The pricing of China Region ETFs - an empirical analysis

Yao Zheng
University of New Orleans

Eric Osmer
University of New Orleans

ABSTRACT

Using a sample of exchange-traded funds (ETFs) that focus on investing in China Regions this paper investigates the effects of exchange rate, market performance, liquidity and fund size in the pricing of ETFs. Empirical results suggest that an appreciating exchange rate of the US dollar against the renminbi and better performance of the US stock market is associated with a lower discount for ETFs. For the liquidity measures, an increase in the Amihud illiquidity or trading infrequency is associated with a higher ETF discount; however, an increase in the turnover ratio is related to a lower ETF discount. The liquidity impact stays significant after controlling for aggregate and fund specific factors. Further, the larger the fund size the lower the discount.

Keywords: exchange-traded funds, liquidity, exchange rate, China, Amihud

INTRODUCTION

Exchange traded funds, or ETFs, have gained increasing popularity with investors over the last decade. They offer investors numerous benefits such as lower costs, trading flexibility, tax efficiency, transparency, and exposure to a variety of markets. Due to the fact that ETFs are traded on stock exchanges like stock, they closely reflect the performance of an underlying basket of securities. However, sometimes the prices of exchange-traded funds deviate from their net asset value, or NAV; therefore, a premium or discount occurs. ETFs trade at discounts when their prices are lower than the NAV. In contrast, ETFs trade at premiums when their prices are higher than the NAV. Thus, it is important to investigate the sources that contribute to the price deviations of ETFs.

In order to meet this purpose, this study aims to examine the factors that may contribute to discounts or premiums of ETFs. More specifically, this research focuses on China Region ETFs for the following reasons: there is a fast growing number of ETFs that focus on China due to high growth rates of the Chinese economy and emerging market diversification; the exchange rate of the renminbi has gone through considerable changes over the past several years and therefore managing exchange rate risk becomes important for investors. Empirical results suggest that the appreciating exchange rate of the US dollar against the renminbi and better performance of the US stock market is associated with a lower discount of ETFs. Additionally, liquidity and fund size also have significant influence in the pricing of ETFs. For liquidity measures, an increase in the Amihud illiquidity or trading infrequency is associated with a higher ETF discount; however, an increase in the turnover ratio is related to a lower ETF discount. Further, the larger the fund size the lower the discount.

LITERATURE REVIEW

There is a growing body of literature regarding both US and foreign ETFs. Engle and Sarkar (2002) study the discount and premiums attached to domestic and foreign ETFs. They find that domestic ETFs are associated with smaller premiums and discounts relative to international funds. Their results indicates that the pricing for domestic funds have more efficiency than international funds. Jares and Lavin (2004) document significant discounts for Asian ETFs. They find that fund returns are positively related with lagged deviations, which implies a lucrative trading strategy. In contrast Lin, Chan, and Hsu (2006) investigate Taiwan ETFs and find evidence of efficient pricing. Their results suggest that ETFs closely reflect the performance of the underlying stock make indices.

More recently, Delcoure and Zhong (2007) report significant premiums for ETFs after controlling for cost of transaction and differences in time-zones. Further analysis indicates that exchange rate volatility, financial and political crises, liquidity, trading activity and institutional holders are sources for these premiums. Ackert and Tian (2008) document new evidence about the discounts and premiums of US ETFs and country ETFs listed in the United States. They find that the US ETFs are closely priced to their NAVs of underlying assets; however, the country ETFs deviate from their NAVs. The significant and positive autocorrelations in those premiums can be explained by momentum, size and liquidity effect.

This inclusive evidence on the pricing of ETFs motivates this study to examine factors that might contribute to the discount or premium attached to ETFs. As stated earlier, the ETF sample studied in this paper is US ETFs focusing on China Regions (excluding Taiwan). Therefore, this paper analyzes the effects of changes in exchange rate of the US dollar against

the renminbi, the relative market performance, liquidity and fund size on the pricing of China Region ETFs. The basic intuition is follows: a change in exchange rate, such as a stronger dollar against the renminbi, might make ETFs focusing on China Regions less attractive to investors resulting in a higher discount; better US market performance will make China Region ETFs less preferable and thus resulting in a smaller discount; illiquid shares suffer higher trading costs and are forced to reduce their price in order to provide higher expected returns; smaller ETFs might have higher trading costs and be less liquid, hence having a higher discount.

DATA AND VARIABLES

This study focuses on how exchange rate, market performance, liquidity and fund size impact the pricing of exchange-traded funds. Particularly in terms of liquidity, three different measures are examined: Amihud illiquidity measure, turnover ratio measure and infrequent trading. This is to insure that all the different aspects of liquidity are captured.

The sample is constructed using all ETFs with a focus on mainland China. To be included in the sample, a fund must have daily price data, daily trading volume, shares outstanding and net asset value of underlying holdings. The sample includes 15 ETFs and spans from October, 2004 to December, 2011. Table 1 reports the sample ETFs and their respective fund families and inception dates. The oldest ETF included in our sample is iShares FTSE China 25 Index Fund, which inception is October, 2004. The newest ETF included in the sample is Global X China Materials ETF, which inception date is January, 2010. The sample of ETFs only includes ETFs with a focus in China[1] (Taiwan is not included).

The change in exchange rate of Renminbi to one US Dollar (RMB/USD) is calculated as monthly variations in the change of exchange rates.[2] Figure 1 plots the change of exchange rate (in percentage) between the renminbi and the US dollar over the 2004 to 2011 period. Figure 1 suggests that exchange rate may be one important reason for changes in the ETFs discount since exchange rate policy seems to be going through considerable changes over that period.

Next, the discount or premium is calculated as the difference between the NAV and the price of fund *i* on day *t* as listed by the equation below:

$$Discount_{it} = Price_{it} - NAV_{it}$$

If $Discount_{it}$ is negative, fund *i* is trading at a discount. If $Discount_{it}$ is positive, then fund *i* is trading at a premium. Daily discount or premium of the sample period is calculated first. After computing the daily discount for each China Region ETF, monthly discount is then computed as the average for each month. Figure 2 plots the average monthly China Region ETF's discount over the sample period. It is apparent from the plot that the China Region ETF's discount is shrinking over time, and in the later part of the sample China Region ETFs sometimes are traded at premiums. This is not too surprising given the fact that most China Region ETFs incept during the later sample period. This increasing number of ETFs may help with the price discovery process.

Additionally, we calculate the market performance measure, which reflects market-wide performance across two markets, measured as returns of the two cross market indices for the US

[1] ETFs with holdings in China A-share and Hong Kong H-shares are also included in the sample.

[2] The study also calculates the change of implied exchange rate using the implied exchange rate. It is similar to the change of exchange rate.

and China stock markets. These market performance measures are later included in our model to allow for the influence of market performance on the ETF discount. To this end, we use the return SSE Composite Index and S&P 500 Index for China and US stock markets, respectively. Figures 3 and 4 plot the returns of these two indexes from 2004 to 2011. As shown in the figures, the two indices experience ups and downs differently as well as differences in magnitude. Therefore it is necessary to analyze the impact of these movements on the discount or premium of China Region ETFs.

Next, the three liquidity measures are calculated: the Amihud illiquidity measure, the turnover ratios and the infrequency of trading measure. The Amihud (2002) measure of illiquidity is computed from the daily price and volume data. For each ETF in the sample, we begin by calculating the measure daily when there is trading. Then we average these measures for all the trading days of each month to get the monthly data:

$$Illiqudity_{i,t} = \frac{1}{Days_t} \sum_{d=1}^{Days_t} \frac{|R_{i,d}|}{Volume_{i,d}}$$

where $Days_t$ denotes the number of total trading days in month t, $R_{i,d}$ is fund i's return on day d, and $Volume_{i,d}$ denotes the fund i's trading volume on day d, calculated as the product of the price on day d times total number of shares traded on that day

Amihud illiquidity measures the price impact aspect of liquidity and identifies the effect of a given size trade on share price. Liquidity, also has another aspect – trading. To address this aspect, we include the turnover ratio as an additional measure for liquidity. The turnover ratio estimates trading activity of the stocks and is divided by total shares outstanding in the market. The monthly turnover ratio is computed by averaging daily turnover ratios *i* each month. The turnover ratios for ETFs are calculated as follow:

$$Turnover\ Ratio_{i,t} = \frac{1}{Days_t} \sum_{d=1}^{Days_t} \frac{Volume_{i,d}}{Outstanding_{i,d}}$$

where $Outstanding_{i,d}$ is the total fund i outstanding shares in the market on day *d*.

Furthermore, in some rare situations, some ETFs are very illiquid and there is no trading occurring at all during a trading day. In a way, this infrequency of trading is another facet of illiquidity. Therefore, the third liquidity measure is defined as zero trading activity days divided by the total number of trading days in the month.

Also included is the size of ETFs, which is calculated as the natural logarithm of market capitalization of an exchange-traded fund. In some cases, larger ETFs can offer lower fees than smaller ETFs. This paper hypothesizes that smaller ETFs that generally have higher trading costs, are more risky and are less liquid; therefore, investors will request greater discounts as compensation.

Table 2 provides summary statistics of these variables. The mean (median) of monthly discount of China Region ETFs is -0.1506 (-0.0018) with a standard deviation of 1.2994. This implies that on average, China Region ETFs are traded at a discount when one compares them to their net asset value. The mean (median) monthly change of exchange rate of Renminbi to one US Dollar (RMB/USD) is -0.02% (-0.01%), implying that on average the US dollar is depreciating over the sample period. The average monthly returns for the S&P 500 Index and

SSE Composite Index are 0.26% and -0.35%, respectively. This indicates that during the sample period, the US stock market is in general doing better than the Chinese stock market. This may partially contribute to the discounts associated with China Region ETFs.

Table 3 provides the correlation coefficients for discount, liquidity and fund size. Amihud illiquidity measure is negatively correlated with ETF discount, implying that the higher the illiquidity of the ETF the larger the discount of the fund. Similarly, the negative correlation between infrequency of trading and discount also confirms that less frequently traded ETFs are associated with a higher discount. In contrast, turnover ratio is positively correlated with discount, which means that the more active a fund trades the less the discount. Active trading helps with price discovery. Not surprisingly, Amihud illiquidity measure exhibits a positive correlation with infrequency of trading and a negative correlation with the turnover ratio. The fund size also shows a negatively correlation with the Amihud measure and infrequency of trading, implying that smaller ETFs tend to be less liquid. However, the correlation coefficient for fund size and turnover ratio is negative. This result is counter-intuitive. A possible reason is that some of the trading may come from excessive speculation or insider information. It also suggests that turnover is a noisy indicator of liquidity. Therefore, the initial analysis suggests that exchange rate, market performance, liquidity and fund size contribute to the discount attached to China Region ETFs. To obtain a clearer picture of these effects, a more in-depth analysis is performed in the next section.

METHODOLOGY AND EMPIRICAL RESULTS

In this section, a panel approach is used to examine the discount attached to China Region ETFs across time and funds are related to exchange rate, market return, liquidity effect, and size effect. More specifically, the following independent variables are used: the change in exchange rate of the US dollar to the renminbi, the return on S&P 500 composite index, the return on SSE composite index, natural log of the size of ETF, the Amihud illiquidity, the turnover ratio measure as well as trading infrequency measure. The full model of the regression is specified as follow:

$$ETF\_Discount_{it}=\beta_0+\beta_1\Delta Exchange\ Rate(^{RMB}/_{USD})_t+\beta_2 Return\ on\ S\&P500_t+\beta_3 Return\ on\ SSE_t$$

$$+\beta_4\ Log(Fund\ Size)_{it}+\beta_5 Amihud\ Illiquidity_{it}+\beta_6 Turnover\ Ratio_{it}+\beta_7\ Trading\ Infrequency_{it}+\varepsilon_{it}$$

Table 4 presents the analysis of using the above model to explain the pricing ETF with and without controlling for fund-specific fixed effects.[3] The positive coefficient suggests that the variable of interest has the effect of making the ETF discount smaller while the negative one suggest the opposite. The panel analysis first looks at aggregate effects such as changes in the exchange rate, stock market performances in both US and China, and then focuses on fund-level variables such as fund size and liquidity and effects. The regression results presented in Table 4 consist of 15 funds for the period of October, 2004 to December, 2011. The number of total observation is 578.

[3] The choice for using a fixed effects model is based on the results of the Hausman test. The Hausman specification test compares the fixed versus random effects under the null hypothesis that the individual effects are uncorrelated with the other regressors in the model. Based on the test results the null hypothesis is rejected; therefore, a random effects model produces biased estimators. So, a fixed effects model is preferred.

Model (1) indicates that the change of the exchange rate does in fact have a big impact on explaining the discount—about 40% of the variations of discount by itself. The influence of this variable retains its statistical and economic significance even after adding other factors. An increase in Δ*Exchange Rate (RMB/USD)* indicates that the US dollar is appreciating or the renminbi is depreciating. The coefficient of change in exchange rate is positive and significant, which indicates that a weaker renminbi against the US dollar is associated with a higher ETF discount. This may be due to a decrease in demand for RMB denominated Chinese security, which occurs when investors suspect or anticipate the renminbi values may go down. Therefore, a larger discount is needed to attract or compensate these investors.

Model (2) allows for market wide performance effects in extension to changes in exchange rates. The regression coefficient for return on S&P 500 index is positive and significantly related to the ETF discount. This implies that better market performance in the US stock market is associated with a smaller ETF discount. The coefficient for return on SSE composite index is insignificant and indicates that the China stock market performance has limited influence of the pricing of ETFs. Model (3) adds fund size as an explanatory variable. The positive coefficient indicates the larger the fund size, the smaller the ETF discount. This is consistent with larger ETFs generally having lower trading costs and less information asymmetry – resulting in a lower ETF discount. This may also be the result of investors viewing the smaller size of ETFs as being more risky and less liquid; therefore, investor will request a greater discount as compensation.

Models (4) adds liquidity factors and examines their impacts on the ETF discount. Model (4) looks at the Amihud illiquidity, which captures how liquidity impact price. The negative coefficient indicates that the higher the illiquidity of a fund, the more ETF is discounted relative to NAV. This is consistent with the economic intuition that an increase in the illiquidity requires more discount as compensation. This result remains robust as more explanatory variables are added to the model. We further examine the trading aspect of liquidity by adding a relative turnover ratio. Empirical results suggest that relatively active trading ETFs are associated with a smaller discount. This makes sense because investors require a higher discount for less actively traded ETFs since they are less liquid. As mentioned earlier, in some situations, ETFs are too illiquid and zero trading occurs. The study examines this aspect of illiquidity by including the trading infrequency measure as mentioned earlier. The negative coefficient of trading infrequency is statistically significant which suggest that the more infrequently ETF shares trade, the more discount investors will require. In sum, these results suggest that liquidity is important in the pricing of ETF shares.

Model (5) extends Model (4) by including the lagged one-period value of independent variables to control for potential endogeneity issues. The coefficients and the significance level obtained from this model are essentially the same with Model (4). Meanwhile, Models (6)-(10) are the regression result after controlling for fund specific fixed effects; these results closely reflect those of the pooled regression. Thus, the estimation results from this study are robust and provide support for the notion that exchange rate, market performance, liquidity and fund size affect the pricing of China Region ETFs.

CONCLUSION

Using a sample of 15 China Region ETFs, this study analyze the effects of exchange rate, market performance, and liquidity in pricing of exchange traded funds. Empirical results suggest that an appreciating exchange rate of the US dollar against the renminbi and better performance

of the US stock market is related with a smaller discount of ETFs. For the liquidity measures, an increase in the Amihud illiquidity or trading infrequency is associated with a higher ETF discount, while an increase in the turnover ratio measure is related to a lower ETF discount. The liquidity impact stays significant after controlling for aggregate and fund specific factors. Further, the larger the funds size the lower the discount.

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Table 1. List of China Region ETFs

Fund Name	Fund Family	Inception Date
iShares FTSE China 25 Index Fund	iShares	5-Oct-04
SPDR S&P China	State Street Global Advisors	19-Mar-07
PowerShares Golden Dragon China	PowerShares	9-Dec-04
Guggenheim China Small Cap	Guggenheim Investments	30-Jan-08
Global X China Consumer ETF	Global X Funds	1-Dec-09
Guggenheim China All-Cap	Guggenheim Investments	19-Oct-09
Guggenheim China Technology	Guggenheim Investments	8-Dec-09
Guggenheim China Real Estate	Guggenheim Investments	18-Dec-07
Market Vectors China ETF	Van Eck	13-Oct-10
iShares MSCI China Small Cap Index	iShares	28-Sep-10
Global X China Financials ETF	Global X Funds	11-Dec-09
Global X China Energy ETF	Global X Funds	16-Dec-09
Global X China Industrials ETF	Global X Funds	1-Dec-09
Global X NASDAQ China Technology ETF	Global X Funds	9-Dec-09
Global X China Materials ETF	Global X Funds	14-Jan-10

Table 2. Summary Statistics

	Mean	Median	Std.DeV	Minimum	Maximum
Discount/Premium	-0.1506	-0.0018	1.2994	-6.6091	5.9960
Δ Exchange Rate (RMB/USD)	-0.0002	-0.0001	0.0002	-0.0010	0.0002
Return on S&P 500	0.0026	0.0078	0.0504	-0.1694	0.1077
Return on SSE	-0.0035	0.0837	-0.0043	-0.2463	0.2744
Amihud Illiquidity Measure	0.0395	0.0379	0.0222	0.0000	0.1172
Turnover Ratio	0.0035	0.0006	0.0081	0.0000	0.0609
Infrequency of Trading	0.0024	0.0000	0.0167	0.0000	0.1905
Log (Fund Size)	15.0837	14.8517	2.5897	9.9074	21.3118

Table 3. Correlations between Discount, Liquidity, and Fund Size

	Discount/Premium	Amihud Illiquidity Measure	Turnover Ratio	Infrequency of Trading	Log (Fund Size)
Discount/Premium	1.0000	-0.1358	0.2342	-0.0466	0.2039
Amihud Illiquidity Measure		1.0000	-0.0667	0.2657	-0.4786
Turnover Ratio			1.0000	-0.2162	-0.7790
Infrequency of Trading				1.0000	-0.0456
Log (Fund Size)					1.0000

Table 4. Relationship between the China Region ETFs discounts, Exchange Rates, Market Performance, Liquidity, and Size

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)
Constant	-0.08**	-0.06**	2.96**	4.54*	4.76*	0.27**	0.27**	-1.67**	-1.57*	-1.38*
	(0.08)	(0.08)	(0.32)	(0.50)	(0.53)	(0.26)	(0.26)	(0.58)	(0.56)	(0.91)
Δ Exchange Rate	0.41***	0.61***	0.60***	0.86***	0.98***	0.60***	0.71***	0.77***	0.75***	0.93***
	(0.27)	(0.28)	(0.26)	(0.25)	(0.28)	(0.19)	(0.19)	(0.19)	(0.20)	(0.23)
Return on S&P 500		3.46***	3.17***	2.60***	3.12***		2.61***	2.33***	2.31***	2.78***
		(1.34)	(1.23)	(1.17)	(1.30)		(0.93)	(0.91)	(0.91)	(1.02)
Return on SSE		-1.76	-1.11	-0.89	-1.07		-0.89	-0.85	-0.87	-0.87
		(0.81)	(0.75)	(0.72)	(0.76)		(0.57)	(0.56)	(0.56)	(0.60)
Log (Fund Size)			0.46**	0.59**	0.56**			0.36**	0.35**	0.34**
			(0.05)	(0.06)	(0.23)			(0.08)	(0.11)	(0.19)
Amihud Illiquidity				-17.41***	-9.58***				-8.88***	-4.99***
				(3.03)	(8.09)				(5.07)	(15.21)
Turnover Ratio				11.73**	12.63**				9.20*	8.69*
				(7.46)	(10.68)				(8.51)	(9.98)
Infrequency of Trading				-4.65***	-3.77***				-0.80***	-2.65***
				(3.20)	(4.01)				(3.24)	(3.63)
Fund Specific Fixed Effects	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	578	578	578	552	486	536	536	536	536	466
R-square	0.40	0.43	0.52	0.60	0.68	0.65	0.69	0.78	0.81	0.84

*, **, *** denoting the 10%, 5% and 1% significance levels

Figure 1. Change in Exchange Rate

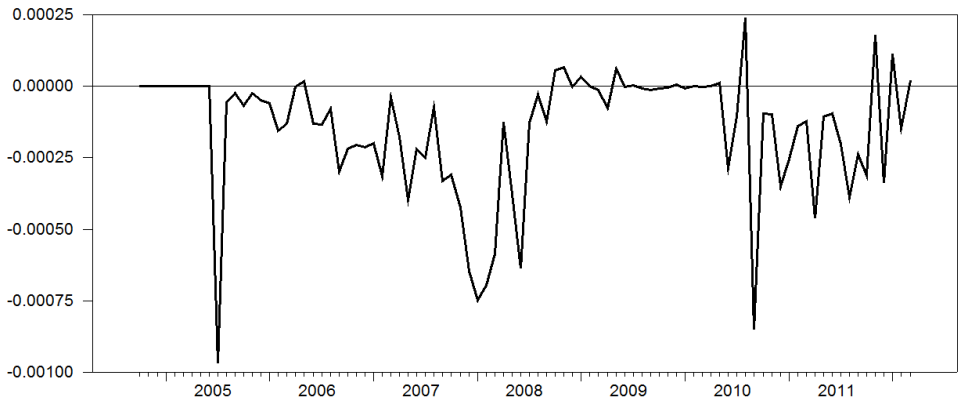

Figure 2. Average Discount for China Region ETFs as Percentage of NAV

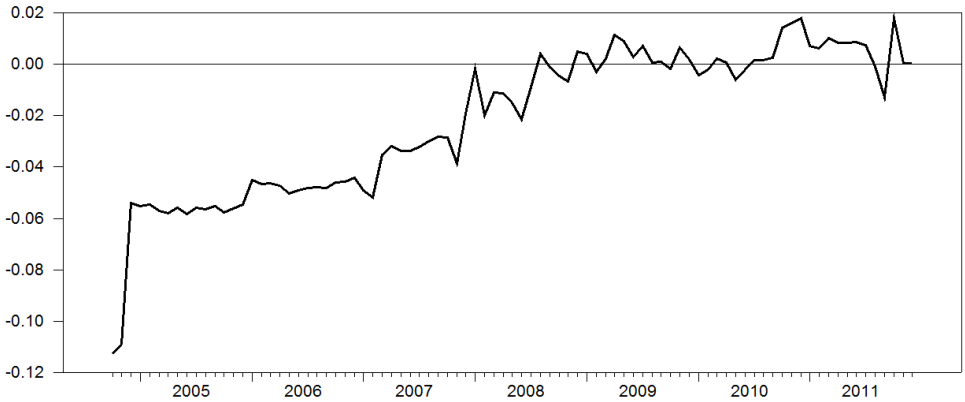

Figure 3. Return on S&P 500 Composite Index

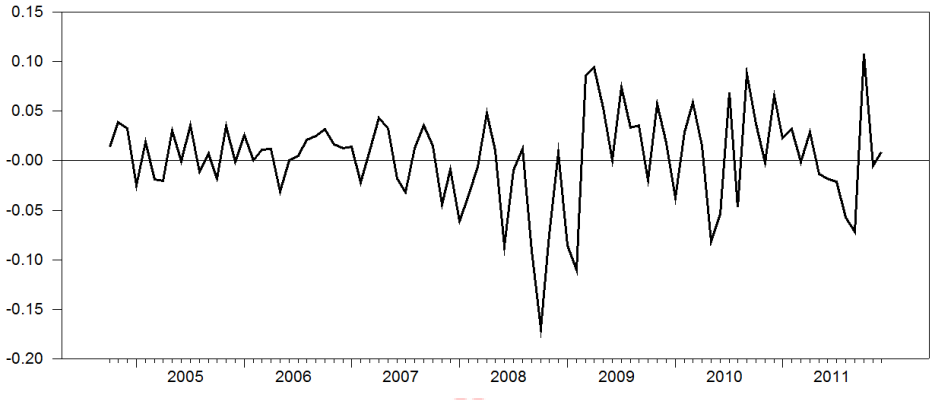

Figure 4. Return on SSE Composite Index