC06	NITC Bond	1994/4/12

TI03	TIIM Bond Fund	1997/2/13	TS01	ShinKong High Yield	1994/1/31
CI10	HSBC NTD Money Management Fund 2	1996/10/17	0008	ING Taiwan Income Fund	1991/12/6

Note: The code represents the bond fund's trading code, respectively.

As described above, this article investigates the effect of a bond segregation policy in Taiwan. The dataset hence consists of bond funds that were issued in Taiwan. For the purpose of comparison, the sample period for the study covers ten years, from January 2001 to June 2010, total of 32 bond funds. The data were obtained from the Taiwan Economic Journal (TEJ) database.

Table 2 reports the descriptive statistics of the average ratios of Fund performance, Asset, Fee and Volatility of bond fund. The Fund performance between 0.003% to 0.945% and the mean is 0.005%, which shows that the fund manager Operating performance of the overall bond fund is very different. We see the Asset is 0.233 (NT$ million) between 91,353(NT$ million), which means that the multivariate scale bond funds available to investors choose to invest funds. Here, the Fee is 0.194% between 0%, which explains that different bond funds use different cost mechanism to provide property investors choose funds. Whereas the Volatility is 0% between 0.721%, which means that the fund company issued a high-or low-risk fund, hoping to attract different investors. The Sharpe index is between 5.452% to -28.231%, and its mean is -3.626%, which explains that a great difference between the high and low indicators, Implied overall bond funds operating performance have a big gap, all of the Jarque-Berra (J-B) statistics reject the null hypotheses of normality distribution.

Table 2: Summary statistics of bond funds' performances

	Fund performance (%)	**Asset (NT$ million)**	**Fee (%)**	**Volatility (%)**	**Sharpe index (%)**
Mean	0.140	26,702	0.021	0.070	-3.626
Std	0.100	17,558	0.009	0.066	5.663
Max	0.945	91,353	0.194	0.721	5.452
Min	0.003	0.233	0.000	0.000	-28.231
Skewness	1.3069	0.617	2.479	3.164	-0.949
Kurtotsis	2.2206	2.702	54.290	20.861	0.078
J-B	1882.11***	2746.61***	475534***	76042***	578***

Note: P-value is the probability that the data come from the normal distribution, according to the Jarque -Berra normality test.

In order to test the long-run relationships and avoid the spurious regression among fund performance between asset, volatility, Management fee, Sharpe index. Based on the

results of the stationary test of variables in Table 3, it is abundantly clear that all the variables have stationary characteristics since the nulls of the unit root are mostly rejected. In other words, all variables were integrated of order one.

Table 3: Unit root test results

Fund performance	Level	P-value	Difference	P-value
Management fee	14.6313	0.2842	3.7103	0.000***
Asset	-1.6366	0.6218	-27.7635	0.000***
Volatility	-3.2813	0.1120	-8.2436	0.000***
Management fee	-31.346	0.9941	-44.8976	0.000***
Sharpe index	14.6313	0.4055	3.5516	0.000***

Table 4 we apply of nonlinear fixed effects models and random effects models above to observe the fund performance correlation between the Management fee, Asset, Volatility, Management fee, Sharpe index, respectively. From panel A and B, found that fund performance and volatility, management fee, Sharpe index as a positive significant relationship, but fund performance between Asset as a negative significant relationship. In comparison, the Coefficient between fund performance and volatility have the most positive significant relationship, implied bond fund performance depends on enhance risk investment.

Table 4: Estimated coefficients of fix effects and random results

	Panel A: Fix effect		Panel B: Random effect	
	Coefficient	p-value	Coefficient	p-value
Asset	-7.1383	1.1200 ***	-2.0923	6.6100 ***
Volatility	0.2234	1.0800 ***	0.2478	6.4600 ***
Management fee	0.0257	1.1500 ***	0.0148	6.4600 ***
Sharpe index	0.5956	0.0959 *	0.5334	0.0959 *

Note: The numbers in brackets indicate p-values. ***, **, and * indicate significance at the 0.01, 0.05 and 0.1 level.

Table 5 and Figure 1, we found that fund performance correlation between the management fee, volatility and management fee are all positively relationship in addition to asset. In comparison, there is positive correlations between fund performance and volatility, implies that risk factor compared to other variables affect the fund performance.

Table 5: The results of correlation coefficients

Fund performance	Asset	std	Sharp Index	Management fee	
1.0000	-0.2330	0.2564	0.1719	0.0543	Fund performance
	1.0000	-0.0604	0.3613	0.0036	asset
		1.0000	0.2676	-0.0107	std
			1.0000	0.0943	Sharpe Index
				1.0000	management_fee

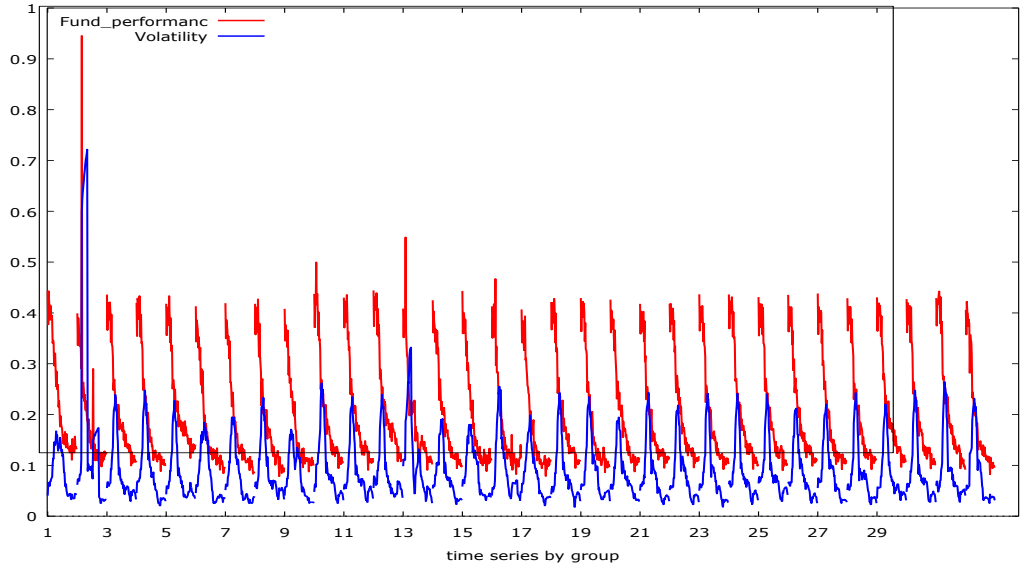

Figure 1: Fund performance versus volatility _all of bond funds

Table 6 reports a series of data can often contain a structural break, due to a change in policy or sudden shock to the economy. In order to test for a structural break, we use the Chow test, this is Chow' first test (the second test relates to predictions). The model in effect uses an F-test to determine whether a single regression is more efficient than two separate regressions involving splitting the data into two sub-samples.

We applied Chow test to formally test the structural change of fund performance during the period from January 2001 to June 2010. The results of chow test show that the trend of volatility of management fee significantly existed structure-break which peak on December 2005. It represents significant at 5% significance level through Chow test on Table 6. Especially bond funds necessary for the segregation policy was completed in December 2005, a great shock result in bond funds, fund changes in the market, because investors fear generated for bond funds lost confidence.

Table 6: The results of chow test

Chow statistics	Breakpoint:2005/12	
		P-value
F(5, 110)	57.7918	0.0000***
F(9, 110)	422.2407	0.0000***

Note: *** denotes significant at the 1% significance level.

Table 7 we also apply the Quantile Regression Model to observe the rank correlation between fund performance and asset, volatility, management fee, Sharpe index. We see the fund performance and asset as a negative significant relationship, volatility, fund performance and volatility, Sharpe index as a positive significant relationship (tau = 0.05, 0.25 0.50 0.75), but fund performance between volatility as a negative significant relationship (tau = 0.95), implied extreme values have been generated risk coefficient and fund performance change relations.

The extreme value of the display the risk coefficient fund performance has changed the relationship, said to enhance the risk coefficient, resulting in lower fund performance, tells us that the mutual fund industry operating the transition risks lever, the pursuit of short-term fund performance, but cannot afford a long-term test of the market.

Due to the mutual fund industry and cause the fund industry for the lack of risk management of liquidity risk, systemic risk, but also makes investors confidence collapse. We know that the nature of bond funds for the demands of a stable income and long-term business, not the demands of high-risk leveraged to meet the short-term fund performance, therefore, the mutual fund industry needs to strengthen risk management professional.

Table 7: Quantile regression model results

tau = 0.25, 0.50, 0.75, 0.95			
	Tau	**Coefficient**	**P-value**
Asset			
	0.25	-1.9051	0.0000***
	0.50	-3.6469	0.0000***
	0.75	-3.7863	0.0000***
	0.95	-2.3510	0.0000***
Volatility			
	0.25	0.4413	0.0000***
	0.50	0.5749	0.0000***
	0.75	0.3378	0.0000***
	0.95	**-0.3393**	0.0000***
Sharpe Index			

	0.25	0.0084	0.0000***
	0.50	0.0081	0.0000***
	0.75	0.0144	0.0000***
	0.95	0.0021	0.2253
Management fee			
	0.25	0.1230	0.1254
	0.50	0.1191	0.2534
	0.75	0.7736	0.2674
	0.95	0.3020	0.2315

Conclusion and Remarks

This article conducts an empirical investigation into the mutual fund industry risk management and performance Sustainability. We further Quantile Regression Model to obtain the rank correlation between these ratios and fund performance.

We apply the Quantile Regression Model to observe the rank correlation between fund performance and asset, volatility, management fee, Sharpe index. We see fund performance between volatility as a negative significant relationship (tau=.95), implied extreme values have been generated risk coefficient and fund performance change relations. The extreme value of the display the risk coefficient fund performance has changed the relationship, show that enhance the risk coefficient, resulting in lower fund performance, tells us that the mutual fund industry pursuit of short-term fund performance through operating the transition risks lever, but cannot afford a long-term test of the market. Due to the mutual fund industry lack of risk management and cause the fund industry for the liquidity risk, systemic risk, but also makes investors confidence collapse.

Finally, we know that the nature of bond funds for the demands of a stable income and long-term business, not the demands of high-risk leveraged to meet the short-term fund performance and recommends that the mutual fund industry needs to strengthen risk management professional and pursuit of performance Sustainability.

References

Akaike, H. (1974). A new look at the statistical model identification. IEEE Transactions on Automatic Control, 19(6): 716-723.

Blake, C., Elton, E. & Gruber, M. (1993). The performance of bond mutual funds, Journal of Business, 66(3): 371-403.

Chen, Y., Ferson, W. E. & Peters, H. (2010). Measuring the timing ability and performance of bond mutual funds, Journal of Financial Economics 98(1): 72-89.

Chiou, S. C. & Tsay, R. S. (2008). A copula-based approach to option pricing and risk assessment, Journal of Data Science, 6: 273-301.

Detzler, M. (1999). The performance of global bond mutual funds, Journal of Banking and

Finance, 23, 1195-1217.

Elton, E. J., Gruber, M. J. & Blake, C. R. (1995). Fundamental economic variables, expected returns, and bond fund performance, Journal of Finance, 50(4): 1229-1256.

Gallagher, D. R. & Jarnecic, E. (2002). The Performance of active Australian bond funds, Australian Journal of Management, 27(2): 163-185.

Hsu, C. C., Tseng, C. P. & Wang, Y. H. (2008). Dynamic hedging with futures: a copula-based GARCH model. Journal of Futures Markets, 28: 1095-1116.

Hu, L. (2006). Dependence patterns across financial markets: a mixed copula approach. Applied Financial Economics, 16(10): 717-729.

Hull, J. (2010). Risk management and financial institutions, 2nd Edition, Pearson Prentice Hall.

Joe, H. (1997). Multivariate models and dependence concepts, London: Chapman & Hall.

Junker, M., Szimayer, A. & Wagner, N. (2006). Nonlinear term structure dependence: copula functions, empirics, and risk implications. Journal of Banking and Finance, 30: 1171-1199.

Koenker, Roger & Gilbert, W. Bassett (1978). Regression Quantiles, Econometrica, 46: 33-50.

Morey, M. R. & Neal, E. S. (2006). Window dressing in bond mutual funds. Journal of Financial Research, 29(3): 325-347.

Manner, H. & Reznikova, O. (2009). Time-varying copulas: a survey, Universite catholique de Louvain, Institut de statistique, Mark, W. R., James, D. P., Paul, A. P. & Fran, X. (2001). Selecting a bond mutual fund: just keep it simple. Journal of Financial Planning, 14(4): 44-49.

Nelsen, R. B. (2006). Introduction to copulas, Springer Verlag, New York. 2nd Edition.

Palmon, O. & Jeffrey, P. (1991). Inflation uncertainty, real interest rate uncertainty and the liquidity premium on government bonds. The Financial Review, 26: 459-477.

Palaro, H. P. & Hotta, L. K. (2006). Using conditional copula to estimate value at risk, Journal of Data Science, 4: 93-115.

Rodriguez, J. C. (2007). Measuring financial contagion: a copula approach. Journal of Empirical Finance, 14(3): 401-423.

Schwarz, G. (1978). Estimating the dimension of a model. Annals of Statistics, 6: 461-464.

Shu, P. G., Yeh, Y. H. & Yamada, T. (2002). The behavior of Taiwan mutual fund investors—performance and fund flows. Pacific-Basin Finance Journal, 10: 583–600.

Sklar, A. (1959). Fonctions de repartition a n dimensions et leurs marges.