Volatility Timing in ETFs: Evidence From Hong Kong Market

by

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Abstract

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This paper tests the significance of volatility timing skills in Hong Kong ETFs market. The historical data on thirty-nine ETFs are collected through 2000 to 2012. To study the existence of volatility timing in different periods, this paper separates the dataset into two parts by the year of 2010. The results show that only two funds confirm the existence volatility timing, although one of the coefficient is small. Other funds even keep expanding their market exposure when market volatility increases. In both time periods (before and after 2010), volatility timing does not significantly exist in majority of the funds.

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Chapter 1 ：Introduction

1.1 Purpose of Study

As an important product of financial innovations, exchange-traded fund (ETFs) combined the advantages of traditional mutual funds and provided investors with a new conduit for financial market and a new instrument for investment. As was born and developed for years, the coverage of ETFs has been well expanded from pure index funds to commodity funds. Furthermore, many aggressive trading strategies which includes swap, short selling and leverage, are employed to guarantee the returns or hedge investment position.

Due to the similarity of the hedging strategy between ETFs and Collateralized Debt Obligations(CDOs), many concerns raised, especially after the occurrence of subprime crisis. Rubino (2011) maintains that the steps of financial innovation is always faster than those of regulations. In spite of the debate about whether derivatives, such as CDS, should be used as risk management tools, the trading skills of fund managers are the trigger events of the potential crisis. Specifically, the value of CDOs is primarily based on property price, so CDOs will be in danger when property price falls down. Similarly, the earning position of ETFs is the trigger event because majority of ETFs promise a certain amount of profit during marketing. Therefore, when ETFs have serious loss in wide scale, the system will be in danger too. By testing the existence of timing skills of funding managers', this paper will test the volatility timing skills of managers' of ETFs traded in Hong Kong markets.

1.2 Background: Hong Kong market and ETFs

As the seventh largest stock exchange, Hong Kong Stock exchange owns 2.3 trillion by market capitalization. In Hong Kong Stock Exchange, there are more than 90 ETFs traded with a wide range of coverage, including Chinese mainland, Russia, India and other emerging markets. According to SEC Release(2008), ETFs have been available in the US and in Europe since 1993 and 1999 respectively. The market value of ETFs in U.S. market has surged to 882 billion with more than 900 funds(ETFDB, 2012). ETFs is one of the most popular financial products and increasingly growing globally.

1.3 Outline of the Paper

The first part of this paper is a brief introduction of the research purpose ,and it outlines the potential risk of ETFs and the importance of Hong Kong financial market. The second chapter is the literature review and in this part, the logic inside of ETFs will introduced in detail; the Modern Portfolio Theory (MPT) will be reviewed. The third part is the methodology and data employed in this paper. The hypotheses and underlying assumptions will also be introduced. The fourth chapter is the analysis of results.

Chapter 2: Literature Review

2.1 Logic of ETFs

From the perspective of structure, ETFs are basically open-end funds which means the investors can add or redeem from the fund at the NAV (net asset value). However, the investors of ETFs who can enjoy redemption policy are specified, called authorized participants, and these investors are normally large financial institutions.

When it comes to the liquidity issue, ETFs' liquidity have two main sources. Firstly , the authorized participants could redeem their funds in cash or shares from the fund. Another liquidity source is from the market. Like close-end funds, ETFs can be traded in the secondary markets and the trading methodology is the same as that of a normal stock. Therefore, investors could trade shares in secondary market with the share price fluctuating around NAV. Because of the liquidity, an arbitrage opportunity exists in the ETFs' trading strategy that allowing investors to liquidate their shares of ETFs in secondary market instead of redeeming them from the investment companies when the share price of ETF is higher than the NAV and vice versa. Therefore, the value of ETFs is determined by the two sources reflecting the features of open-end fund and close-end fund.

However, a major concern is whether or not EFTs will be the next CDOs? Rubino (2011) expressed his concern about ETFs. With the development of ETFs, a wide range of trading strategies are used, such as short selling, swap and leverage. For instance, some exchange-traded funds focus on replicating the performance of a certain index, and so the ETFs' performance relative to the index plays an important role. To hedge the performance of ETFs, many fund managers are using credit default swaps (CDS) to hedge positions. Theoretically, this trading strategy is an ideal plan protecting the benefits realized by investment companies and investors, but the "efficiency" of modern financial market will not bear the sacrifice of illiquidity. As one of the largest exchange market, Hong Kong Stock Exchange should well regulate the ETFs fund trading strategies and the managers' in charge.

2.2 The Development and Limitations of the Modern Portfolio Theory

Markowitz (1952) put forward the Modern Portfolio Theory (MPT). The principle of a efficient portfolio in MPT is that given a risk level, the return must be highest among the rational options; given the a return level, the risk a portfolio exposes to must be lowest among the rational options. MPT is the first theory provides a framework of portfolio evaluation methodology, and numerous searches later are basically expansion of MPT.

In 1966, Sharpe took risk free asset into MPT and derived the capital market line

(CML) and security market line (SML) by assuming a full access of all potential investment asset and a numeric measure risk tolerance. In 1960s, based on the degree of diversification of portfolio, Terynor issued the Treynor performance Index that assumed the portfolio is well diversified and exposes only to systematic risk (β); Sharpe issued the Sharpe Performance Index that assumed the portfolio is not well diversified and exposes to systematic risk and unsystematic risk (σ). Jensen (1968) develop the Jensen's Alpha performance index based on CAPM.

Some limitations still exist in these evaluation methods. For instance, the underlying assumptions are too strong to achieve and well diversification is hard to achieve; the test on these methods are hard to compliment, because variables are basically not normal distributed; these methods cannot identify the source of return by fund managers' timing skills.

2.3 Traditional Models of Timing Skills

Numerous issues exist in or out stock market, and those issues could directly or indirectly impact on the performance of portfolios. Therefore, it is different to build a model to capture all potential elements to measure or forecast the performance of a portfolio. In reality, the return of a portfolio is directly from the trading process of fund managers, and the daily trading of managers based on their own understanding of market is assumed to cover all relevant issues. So it is meaningful to take managers' trading skills into consideration when we try to study the performance of portfolios.

A popular evaluation method of funds managers' timing skills are the market timing skills. Market timing theory, by Treynor and Mazuy (1966), refers that expected market return is an key of the market timing that when the expected market return is high, rational investors should move into the market and invest in risky asset; when the expected return is low, rational investors should move out of the market or invest in risk free assets. Therefore, funds can obtain abnormal returns by balancing the weight of different components in time and the accuracy of managers' market forecasting is vital in this evaluation system.

In Treynor & Mazuy (T-M) Model, the square of excess market return is introduced into the traditional capital pricing model to capture fund managers' market timing skills. Fama (1972) categorized fund managers' trading skills and defined them. He pointed of out that there two forecasting abilities are Microforecasting which focuses on the change of a certain stock relative to change of others or stock selectivity, and Macroforecasting which focuses on the change of a certain stock relative to the trend of whole market or market timing. Then researchers focused much on timing skills. Merton (1981) put forward a model to compare the performance of stock market and bond market, but he did not get into detail about measuring the abnormal return.In 1981, Herikisson and Merton, who completed Merton's model, used another model to capture and measure the market timing. In 1984, Henriksson and Merton researched 116 U.S. open-end funds for 12 years, based on months data, but they did not get a significant result to prove the existence of market timing. Other researches by Veit and Cheney (1982) and Kon (1983) also supported the result of Merton's.

In 1984, Chang and Lewellen chose 67 U.S. mutual funds as data sample and the results showed no good stock selectivity and no market timing existed. However, C-L model tried to analyzed funds in different market conditions, and this innovation granted inspiration to the study. In a long time period, researchers focus on market timing, but the results of research could not give a significant result.

In 1990s, the focus of researches started turning to volatility timing. Volatility timing, similar to the dynamics of market timing, is another evaluation method that treats expected return volatility as the investment signal. After the research of Engle in 1982, Bollerslev, Chou and Kroner (1992) did research on forecasting volatility and they found market volatility has the characteristic of cluster and persistence. So they came to the conclusion that the expected volatility could be forecasted from historically data, for example based on estimation windows with a certain length of timing period. Compared to marketing timing, the forecasting volatility is more feasible and realistic, based on numerous econometrical model, on forecasting return.

Researches done by Glosten, Jagannathan and Runkle (1993) and by Whithlaw (2000) show that there is no significant positive correlation between conditional market return and conditional market volatility. Based on those result, fund managers could decrease their market exposure when market volatility increases. Briefly, when the expected volatility is high, market may involve relatively higher risk and investors should move out of the risky assets and vice versa.

Busse (1999) pointed out the volatility timing is derived from fund managers' market judgment. He derived that by the increase of market volatility, the Beta of a portfolio will decrease, and this relationship could be expressed into a linear function. Busse concluded that with data of daily return of mutual funds, the result shows volatility timing could effectively increase the adjusted performance ratio by maintaining the level return and decreasing the market exposure. In addition, the level of abnormal return also significantly promoted. Moreover, the study of Busse was a template of condition analysis, and his idea give a important hit to further study.

However, there are some limitations in Busse's model: firstly, the risks of portfolios may be just from the market, and other risks, such as interest rate, policy changes, relevant events, etc.; second, the Beta of a portfolio may automatically fluctuate by the change of market condition, but volatility timing is a process of artificially adjusting. So when a fixed Beta is used to test the existence of volatility timing, the result may be biased. Therefore, a more accurate Beta, which can could efficiently replicate the real Beta is needed to make sure the reliability of testing results; third, the market timing and volatility timing are not well clarified in this model.

2.4 Recent Studies on Volatility Timing

Johannes, Polson and Stroud (2000) compared the performance of market timing strategy and volatility timing strategy by using S&P 500 index data from 1980 to 2000. They concluded that volatility timing strategy has a better performance because market volatility could be more reliably forecasted and is immune to the process of risk estimation. Moreover, they pointed out that market timing strategy does not have significant economic value due to the numerous bias in process of return estimation.

In 2000, Fleming, Korby, Ostdiek had a research on the economic value of volatility timing based on a short-term volatility estimation by using S&P 500 index future.

Their research shows the short term volatility estimation has a good performance as the signal of volatility timing strategy.

Cao (2011) used Busee model test the volatility timing skills of hedge funds managers in emerging market by using CSIDM Hedge Fund Index. The result does not indicate a significance of volatility timing skills. The only region shows a significant result is Eastern European, and so Cao concludes that hedge fund managers does not possess or using volatility timing as a trading methodology.

According to the former researches, it is clear that volatility timing and market timing both have tight relationship with changes of market trend. However, the traditional models do not try to discuss volatility timing skills from the perspective of estimation windows and the forecasting power of estimation window. Moreover, the data used in researches are mutual funds and hedge funds, and ETFs are seldom used as the data sample. Therefore, a research about the significance of fund managers' trading skills in ETFs is necessary for investors and the whole market to have a better understanding of the industry.

2.5 Objectives

According to previous researches, the importance of timing skills is widely confirmed. Researchers tried to test volatility timing mainly in U.S. mutual fund market and derivative market, but the researches in Hong Kong market is rarely undertaken. Therefore, the main objectives of this paper are to test the existence of volatility timing in Hong Kong Market. Specifically, the tests could be made in different time periods, based on different risk estimators.

Chapter 3: Methodology and Data

3.1 Model

This model employed in the paper is modified Busse (1999) model.

$$R_{pt} = \alpha_p + \beta_{1mp}R_{mt} + \gamma_{mp}(\sigma_{mt} - \overline{\sigma}_m)R_{mt} + \beta_{2mp}R_{mt}^2 + \varepsilon_{pt}$$

R_{pt}: the daily excess return of fund. This variable is calculated by subtracting daily risk free rate from the daily return of a fund. Because the quotas of funds are collected, the daily risk free rate is collected and matched with funds based on their dates.

α_p= abnormal return of funds. With a certain level of market exposure, the theoretical return could be measured by CAMP. However, the performance of a fund in reality is not exactly equal to its theoretical estimation. Specifically, when the estimation is higher than the virtual performance, the fund will has a positive abnormal return and vice versa. Therefore this constant represents the quality of funds .

β_{1mp}= the beta of funds, shows the relationship between portfolio and market. This coefficient represents the sensitivity of fund to the market movement.

R_{mt}= the daily excess return of market. This variable is computed by market daily return minus daily risk free rate.

σ_{mt}= market volatility. It is the standard deviation of market returns in previous trading days. In the data set, this variable is estimated by four estimation windows. The estimation windows are the all short-term, which are 10-day, 30-day, 60-day and 90-day.

$\overline{\sigma}_m$= average market volatility. This variable is used to measure the average market volatility level in the period of collected quota. Average market volatility acts as a benchmark to indicate current market volatility level by being compared with short-term market volatility.

γ_{mp}= volatility timing estimator. This coefficient is the primary indicator of existence of volatility timing. By using market volatility and average market volatility, fund managers could define market volatility status. In detail, when market volatility is higher than average market volatility, the market should be in a high volatility period, so funds manager should transfer capital from high volatility market to low volatility market, based on volatility timing theory. Therefore, a significantly positive coefficient explains a good volatility timing in ETFs and vice versa.

β_{2mp}= Market timing estimator. This coefficient captured the market timing skills of fund managers'. A significantly positive result will refer a good market timing skill.

ε_{pt}= error term, capturing the effect of other elements those are not employed in regression function.

3.2 Data Source

As a market capitalization weighted index, the Hang Seng Index (HSI) is the primary estimator of daily market estimation in Hong Kong. HSI covers 70% market scale by market capitalization. Therefore, the daily return of HSI is employed as the market return. The Historical daily closing quotas of HSI from Jan 1st 2000 to July 26th 2012 are collected form Bloomberg Terminal. There 40 ETFs are collected as the data sample. Those ETFs are all registered in Hong Kong market and Traded in Hong Kong Dollar, so they are effective representatives for the performance of ETFs in Hong Kong market. Similarly, the data of these funds are collects from Bloomberg Terminal with the same time period as market quota.

3.3 Hypotheses

H_{01}: The volatility timing skills do exist in Hong Kong ETFs market. To make this test, all historical data of ETFs will be treated as whole. By regression analysis, the p-value of volatility captured the significance of volatility timing skills, then the coefficient of this variable is going to show the quality of volatility timing.

H_{02}: The volatility timing skills exist in Hong Kong ETFs market.

H_{03}: The volatility timing skills exist in Hong Kong ETFs market before 2010.

H_{04}: The volatility timing skills exist in Hong Kong ETFs market after 2010.

The reason why 2010 is chosen as the boundary of two test is since the occurence of subprime crisis, the effect of crisis generally decreased and the effect is negligible after 2010. Moreover, the similarity of hedging strategies between CDOs and ETFs raises an question that whether ETFs managers started taking the trading process seriously.

Chapter 4: Results Analysis

4.1 Data Overview

According to table 1, there are nearly 35 thousand data points in the data set. The average excess return of fund and market are both positive with high volatility. This feature shows that both market and ETFs have good performance in the collected time period. Compared with the average performance of funds and market, the volatility levels are high however, so this relationship might indicates the potential timing skill. Mainly, the testing results are based on $\gamma_{mp}$the coefficient of $(\sigma_{mt} - \overline{\sigma}_m)R_{mt}$. So, in the regression model, the function $(\sigma_{mt} - \overline{\sigma}_m)R_{mt}$ is named as key variable. In the key variable, the market volatility could be calculated by four different estimation windows, so there is a suffix after the key variable to indicate its estimation method.

Table 1. Data Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
exfr	34760	.0001344	.0193992	-.32	.514085
exmr	34718	.0000508	.0144414	-.270494	.2718099
key10	34213	.0000111	.0062049	-.5001152	.3432945
key30	34227	-7.67e-06	.0041589	-.2384817	.1627575
key60	34227	-6.29e-06	.0032785	-.1482651	.0981806
key90	34227	-7.50e-07	.0027763	-.1110996	.0717075

In table2, the correlation of different main variables are well computed. In the regression, the excess return of fund, as the depend variable, will repeatedly regress with other five explanatory variables. First of all, the multicollinearity issue will be a concern. Specifically, when the explanatory variables are tightly related, the Ordinary Least Square (OLS) is still the best estimator with the lowest error; however, the coefficients of explanatory variables will not be able to effectively explain their impact on dependent variable. Therefore, following table 2 a series of collinearity diagnostics undertake between excess market return and key variables.

Table 2. Correlation Matrix

	exfr	exmr	key10	key30	key60	key90
exfr	1.0000					
exmr	0.6152	1.0000				
key10	0.4009	0.5432	1.0000			
key30	0.4014	0.5489	0.9042	1.0000		
key60	0.3839	0.5550	0.8157	0.9375	1.0000	
key90	0.3645	0.5358	0.7585	0.8827	0.9712	1.0000

As is shown in table 3, Variance Inflation Factor (VIF) is used to test to multicollinearity issue. The function for VIF is:

$$\mathrm{VIF} = \frac{1}{1 - \mathrm{R}^2}$$

When VIF is lower than 10, the collinearity between explanatory variables will not have serious impacts on the regression and test result. Here, the VIF level between explanatory variables are all lower than two. Therefore, the multilinearity issue is not a concern.

Table 3. Collinearity Diagnostics

Variable	VIF	SQRT VIF	Tolerance	R-Squared
exmr	1.43	1.20	0.7001	0.2999
key10	1.44	1.20	0.6967	0.3033
exmr2	1.01	1.01	0.9876	0.0124
Mean VIF	1.29			

Variable	VIF	SQRT VIF	Tolerance	R-Squared
exmr	1.43	1.20	0.6974	0.3026
key30	1.43	1.20	0.6978	0.3022
exmr2	1.00	1.00	0.9978	0.0022
Mean VIF	1.29			

Variable	VIF	SQRT VIF	Tolerance	R-Squared
exmr	1.45	1.20	0.6910	0.3090
key60	1.45	1.20	0.6915	0.3085
exmr2	1.00	1.00	0.9986	0.0014
Mean VIF	1.30			

Variable	VIF	SQRT VIF	Tolerance	R-Squared
exmr	1.40	1.18	0.7123	0.2877
key90	1.40	1.18	0.7128	0.2872
exmr2	1.00	1.00	0.9990	0.0010
Mean VIF	1.27			

4.2 Regression Results

(1) PLS Regression

A raw regression is undertaken to test the significance of volatility timing. Specifically, instead of testing each fund one by one, this Panel Least Square (PLS) method treats all historical quotas as a whole to drive out the overall effect of volatility timing. According to table 4, excess market return significantly influences fund performance at 1% critical level for all four volatility estimation windows with a positive coefficient. This result shows that when market volatility increases, the market exposure of ETFs increase. However, according to volatility timing theory, when the market volatility increases, funds manager should relocate investment capitals into a market with low volatility and decrease market exposure. Therefore, the result shows that volatility timing skills do not exist in Hong Kong ETFs market. The reasons for this position are: the fund industry generally has its own judgment on the movement of market, instead of tightly following market tendency; funds have their own trading strategies, so the market volatility status is just one of numerous market condition indicators. In contrary, market volatility timing indicator has a positive coefficient for all four regression that means ETF managers have good market timing skill; however, all of them are not significant. All in all, this PLS regression test rejects the first hypothesis that the volatility timing exists in Hong Kong ETFs market.

Table 4. Raw Regression

VARIABLES	exfr	exfr	exfr	exfr
exmr	0.756***	0.757***	0.778***	0.789***
	-42.29	-47.83	-52.73	-56.21
exmr2	0.205	0.281	0.303	0.312
	-0.665	-0.925	-0.993	-1.014
key10	0.291***			
	-2.921			
key30		0.422***		
		-3.499		
key60			0.360***	
			-2.716	
key90				0.340**
				-2.473
Constant	6.04E-05	4.99E-05	4.32E-05	3.87E-05
	-0.641	-0.537	-0.463	-0.414
Observations	34,213	34,227	34,227	34,227
R-squared	0.385	0.385	0.382	0.381

(2) OLS regression

The previous PLS regression treats historical quotas as a whole, while the OLS estimator will analyze the fund performance one by one to evaluate the effect of volatility timing skills. The following tables, table 6 to table 9, are the regression results. Each table use one of the four volatility estimation windows(10-day, 30-day, 60-day, 90-day).

Table 5 is a brief summary of regression results. The results show that more than the market volatility has significant effect on more than 80% funds. Specifically, fund managers will take actions when market volatility changes. There is not big difference between different volatility estimation windows. However, to find out whether fund managers take actions by using volatility timing strategies, the signs of coefficients of key variables are going to tell.

Table 5. Results Summary

	key10	key30	key60	key90
1%	27	31	31	30
5%	5	3	2	3
10%	0	0	1	2
insignificant	7	5	6	4
cumulative	39	39	39	39

Table 6 gives a further summary about the sign of key variables. According to regress results, funds No. 4 and 32 have significant negative coefficients. Their coefficients explain that when market volatility increases, the market exposure of funds decreases. However, the coefficient of fund No.4 is relatively low. It refers that the manager of this fund has volatility timing skills, but the relevant actions are not effective decrease the market exposure of funds. As the same time, fund No.32 has a high coefficient. Therefore, it concludes that the fund manager take serious actions when market volatility changes; these actions effectively decrease the market exposure of this fund.

Table 6. Two-fund with Negative Coefficient

	id=4	id=32
key10	-0.296	-2.007
key30	-0.557	-3.396
key60	-0.784	-4.994
key90	-0.966	-6.886

4.3 Before and After 2010

To study the significance of volatility timing before and after subprime crisis, the data set is separated into two part by the date of January 1st 2010. Based on the data before 2010,the raw regression is undertaken, and the table 10 summarizes the results below.

Table 11. Raw Regression Before 2010

VARIABLES	exfr	exfr	exfr	exfr
exmr	0.355***	0.370***	0.396***	0.407***
	(4.412)	(5.011)	(5.122)	(4.935)
exmr2	-0.0421***	-0.0354***	-0.0348***	-0.0362***
	(-3.718)	(-3.302)	(-3.347)	(-3.723)
key10	0.00514***			
	(5.383)			
key30		0.00925***		
		(10.21)		
key60			0.0115***	
			(11.17)	
key90				0.0117***
				(6.358)
Constant	0.000488***	0.000560***	0.000558***	0.000526***
	(3.204)	(3.887)	(3.882)	(3.614)
Observations	12,365	12,365	12,365	12,365
R-squared	0.549	0.597	0.588	0.553

As is shown in table10, all key variables have positive significant coefficient at 1% critical level. It indicates that all ETF managers did not employed volatility timing strategy before 2010. In contrary, when the market volatility increases, the market exposure increases, in the other word, funds are exposed to higher risky.

In the following tables, funds are regressed one by one to drive out the effect of volatility timing, based on different volatility estimation windows. The tables explain that in first regression model with 10-day volatility estimation window, only funds No. 3 and 5 have significant negative coefficients. However, their coefficients are so low that their effect are economically negligible. For other regressions, no more key variable has significant and negative sign. Therefore, it is rational to conclude that volatility timing skills did not exist in Hong Kong ETFs market before 2010.

Similarly, a series of empirical study will are undertaken to analyze the existence of volatility timing skills in Hong Kong ETFs market after 2010. Firstly, all historical data are treated as a whole. According to table 5, volatility estimation with long-term windows (60-day and 90-day) have significant effect on the excess return of market. However, neither of them own negative coefficient, so volatility timing skills do not exist in Hong Kong market in this period when historical data is treated as a whole.

Table 16. PLS after 2010

VARIABLES	exfr	exfr	exfr	exfr
exmr	0.434***	0.448***	0.442***	0.454***
	(6.100)	(5.625)	(5.865)	(5.999)
exmr2	-0.139***	-0.138***	-0.138***	-0.140***
	(-5.304)	(-4.447)	(-5.338)	(-5.349)
key10	0.00882			
	(1.268)			
key30		0.00671		
		(0.842)		
key60			0.0165***	
			(2.737)	
key90				0.0137**
				(1.975)
Constant	-8.79e-05	-6.79e-05	-8.70e-05	-9.71e-05
	(-1.384)	(-0.993)	(-1.198)	(-1.210)
Observations	21,771	21,785	21,785	21,785
R-squared	0.505	0.480	0.494	0.482

Then, each fund is regressed with OLS to find out the existence of volatility timing skills. Based on the regression results in table 15 to 18, it summarizes that in spite of fund No.20 in 10-day volatility estimation regression model, no fund has a significant and negative coefficient. Moreover, fund No.20 owns a very small coefficient, so its volatility timing effect is negligible. Therefore, It states that volatility timing is not widely used as a trading strategy.

Chapter 5: Conclusion

As a new born financial product, ETF plays an increasingly important role in financial market. Due to the occurrence of subprime crisis and the similarity between ETFs and CDOs in hedging strategy, this paper focuses on the trading abilities of fund managers. The paper separates the dataset into two parts to study the volatility timing before and after 2010 in ETFs. In addition, three different estimation window are employed into regression models. The regression result show that few funds in dataset has a statistically significant coefficient to prove the existence of volatility timing. When regressions are undertaken in two separated dataset, the similar results show that volatility timing is not used by fund managers. After subprime crisis, the similarity between ETFs and CDOs raises a lot of concerns. Testing volatility timing is only a part of fund quality research, and numerous methods could make further study on ETFs. Therefore, the absence of volatility timing is not significant to judge the quality of a funds. All in all, other evaluation method can be undertaken to make a further on the characteristics of funds.

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VARIABLES	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	6.403***	0.797***	4.019***	3.067***	4.675***	6.065***	0.407***	0.515***	5.965***	2.627***	2.668***	2.171***	3.655***
	(38.51)	(53.93)	(74.92)	(50.62)	(51.07)	(77.61)	(87.31)	(59.96)	(95.82)	(10.82)	(81.48)	(101.2)	(104.2)
exmr2	27.13	0.300	9.394	1.868***	6.330	21.04	0.0328	0.0779	36.95**	3.110	15.21***	5.753***	6.063
	(0.962)	(0.942)	(1.065)	(12.52)	(0.635)	(0.915)	(0.280)	(0.441)	(2.362)	(0.257)	(3.972)	(4.871)	(0.897)
key10	1.075	0.189**	0.483	-0.296***	0.891**	2.405***	0.167***	0.176***	4.652***	2.286***	1.528***	0.894***	1.798***
	(1.228)	(2.482)	(1.308)	(-12.18)	(2.232)	(4.325)	(4.612)	(3.709)	(12.17)	(5.845)	(8.677)	(7.847)	(8.061)
Constant	0.000241	0.000192	2.52e-05	0.000212	0.000352**	-2.63e-07	0.000170	0.000235	-6.89e-05	0.000647	-0.000376***	-0.000242**	-7.55e-05
	(0.898)	(1.029)	(0.209)	(1.284)	(1.997)	(-0.00114)	(1.185)	(1.145)	(-0.896)	(0.762)	(-2.928)	(-2.243)	(-0.765)
Observations	1,822	2,054	3,025	1,167	2,557	1,337	1,861	1,687	962	1,110	845	843	588
R-squared	0.844	0.893	0.892	0.958	0.851	0.930	0.955	0.934	0.979	0.868	0.971	0.977	0.987

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
4.069***	4.572***	10.62***	4.572***	2.624***	3.530***	2.432***	8.415***	9.800***	5.642***	2.654***	10.95***	10.53***
(130.7)	(215.4)	(98.25)	(215.4)	(59.09)	(87.04)	(172.4)	(137.6)	(157.4)	(77.14)	(179.9)	(95.70)	(155.2)
18.62***	15.06**	128.5**	15.06**	8.122	9.350	4.593**	27.26	82.71**	46.82*	5.321***	91.09*	49.23
(3.347)	(1.968)	(2.179)	(1.968)	(1.153)	(1.101)	(2.154)	(0.856)	(2.111)	(1.851)	(3.209)	(1.825)	(1.528)
2.150***	0.529	3.283***	0.529	1.351**	1.027**	0.881***	3.503***	3.464***	1.510**	0.982***	0.360	3.804***
(9.170)	(1.484)	(3.084)	(1.484)	(2.084)	(2.124)	(9.723)	(4.124)	(3.609)	(2.036)	(8.835)	(0.376)	(5.755)
-8.27e-05*	-5.48e-05	-0.000307**	-5.48e-05	-0.000239	-0.000108	-1.10e-05	1.04e-05	-0.000133	-0.000285*	-2.20e-06	-0.000183	-3.12e-05
(-1.837)	(-1.076)	(-2.493)	(-1.076)	(-1.518)	(-1.603)	(-0.218)	(0.145)	(-1.159)	(-1.843)	(-0.0781)	(-1.402)	(-0.596)
380	424	501	424	446	473	732	588	500	424	732	493	498
0.996	0.996	0.981	0.996	0.966	0.989	0.993	0.991	0.993	0.981	0.995	0.986	0.995

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
8.008***	10.26***	2.636***	2.636***	7.467***	4.953***	2.318***	2.434***	7.847***	13.09***	6.873***	9.318***	24.06***
(127.6)	(129.2)	(199.9)	(199.9)	(113.1)	(110.1)	(146.9)	(142.2)	(111.2)	(81.97)	(83.37)	(14.38)	(87.78)
44.30*	54.17	2.558*	2.558*	24.62	25.34***	5.197**	8.154***	54.49	213.4**	49.75	23.57	220.6
(1.858)	(1.490)	(1.671)	(1.671)	(1.160)	(3.124)	(2.149)	(3.783)	(1.519)	(2.032)	(1.591)	(0.389)	(0.557)
3.007***	4.586***	1.442***	1.442***	-0.745	-2.007***	1.207***	1.183***	2.752***	1.907	-0.250	49.13***	12.71***
(6.226)	(7.192)	(14.60)	(14.60)	(-1.044)	(-5.770)	(8.534)	(7.229)	(2.812)	(1.054)	(-0.243)	(10.10)	(5.417)
-1.63e-05	-4.88e-05	2.12e-05	2.12e-05	-4.37e-05	-0.000118**	-2.25e-05	-9.91e-05**	-0.000132*	-0.000423**	-0.000305	-0.000458	-4.15e-05
(-0.345)	(-0.754)	(0.463)	(0.463)	(-0.369)	(-2.002)	(-0.453)	(-2.233)	(-1.742)	(-2.024)	(-1.640)	(-1.338)	(-0.405)
651	496	569	569	588	739	732	732	588	496	588	494	498
0.991	0.993	0.996	0.996	0.986	0.985	0.992	0.992	0.986	0.971	0.971	0.804	0.986

Table 7. OLS with 10-day Volatility Estimation Window

VARIABLES	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	6.239***	0.781***	3.968***	3.039***	4.650***	6.028***	0.399***	0.506***	5.975***	2.705***	2.654***	2.173***	3.677***
	(35.06)	(56.07)	(75.39)	(50.66)	(52.13)	(58.73)	(88.95)	(60.12)	(130.1)	(11.80)	(89.19)	(109.1)	(111.5)
exmr2	26.83	0.374	10.22	1.915***	9.125	26.09	0.0835	0.109	41.74***	3.264	12.87***	4.535***	7.783
	(0.954)	(1.245)	(1.153)	(6.106)	(0.968)	(1.290)	(0.862)	(0.755)	(4.811)	(0.258)	(5.395)	(4.581)	(1.183)
key30	2.643***	0.367***	1.067***	-0.557***	1.401***	4.868***	0.285***	0.320***	6.499***	3.189***	2.085***	1.416***	2.867***
	(2.608)	(4.178)	(2.657)	(-8.854)	(2.691)	(7.628)	(8.446)	(6.881)	(31.16)	(8.521)	(19.01)	(16.24)	(7.847)
Constant	0.000275	0.000168	2.01e-05	0.000154	0.000317*	-4.28e-05	0.000117	0.000212	-9.50e-05*	0.000552	-0.000265***	-0.000121	-8.48e-05
	(1.014)	(0.930)	(0.163)	(0.910)	(1.849)	(-0.208)	(0.943)	(1.243)	(-1.840)	(0.627)	(-2.955)	(-1.289)	(-0.882)
Observations	1,822	2,054	3,025	1,167	2,557	1,337	1,861	1,687	962	1,110	852	850	588
R-squared	0.849	0.898	0.893	0.956	0.852	0.941	0.962	0.941	0.988	0.890	0.978	0.983	0.988

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
4.108***	4.605***	10.64***	4.605***	2.656***	3.555***	2.438***	8.445***	9.830***	5.699***	2.660***	10.94***	10.62***
(154.3)	(208.4)	(95.70)	(208.4)	(52.30)	(86.68)	(168.9)	(140.7)	(139.9)	(72.95)	(181.3)	(98.83)	(154.4)
14.80***	13.51*	140.2**	13.51*	9.456	10.02	3.907**	22.84	78.14**	50.25**	4.253**	93.38*	53.67
(2.850)	(1.780)	(2.461)	(1.780)	(1.396)	(1.186)	(1.985)	(0.744)	(2.332)	(2.072)	(2.527)	(1.873)	(1.324)
2.627***	-0.108	6.366***	-0.108	2.295***	1.164**	1.143***	5.815***	6.039***	0.965	1.187***	1.315	4.322***
(8.495)	(-0.216)	(5.020)	(-0.216)	(2.797)	(2.275)	(8.349)	(6.708)	(8.525)	(1.047)	(8.362)	(0.967)	(4.331)
-5.19e-05	-2.54e-05	-0.000322***	-2.54e-05	-0.000245	-0.000107*	-9.25e-06	1.72e-05	-0.000118	-0.000287**	4.12e-06	-0.000192	-3.29e-05
(-1.340)	(-0.505)	(-2.652)	(-0.505)	(-1.624)	(-1.662)	(-0.202)	(0.246)	(-1.199)	(-1.982)	(0.148)	(-1.460)	(-0.520)
380	424	501	424	446	473	732	588	500	424	732	493	498
0.997	0.996	0.982	0.996	0.966	0.988	0.993	0.991	0.993	0.981	0.995	0.986	0.994

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
8.029***	10.35***	2.664***	2.664***	7.437***	4.956***	2.334***	2.441***	7.879***	13.07***	6.870***	8.168***	24.28***
(129.3)	(137.2)	(205.7)	(205.7)	(114.3)	(109.5)	(151.2)	(153.3)	(113.7)	(75.41)	(72.80)	(7.258)	(84.47)
43.95*	72.94*	3.315	3.315	22.65	21.06**	4.245*	7.603***	57.10*	229.5**	49.02	-148.3	319.2
(1.873)	(1.867)	(1.550)	(1.550)	(0.998)	(2.533)	(1.774)	(3.909)	(1.680)	(2.204)	(1.555)	(-1.486)	(0.826)
5.012***	5.817***	1.549***	1.549***	-0.667	-3.396***	1.617***	1.623***	5.318***	4.612**	-0.468	74.79***	18.29***
(7.677)	(6.528)	(9.137)	(9.137)	(-0.661)	(-6.877)	(8.124)	(9.642)	(4.793)	(2.342)	(-0.381)	(6.600)	(6.034)
-2.74e-05	-7.18e-05	-1.54e-05	-1.54e-05	-3.47e-05	-9.48e-05	-2.12e-05	-0.000101***	-0.000140*	-0.000459**	-0.000300	-0.000161	-5.44e-05
(-0.600)	(-1.074)	(-0.300)	(-0.300)	(-0.275)	(-1.608)	(-0.448)	(-2.621)	(-1.887)	(-2.209)	(-1.618)	(-0.393)	(-0.543)
651	496	569	569	588	739	732	732	588	496	588	494	498
0.991	0.993	0.995	0.995	0.986	0.986	0.992	0.993	0.986	0.972	0.971	0.695	0.986

Table 8. OLS with 30-day Volatility Estimation Window

VARIABLES	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	6.391***	0.794***	4.007***	2.990***	4.824***	6.080***	0.401***	0.512***	6.053***	2.839***	2.669***	2.189***	3.683***
	(35.77)	(60.82)	(77.27)	(49.96)	(62.94)	(56.48)	(91.53)	(60.72)	(143.8)	(14.41)	(102.4)	(141.5)	(124.5)
exmr2	30.13	0.425	10.77	1.956***	12.24	27.72	0.0943	0.122	32.07***	2.790	10.35***	3.019***	5.174
	(1.088)	(1.416)	(1.217)	(4.293)	(1.306)	(1.283)	(0.943)	(0.870)	(2.854)	(0.237)	(5.383)	(3.621)	(0.972)
key60	2.132*	0.346***	0.943**	-0.784***	0.508	6.351***	0.338***	0.342***	8.188***	4.453***	2.839***	2.183***	4.504***
	(1.700)	(3.786)	(2.119)	(-6.453)	(0.834)	(7.937)	(8.553)	(6.668)	(24.18)	(9.616)	(33.08)	(26.11)	(11.74)
Constant	0.000226	0.000140	1.16e-05	0.000157	0.000274*	-4.66e-05	0.000105	0.000201	-6.36e-05	0.000507	-0.000176**	-2.16e-05	-3.32e-05
	(0.856)	(0.788)	(0.0952)	(0.902)	(1.648)	(-0.216)	(0.843)	(1.250)	(-1.161)	(0.625)	(-2.447)	(-0.253)	(-0.404)
Observations	1,822	2,054	3,025	1,167	2,557	1,337	1,861	1,687	962	1,110	852	850	588
R-squared	0.845	0.894	0.892	0.953	0.848	0.942	0.960	0.938	0.990	0.916	0.984	0.987	0.991

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
8.056***	10.40***	2.688***	2.688***	7.413***	4.960***	2.347***	2.457***	7.884***	13.03***	6.821***	7.508***	24.43***
(133.0)	(131.2)	(172.9)	(172.9)	(110.9)	(107.5)	(152.8)	(153.7)	(116.0)	(75.72)	(65.68)	(4.829)	(83.69)
43.23*	60.34	2.072	2.072	22.90	23.03***	3.084	6.088***	45.91	210.2**	51.42	-217.8*	258.0
(1.957)	(1.582)	(0.854)	(0.854)	(0.969)	(2.812)	(1.438)	(3.419)	(1.471)	(2.392)	(1.626)	(-1.677)	(0.687)
6.776***	7.526***	1.700***	1.700***	0.436	-4.994***	2.232***	2.103***	8.497***	12.67***	2.378	93.86***	22.86***
(8.654)	(7.424)	(9.869)	(9.869)	(0.329)	(-8.806)	(9.258)	(11.06)	(6.031)	(6.187)	(1.528)	(5.983)	(6.404)
-2.91e-05	-4.45e-05	1.43e-05	1.43e-05	-3.79e-05	-9.06e-05	6.63e-06	-7.09e-05**	-0.000124*	-0.000396**	-0.000319*	-8.38e-05	-3.74e-05
(-0.675)	(-0.681)	(0.242)	(0.242)	(-0.287)	(-1.579)	(0.159)	(-1.985)	(-1.786)	(-2.126)	(-1.699)	(-0.186)	(-0.384)
651	496	569	569	588	739	732	732	588	496	588	494	498
0.992	0.993	0.994	0.994	0.986	0.987	0.993	0.994	0.987	0.975	0.971	0.617	0.987

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
4.133***	4.596***	10.63***	4.596***	2.672***	3.546***	2.447***	8.493***	9.887***	5.669***	2.667***	10.92***	10.67***
(167.4)	(188.8)	(102.6)	(188.8)	(57.84)	(80.77)	(167.8)	(136.2)	(134.4)	(72.36)	(187.6)	(100.0)	(142.3)
7.903*	14.48*	127.0**	14.48*	8.673	9.261	3.302	11.57	63.88**	49.08**	3.375**	92.97**	41.10
(1.665)	(1.926)	(2.530)	(1.926)	(1.588)	(1.168)	(1.631)	(0.379)	(2.046)	(2.075)	(1.986)	(1.995)	(0.975)
3.393***	0.400	12.71***	0.400	5.631***	2.322***	1.317***	7.343***	7.433***	3.082***	1.371***	4.146**	4.813***
(10.00)	(0.681)	(7.616)	(0.681)	(6.245)	(4.500)	(7.117)	(8.033)	(9.218)	(2.622)	(7.758)	(2.134)	(4.160)
1.08e-06	-3.66e-05	-0.000312***	-3.66e-05	-0.000238*	-0.000114*	5.29e-06	4.50e-05	-8.23e-05	-0.000299**	1.67e-05	-0.000196	-9.93e-06
(0.0311)	(-0.707)	(-2.742)	(-0.707)	(-1.927)	(-1.790)	(0.115)	(0.631)	(-0.909)	(-2.075)	(0.593)	(-1.545)	(-0.151)
380	424	501	424	446	473	732	588	500	424	732	493	498
0.997	0.996	0.985	0.996	0.971	0.989	0.993	0.991	0.994	0.981	0.995	0.987	0.994

Table 9. OLS with 60-day Volatility Estimation Window

VARIABLES	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	6.450***	0.798***	4.003***	2.963***	4.882***	6.117***	0.402***	0.517***	6.140***	2.936***	2.682***	2.216***	3.705***
	(35.35)	(60.97)	(76.94)	(49.04)	(67.16)	(55.28)	(91.16)	(60.41)	(145.3)	(15.28)	(147.0)	(166.6)	(122.3)
exmr2	30.70	0.441	10.68	1.974***	12.63	27.33	0.0937	0.139	24.21*	3.208	8.053***	1.982**	2.323
	(1.122)	(1.456)	(1.200)	(3.711)	(1.353)	(1.298)	(0.921)	(0.953)	(1.887)	(0.257)	(4.772)	(2.189)	(0.411)
key90	2.047	0.383***	1.180**	-0.966***	0.152	7.650***	0.395***	0.377***	9.968***	5.494***	3.724***	2.804***	5.158***
	(1.447)	(3.954)	(2.486)	(-5.604)	(0.240)	(9.300)	(9.049)	(6.528)	(24.53)	(11.50)	(35.49)	(26.85)	(13.51)
Constant	0.000211	0.000127	1.41e-05	0.000183	0.000267	-2.39e-05	0.000104	0.000174	-5.73e-05	0.000342	-0.000108*	6.22e-05	-2.75e-06
	(0.807)	(0.714)	(0.115)	(1.040)	(1.615)	(-0.115)	(0.833)	(1.057)	(-0.980)	(0.405)	(-1.829)	(0.756)	(-0.0320)
Observations	1,822	2,054	3,025	1,167	2,557	1,337	1,861	1,687	962	1,110	852	850	588
R-squared	0.844	0.894	0.892	0.952	0.848	0.944	0.961	0.937	0.992	0.924	0.991	0.990	0.991

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
4.168***	4.593***	10.69***	4.593***	2.681***	3.568***	2.452***	8.538***	9.959***	5.687***	2.673***	10.94***	10.73***
(149.9)	(182.2)	(100.0)	(182.2)	(50.77)	(76.82)	(172.1)	(127.2)	(125.2)	(74.16)	(197.0)	(101.2)	(131.2)
4.974	15.79**	100.8*	15.79**	6.609	7.331	2.882	5.224	60.78*	44.78*	2.661	82.54*	33.58
(0.983)	(2.191)	(1.943)	(2.191)	(0.991)	(0.928)	(1.416)	(0.157)	(1.941)	(1.833)	(1.495)	(1.798)	(0.731)
4.027***	1.384*	15.27***	1.384*	6.954***	2.339***	1.681***	7.349***	6.808***	3.548**	1.602***	5.733**	3.702***
(10.00)	(1.771)	(7.324)	(1.771)	(4.733)	(3.903)	(7.469)	(5.996)	(6.748)	(2.264)	(7.271)	(2.200)	(2.793)
9.30e-07	-4.96e-05	-0.000291**	-4.96e-05	-0.000240*	-9.70e-05	5.94e-06	6.07e-05	-7.10e-05	-0.000282*	2.15e-05	-0.000174	1.03e-05
(0.0264)	(-0.991)	(-2.562)	(-0.991)	(-1.691)	(-1.538)	(0.130)	(0.794)	(-0.778)	(-1.842)	(0.736)	(-1.399)	(0.146)
380	424	501	424	446	473	732	588	500	424	732	493	498
0.997	0.996	0.984	0.996	0.969	0.989	0.994	0.990	0.993	0.981	0.995	0.987	0.993

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
8.077***	10.46***	2.719***	2.719***	7.434***	5.001***	2.353***	2.470***	7.909***	13.09***	6.842***	8.995***	24.60***
(142.8)	(121.9)	(141.6)	(141.6)	(111.5)	(111.0)	(165.9)	(162.1)	(117.1)	(78.74)	(65.27)	(7.560)	(86.12)
39.98*	47.86	2.757	2.757	24.97	15.77**	2.083	4.910***	37.99	163.4**	48.98	-250.5**	244.0
(1.932)	(1.169)	(1.013)	(1.013)	(1.093)	(2.159)	(1.083)	(2.922)	(1.196)	(1.988)	(1.557)	(-2.147)	(0.631)
9.143***	7.897***	1.673***	1.673***	-1.537	-6.886***	3.088***	2.685***	11.13***	17.91***	1.313	120.7***	27.94***
(8.919)	(7.201)	(8.690)	(8.690)	(-0.896)	(-12.23)	(11.93)	(12.21)	(6.626)	(7.636)	(0.600)	(6.676)	(7.456)
-2.60e-05	-2.35e-05	-1.98e-05	-1.98e-05	-4.06e-05	-3.58e-05	7.34e-06	-6.83e-05**	-0.000111	-0.000343*	-0.000310*	-0.000180	-3.44e-05
(-0.636)	(-0.342)	(-0.304)	(-0.304)	(-0.317)	(-0.697)	(0.199)	(-2.029)	(-1.596)	(-1.940)	(-1.657)	(-0.422)	(-0.343)
651	496	569	569	588	739	732	732	588	496	588	494	498
0.992	0.992	0.992	0.992	0.986	0.989	0.994	0.995	0.987	0.977	0.971	0.664	0.987

Table 10. OLS with 90-day Volatility Estimation Window

Table 12. OLS with 10-Day Estimation Window Before 2010

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	1.000***	0.993***	1.005***	0.764***	1.004***	0.964***	0.998***	0.992***
	(196,809)	(401.7)	(305.6)	(6.603)	(201.2)	(42.35)	(1,193)	(123.5)
exmr2	-2.71e-06	-0.447***	1.107***	-0.717	1.157***	2.006***	-0.137***	1.534***
	(-0.0512)	(-430.7)	(135.1)	(-1.606)	(99.26)	(7.523)	(-880.5)	(45.31)
key10	-1.95e-07	0.000327***	-0.000589**	0.00184	-0.000645*	-0.000387	8.30e-05**	-0.000284
	(-1.493)	(2.801)	(-1.984)	(1.362)	(-1.947)	(-0.471)	(2.019)	(-0.627)
Constant	-5.88e-09	0.000273***	-0.000306***	0.000550	0.000590**	-0.00169***	5.22e-05***	0.000937**
	(-0.0479)	(14.58)	(-16.87)	(1.380)	(-15.34)	(-7.085)	(11.58)	(-12.12)
Observatio	1,186	1,419	2,391	532	1,922	702	1,226	1,052
R-squared	1.000	0.999	0.997	0.857	0.995	0.967	1.000	0.989

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	0.999***	0.974***	1.000***	0.930***	1.006***	0.986***	0.993***	0.994***	0.990***
	(163.1)	(124.5)	(77.33)	(37.00)	(78.50)	(37.91)	(221.6)	(254.8)	(114.0)
exmr2	1.127***	-0.739***	-2.621***	-2.622***	3.071***	7.175***	1.461***	-0.822***	-1.982***
	(161.0)	(-68.14)	(-15.46)	(-10.39)	(48.23)	(25.78)	(44.06)	(-154.4)	(-88.19)
key10	-0.000397	0.000451*	-0.00203***	0.00103	0.000736	0.00956	0.000160	-0.000165	-0.00234
	(-0.820)	(1.828)	(-2.900)	(0.964)	(0.287)	(1.336)	(0.141)	(-0.280)	(-1.613)
Constant	0.000631**	0.00120***	0.00172***	0.00227***	0.000537**	-0.00102***	-0.000108**	0.000315***	0.000248***
	(-8.179)	(10.02)	(7.707)	(7.948)	(-4.991)	(-4.708)	(-2.870)	(6.466)	(4.717)
Observatio	327	569	314	314	97	97	16	104	97
R-squared	0.997	0.994	0.982	0.967	0.996	0.977	1.000	0.999	0.998

Table 13. OLS with 30-Day Estimation Window Before 2010

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	1.000***	0.997***	0.998***	0.763***	0.993***	0.926***	1.000***	0.976***	0.993***	0.981***
	(208,745)	(372.9)	(286.9)	(6.548)	(154.7)	(21.57)	(1,260)	(90.68)	(145.6)	(127.7)
exmr2	-2.60e-05	-0.448***	1.112***	-0.654	1.141***	1.834***	-0.137***	1.494***	1.121***	-0.748***
	(-0.530)	(-341.0)	(161.0)	(-1.560)	(84.35)	(6.501)	(-711.4)	(37.05)	(123.1)	(-88.16)
key30	-1.69e-07	0.000249	-0.000385	0.00401	-0.000408	0.00186**	4.45e-05	0.000259	-9.50e-05	0.000373
	(-1.044)	(1.420)	(-0.883)	(1.571)	(-0.910)	(2.391)	(0.725)	(0.441)	(-0.171)	(1.484)
Constant	9.76e-09	0.000276**	0.000309**	0.000692	0.000583**	-0.00152***	5.22e-05***	0.000898**	0.000623**	0.00120***
	(0.0799)	(14.01)	(-17.39)	(1.635)	(-15.49)	(-6.260)	(11.33)	(-12.02)	(-7.967)	(9.634)
Observatio	1,186	1,419	2,391	532	1,922	702	1,226	1,052	327	569
R-squared	1.000	0.999	0.997	0.863	0.994	0.969	1.000	0.989	0.997	0.994

exfr	exfr	exfr	exfr	exfr	exfr	exfr
0.956***	0.916***	1.007***	1.008***	0.993***	0.994***	0.984***
(54.89)	(27.37)	(63.29)	(25.02)	(231.4)	(232.6)	(82.43)
-2.757***	-2.484***	3.077***	7.222***	1.457***	-0.823***	-1.954***
(-14.76)	(-10.20)	(29.10)	(15.14)	(205.8)	(-238.0)	(-58.74)
-0.000513	0.00284***	0.000719	0.00533	0.00104	-0.000269	-0.00305
(-0.613)	(2.797)	(0.141)	(0.350)	(0.148)	(-0.277)	(-1.443)
0.00187***	0.00219***	0.000536**	-0.00101***	-0.000108**	0.000314**	0.000251***
(8.471)	(8.173)	(-4.973)	(-4.304)	(-2.728)	(6.349)	(4.506)
314	314	97	97	16	104	97
0.979	0.971	0.996	0.975	1.000	0.999	0.998

Table 14. OLS with 60-Day Estimation Window Before 2010

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	1.000***	0.998***	0.998***	0.787***	0.989***	0.927***	1.000***	0.973***	0.992***
	(207,311)	(400.6)	(337.7)	(7.042)	(135.7)	(21.59)	(1,352)	(85.03)	(108.1)
exmr2	-3.22e-05	-0.449***	1.112***	-0.606	1.135***	1.790***	-0.137***	1.481***	1.120***
	(-0.593)	(-394.6)	(145.0)	(-1.486)	(80.15)	(6.347)	(-825.4)	(37.93)	(99.48)
key60	-7.99e-08	0.000246	-0.000467	0.00656*	-0.000274	0.00305***	4.94e-05	0.000511	-7.35e-05
	(-0.343)	(1.311)	(-1.050)	(1.689)	(-0.581)	(2.837)	(0.816)	(0.898)	(-0.131)
Constant	1.83e-08	0.000276**	0.000309**	0.000589	0.000578**	-0.00148***	5.22e-05***	0.000885**	0.000621**
	(0.149)	(13.80)	(-17.42)	(1.422)	(-15.52)	(-6.049)	(11.30)	(-12.17)	(-8.173)
Observatio	1,186	1,419	2,391	532	1,922	702	1,226	1,052	327
R-squared	1.000	0.999	0.997	0.865	0.994	0.970	1.000	0.989	0.997

	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
	0.981***	0.940***	0.923***	1.008***	1.020***	0.993***	0.993***	0.981***
	(90.39)	(42.72)	(31.41)	(54.85)	(23.01)	(226.5)	(197.5)	(65.86)
	-0.744***	-2.712***	-2.316***	3.046***	6.668***	1.457***	-0.817***	-1.950***
	(-64.40)	(-14.07)	(-10.34)	(29.58)	(8.578)	(196.2)	(-133.6)	(-45.11)
	0.000532**	0.000694	0.00563***	-0.00145	-0.0135	0.00145	0.00106	-0.00257
	(2.037)	(0.643)	(4.262)	(-0.206)	(-0.589)	(0.251)	(0.838)	(-0.772)
	0.00119***	0.00188***	0.00202***	0.000532**	0.000982**	-0.000106**	0.000305**	0.000254**
	(9.565)	(8.690)	(8.265)	(-5.092)	(-4.290)	(-2.448)	(6.210)	(3.916)
	569	314	314	97	97	16	104	97
	0.994	0.979	0.975	0.996	0.976	1.000	0.999	0.998

Table 15. OLS with 90-Day Estimation Window Before 2010

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	1.000***	0.999***	0.998***	0.828***	0.987***	0.929***	1.000***	0.971***	0.992***	0.983***	0.930***
	(213,386)	(389.3)	(329.9)	(7.957)	(122.5)	(22.27)	(1,296)	(81.03)	(94.43)	(79.33)	(43.34)
exmr2	-3.33e-05	-0.450***	1.110***	-0.661	1.132***	1.730***	-0.137***	1.468***	1.119***	-0.744***	-2.620***
	(-0.601)	(-384.0)	(130.3)	(-1.435)	(75.07)	(6.062)	(-893.6)	(37.25)	(77.94)	(-54.88)	(-14.24)
key90	-5.28e-08	0.000229	-0.000538	0.00764	-0.000174	0.00410***	5.34e-05	0.000787	-6.87e-05	0.000618**	0.00305**
	(-0.189)	(1.159)	(-1.189)	(1.359)	(-0.359)	(2.962)	(0.900)	(1.355)	(-0.109)	(2.130)	(2.304)
Constant	2.02e-08	0.000276***	0.000310**	0.000484	0.000575**	-0.00140***	5.22e-05***	0.000873**	0.000621**	0.00117***	0.00186***
	(0.165)	(13.73)	(-17.45)	(1.103)	(-15.59)	(-5.574)	(11.30)	(-12.32)	(-8.215)	(9.351)	(8.943)
Observatio	1,186	1,419	2,391	532	1,922	702	1,226	1,052	327	569	314
R-squared	1.000	0.999	0.997	0.847	0.994	0.971	1.000	0.989	0.997	0.994	0.980

exfr	exfr	exfr	exfr	exfr	exfr
0.940***	1.009***	1.024***	0.993***	0.994***	0.981***
(39.67)	(56.22)	(26.90)	(244.1)	(196.3)	(69.14)
-2.213***	3.016***	6.443***	1.459***	-0.824***	-1.950***
(-10.93)	(28.69)	(11.36)	(119.7)	(-152.6)	(-44.20)
0.00784***	-0.00299	-0.0193	0.00432	-0.00202	-0.00257
(4.989)	(-0.468)	(-1.224)	(0.278)	(-0.448)	(-0.833)
0.00195***	0.000524**	0.000931**	-0.000103**	0.000314**	0.000253***
(8.361)	(-5.110)	(-4.307)	(-2.431)	(6.448)	(4.002)
314	97	97	16	104	97
0.978	0.996	0.979	1.000	0.999	0.998

Table 17. OLS with 10-Day Estimation Window After 2010

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	0.997***	0.960***	0.991***	0.999***	0.999***	0.995***
	(106,001)	(888,326)	(205,722)	(1.141e+06)	(191,170)	(139,951)	(913,098)	(878,985)	(102,070)	(422,421)	(234,823)	(431,961)	(176.2)	(76.48)	(117.7)	(269.1)	(1,396)	(305.4)
exmr2	-0.000408	-1.82e-05	-7.63e-05	-2.66e-05	-0.000211	-4.66e-05	-3.39e-05	7.02e-06	-0.000108	5.71e-05	-2.29e-05	-7.52e-05	2.399***	-2.935***	-0.319	1.812***	-0.390***	-1.294***
	(-1.157)	(-0.464)	(-0.539)	(-0.860)	(-1.500)	(-0.181)	(-0.956)	(0.224)	(-0.541)	(0.992)	(-0.146)	(-1.548)	(122.6)	(-47.38)	(-1.004)	(237.3)	(-1,148)	(-57.84)
key10	-8.07e-07	1.34e-07*	-4.07e-07	-2.53e-09	-2.86e-07	-1.05e-06	-1.01e-08	1.54e-08	4.38e-07	-9.33e-08	-2.08e-07	-2.77e-08	-0.000709	0.00199	0.000159	-6.08e-05	-7.55e-05	0.000355
	(-1.072)	(1.921)	(-1.303)	(-0.0335)	(-0.922)	(-1.314)	(-0.124)	(0.262)	(0.819)	(-0.639)	(-0.550)	(-0.278)	(-0.996)	(1.602)	(0.742)	(-0.113)	(-0.443)	(0.498)
Constant	7.42e-08	1.20e-08	7.86e-09	2.38e-08*	5.90e-08	1.65e-08	-6.63e-09	7.18e-09	9.12e-09	-3.78e-08	-6.18e-09	1.86e-08	0.000682**	0.000496**	2.02e-05	0.000560**	7.95e-05***	0.000269**
	(0.504)	(0.610)	(0.140)	(1.844)	(0.769)	(0.146)	(-0.453)	(0.456)	(0.119)	(-0.825)	(-0.139)	(0.485)	(-13.93)	(8.278)	(0.908)	(-14.52)	(11.20)	(10.06)
Observatio	635	635	634	635	635	635	635	635	635	541	531	529	589	381	425	502	425	447
R-squared	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995	0.991	0.996	0.998	1.000	0.999

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
1.000***	0.996***	1.002***	0.998***	1.000***	0.997***	0.997***	1.000***	0.965***	0.998***	0.905***	0.992***	1.000***	1.000***	1.000***	1.005***	0.983***	0.998***	1.001***
(273,241)	(372.8)	(610.9)	(619.0)	(231,991)	(275.3)	(257.0)	(84,897)	(29.57)	(1,595)	(26.22)	(280.8)	(1.039e+06)	(252,790)	(227,430)	(373.0)	(108.0)	(725.1)	(171.2)
7.87e-05	1.473***	0.00430	-0.703***	0.000199	1.297***	-1.819***	-0.000151	1.243	-0.277***	-4.977***	1.600***	-8.36e-06	-9.60e-05	-1.59e-05	1.633***	3.486***	-0.599***	2.749***
(0.786)	(333.1)	(0.619)	(-279.7)	(1.581)	(190.9)	(-244.2)	(-0.383)	(1.049)	(-1,600)	(-2.811)	(170.1)	(-0.238)	(-0.687)	(-0.152)	(345.9)	(21.75)	(-487.3)	(66.75)
-8.41e-07***	0.000406	-3.68e-05	0.000275	-1.28e-07	-0.000132	6.12e-05	1.49e-06	0.00138	0.000187*	0.00500**	-0.000307	1.14e-07	3.89e-08	1.12e-07	0.000260	0.000538	0.000250	0.000654
(-3.332)	(0.859)	(-0.979)	(1.521)	(-0.343)	(-0.270)	(0.0797)	(1.233)	(0.990)	(1.912)	(2.069)	(-0.467)	(1.078)	(0.107)	(0.386)	(0.511)	(0.312)	(1.142)	(0.741)
-1.14e-08	0.000338**	2.31e-05	0.000183**	-3.61e-08	0.000518**	0.000443**	1.45e-08	-0.000235	7.28e-05***	0.00121***	0.000598**	1.36e-08	2.56e-08	-9.13e-11	0.000271**	-0.00153***	0.000214**	0.000856**
(-0.264)	(-14.80)	(1.005)	(12.55)	(-0.849)	(-13.24)	(12.04)	(0.108)	(-1.048)	(11.75)	(2.853)	(-14.50)	(1.177)	(0.702)	(-0.00228)	(-14.07)	(-11.82)	(14.31)	(-13.40)
635	589	501	425	635	494	499	635	497	570	570	589	635	635	635	589	497	589	495
1.000	0.999	0.999	1.000	1.000	0.998	0.997	1.000	0.968	1.000	0.955	0.997	1.000	1.000	1.000	0.999	0.982	1.000	0.993

Table 18. OLS with 30-Day Estimation Window After 2010

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	0.993***	0.960***	0.993***	0.999***	0.999***	0.997***
	(112,906)	(923,230)	(218,286)	1.240e+06	(195,733)	(149,582)	(952,094)	(891,125)	(112,418)	(478,826)	(249,661)	(449,046)	(165.9)	(70.48)	(143.6)	(246.1)	(1,146)	(249.2)
exmr2	-0.000432	-2.07e-05	-8.28e-05	-2.62e-05	-0.000216	-8.85e-06	-3.34e-05	5.66e-06	-0.000103	6.50e-05	-1.42e-05	-6.22e-05	2.389***	-2.882***	-0.333	1.811***	-0.390***	-1.288***
	(-1.105)	(-0.512)	(-0.561)	(-0.853)	(-1.481)	(-0.0350)	(-0.957)	(0.178)	(-0.502)	(1.208)	(-0.0939)	(-1.266)	(103.6)	(-42.17)	(-1.006)	(210.9)	(-734.1)	(-95.95)
key30	-1.45e-08	2.27e-07***	-2.60e-07	-3.96e-08	-3.88e-07	-1.01e-06	-5.27e-08	4.01e-08	3.39e-07	-4.79e-08	-1.82e-07	1.40e-07	-0.000300	0.00303**	-0.000239	-3.26e-05	-0.000190	0.000298
	(-0.0135)	(2.663)	(-0.659)	(-0.320)	(-0.937)	(-1.019)	(-0.542)	(0.512)	(0.472)	(-0.254)	(-0.419)	(0.986)	(-0.305)	(2.449)	(-0.797)	(-0.0429)	(-0.900)	(0.275)
Constant	7.25e-08	1.20e-08	9.15e-09	2.39e-08*	6.08e-08	1.56e-08	-6.66e-09	7.33e-09	7.93e-09	-3.93e-08	-5.87e-09	1.33e-08	0.000687**	0.000483***	2.59e-05	0.000560**	7.95e-05***	0.000270***
	(0.483)	(0.602)	(0.162)	(1.849)	(0.789)	(0.138)	(-0.457)	(0.465)	(0.103)	(-0.857)	(-0.133)	(0.347)	(-14.17)	(8.281)	(0.954)	(-14.52)	(11.73)	(9.682)
Observatio	635	635	634	635	635	635	635	635	635	541	538	536	589	381	425	502	425	447
R-squared	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995	0.991	0.996	0.998	1.000	0.999

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
1.000***	0.998***	1.002***	1.000***	1.000***	0.996***	0.999***	1.000***	0.971***	0.998***	0.909***	0.990***	1.000***	1.000***	1.000***	1.006***	0.987***	0.999***	1.005***
(288,529)	(337.8)	(663.2)	(560.8)	(243,574)	(233.4)	(226.8)	(89,600)	(35.13)	(1,487)	(27.65)	(207.3)	1.151e+06	(257,909)	(260,672)	(321.6)	(74.17)	(597.3)	(139.4)
9.42e-05	1.476***	0.00549	-0.702***	0.000204*	1.294***	-1.821***	-0.000164	1.289	-0.277***	-4.862***	1.591***	-6.02e-06	-9.74e-05	-1.66e-05	1.633***	3.526***	-0.600***	2.781***
(0.913)	(326.1)	(0.689)	(-363.7)	(1.652)	(212.3)	(-206.3)	(-0.410)	(1.043)	(-1,552)	(-2.811)	(194.9)	(-0.172)	(-0.711)	(-0.160)	(295.7)	(20.85)	(-570.7)	(90.25)
-8.90e-07***	0.000253	-2.85e-05	0.000182	-3.18e-07	5.68e-05	-0.000347	6.74e-07	0.00105	0.000207*	0.00622**	0.000307	6.17e-08	1.31e-08	1.70e-07	0.000384	0.000159	0.000129	0.000310
(-2.607)	(0.435)	(-0.841)	(0.810)	(-0.797)	(0.0877)	(-0.380)	(0.393)	(0.895)	(1.874)	(2.174)	(0.353)	(0.353)	(0.0328)	(0.473)	(0.538)	(0.0852)	(0.443)	(0.263)
-9.59e-09	0.000338**	2.26e-05	0.000185***	-3.65e-08	0.000518**	0.000446***	1.22e-08	-0.000236	7.25e-05***	0.00117***	0.000596**	1.36e-08	2.56e-08	-4.65e-10	0.000271**	-0.00154***	0.000215***	0.000860**
(-0.221)	(-14.64)	(1.005)	(12.31)	(-0.859)	(-13.33)	(12.20)	(0.0908)	(-1.041)	(11.66)	(2.846)	(-14.56)	(1.175)	(0.702)	(-0.0116)	(-14.06)	(-12.34)	(14.05)	(-13.31)
635	589	501	425	635	494	499	635	497	570	570	589	635	635	635	589	497	589	495
1.000	0.999	0.999	1.000	1.000	0.998	0.997	1.000	0.968	1.000	0.955	0.997	1.000	1.000	1.000	0.999	0.982	1.000	0.993

Table 19. OLS with 60-Day Estimation Window After 2010

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	0.995***	0.961***	0.992***	1.001***	0.999***	0.997***
	(115,720)	(943,763)	(224,863)	(1.270e+06)	(201,751)	(152,226)	(974,033)	(919,613)	(116,451)	(488,732)	(263,139)	(473,225)	(158.8)	(73.23)	(127.7)	(240.5)	(1,015)	(218.6)
exmr2	-0.000450	-1.99e-05	-6.78e-05	-2.76e-05	-0.000206	2.10e-07	-3.00e-05	8.07e-06	-9.99e-05	6.56e-05	-4.99e-06	-6.85e-05	2.394***	-2.888***	-0.319	1.803***	-0.390***	-1.287***
	(-1.138)	(-0.507)	(-0.454)	(-0.893)	(-1.423)	(0.000835)	(-0.850)	(0.253)	(-0.467)	(1.216)	(-0.0333)	(-1.463)	(119.5)	(-48.60)	(-1.004)	(139.5)	(-1,017)	(-164.7)
key60	8.94e-07	1.56e-07	-4.53e-07	3.43e-08	-4.87e-07	-1.17e-06	-1.04e-07	-3.62e-09	4.36e-08	1.10e-07	-2.93e-07	9.46e-08	-0.00101	0.00458***	0.000172	-0.000981	-0.000342	0.000614
	(0.704)	(1.487)	(-0.915)	(0.228)	(-0.972)	(-0.981)	(-0.935)	(-0.0375)	(0.0554)	(0.465)	(-0.548)	(0.527)	(-0.964)	(3.073)	(0.601)	(-1.155)	(-1.433)	(0.515)
Constant	7.32e-08	1.23e-08	6.92e-09	2.39e-08*	5.90e-08	1.07e-08	-7.17e-09	7.01e-09	7.97e-09	-3.85e-08	-6.84e-09	1.48e-08	0.000687**	0.000474**	2.17e-05	0.000554**	7.90e-05***	0.000269**
	(0.486)	(0.623)	(0.123)	(1.849)	(0.767)	(0.0950)	(-0.490)	(0.446)	(0.104)	(-0.835)	(-0.156)	(0.389)	(-14.17)	(8.588)	(0.927)	(-14.30)	(12.07)	(10.12)
Observatio	635	635	634	635	635	635	635	635	635	541	538	536	589	381	425	502	425	447
R-squared	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995	0.992	0.996	0.998	1.000	0.999

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
1.000***	1.000***	1.001***	0.999***	1.000***	0.996***	0.998***	1.000***	0.982***	0.998***	0.918***	0.991***	1.000***	1.000***	1.000***	1.007***	0.989***	0.999***	1.009***
(300,032)	(302.6)	(1,134)	(561.4)	(258,957)	(225.4)	(194.6)	(93,054)	(56.83)	(1,407)	(29.74)	(190.7)	(1.191e+06)	(261,614)	(281,741)	(298.1)	(66.45)	(518.3)	(127.4)
0.000108	1.477***	0.00380	-0.701***	0.000213*	1.293***	-1.817***	-0.000164	1.270	-0.277***	-5.068***	1.596***	-6.95e-06	-9.69e-05	-1.90e-05	1.636***	3.535***	-0.600***	2.787***
(1.019)	(262.1)	(0.395)	(-543.4)	(1.741)	(149.2)	(-91.30)	(-0.411)	(1.038)	(-1,397)	(-2.829)	(179.1)	(-0.197)	(-0.701)	(-0.176)	(281.6)	(21.42)	(-498.2)	(83.50)
-1.00e-06**	-0.000384	0.000255	0.000426	-4.04e-07	-0.000331	-0.000295	1.19e-06	-0.00231	0.000292**	0.00718**	-0.000537	-1.28e-07	-1.30e-07	1.64e-07	-0.000196	-0.000761	0.000149	-0.000981
(-2.569)	(-0.615)	(0.988)	(1.449)	(-0.917)	(-0.359)	(-0.272)	(0.577)	(-0.990)	(1.976)	(2.007)	(-0.539)	(-0.478)	(-0.291)	(0.385)	(-0.230)	(-0.331)	(0.429)	(-0.731)
-1.16e-08	0.000336**	2.23e-05	0.000183***	-3.74e-08	0.000516**	0.000445***	1.16e-08	-0.000217	7.16e-05***	0.00121***	0.000596**	1.39e-08	2.56e-08	-1.90e-10	0.000269**	-0.00155***	0.000215***	0.000857**
(-0.268)	(-14.47)	(1.005)	(12.43)	(-0.881)	(-13.30)	(12.29)	(0.0864)	(-1.031)	(11.99)	(2.848)	(-14.52)	(1.195)	(0.702)	(-0.00474)	(-13.88)	(-12.29)	(14.03)	(-13.26)
635	589	501	425	635	494	499	635	497	570	570	589	635	635	635	589	497	589	495
1.000	0.999	0.999	1.000	1.000	0.998	0.997	1.000	0.968	1.000	0.955	0.997	1.000	1.000	1.000	0.999	0.982	1.000	0.993

Table 20. OLS with 90-Day Estimation Window After 2010

VARIABLE	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
exmr	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	0.997***	0.963***	0.992***	1.001***	0.999***	0.996***
	(116,457)	(947,721)	(232,112)	1.297e+06	(204,777)	(153,801)	(990,193)	(951,097)	(119,904)	(478,057)	(270,504)	(501,697)	(151.2)	(76.13)	(130.2)	(230.0)	(937.7)	(214.2)
exmr2	-0.000482	-1.61e-05	-5.36e-05	-2.87e-05	-0.000205	1.24e-05	-2.72e-05	9.37e-06	-0.000102	6.47e-05	2.37e-06	-6.96e-05	2.393***	-2.844***	-0.321	1.801***	-0.390***	-1.284***
	(-1.229)	(-0.424)	(-0.351)	(-0.915)	(-1.387)	(0.0494)	(-0.766)	(0.296)	(-0.469)	(1.202)	(0.0157)	(-1.504)	(118.6)	(-46.47)	(-1.004)	(166.4)	(-977.3)	(-210.7)
key90	1.68e-06	1.09e-07	-7.30e-07	6.00e-08	-5.02e-07	-6.55e-07	-1.58e-07	-2.37e-08	8.67e-08	9.84e-08	-4.25e-07	1.24e-07	-0.00210*	0.00656***	0.000122	-0.00201**	-0.000451	0.00200*
	(1.094)	(0.876)	(-1.201)	(0.321)	(-0.819)	(-0.495)	(-1.198)	(-0.195)	(0.0889)	(0.383)	(-0.704)	(0.643)	(-1.899)	(3.994)	(0.359)	(-2.085)	(-1.404)	(1.704)
Constant	7.56e-08	1.14e-08	5.92e-09	2.40e-08*	5.96e-08	8.87e-09	-7.35e-09	6.82e-09	8.05e-09	-3.84e-08	-7.27e-09	1.50e-08	0.000680**	0.000441**	2.24e-05	0.000543**	7.89e-05***	0.000264**
	(0.503)	(0.582)	(0.104)	(1.854)	(0.773)	(0.0786)	(-0.503)	(0.434)	(0.105)	(-0.829)	(-0.165)	(0.395)	(-14.12)	(8.251)	(0.932)	(-14.15)	(12.11)	(10.34)
Observatio	635	635	634	635	635	635	635	635	635	541	538	536	589	381	425	502	425	447
R-squared	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995	0.993	0.996	0.998	1.000	0.999

exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr	exfr
1.000***	1.000***	1.001***	0.999***	1.000***	0.997***	0.997***	1.000***	0.982***	0.999***	0.927***	0.992***	1.000***	1.000***	1.000***	1.008***	0.994***	0.998***	1.010***
(306,328)	(285.4)	(998.8)	(578.4)	(267,742)	(228.1)	(170.9)	(94,558)	(56.06)	(1,219)	(32.50)	(191.6)	1.198e+06	(267,703)	(290,836)	(284.4)	(71.36)	(531.0)	(123.2)
0.000105	1.473***	0.000828	-0.700***	0.000224*	1.288***	-1.820***	-0.000175	1.310	-0.277***	-5.112***	1.602***	-6.85e-06	-8.95e-05	-8.02e-06	1.637***	3.579***	-0.600***	2.795***
(0.950)	(225.1)	(0.0917)	(-579.4)	(1.861)	(129.6)	(-96.31)	(-0.442)	(1.044)	(-1,238)	(-2.849)	(180.9)	(-0.194)	(-0.631)	(-0.0703)	(280.3)	(23.24)	(-533.8)	(88.25)
-9.39e-07**	-0.00124*	0.000441	0.000938**	-5.87e-07	-0.00174	9.59e-05	1.82e-06	-0.00361	0.000373**	0.00890**	-0.00159	-1.73e-07	-4.94e-07	-5.47e-08	-0.00117	-0.00339	0.000851*	-0.00210
(-2.060)	(-1.828)	(1.001)	(2.610)	(-1.125)	(-1.420)	(0.0760)	(0.746)	(-1.029)	(2.122)	(2.053)	(-1.323)	(-0.521)	(-0.921)	(-0.104)	(-1.178)	(-1.047)	(1.791)	(-1.277)
-1.02e-08	0.000331**	2.25e-05	0.000178**	-3.81e-08	0.000507**	0.000443**	1.26e-08	-0.000219	7.04e-05***	0.00119***	0.000593**	1.39e-08	2.56e-08	-1.54e-09	0.000266**	-0.00155***	0.000210**	0.000852**
(-0.235)	(-14.41)	(1.008)	(12.60)	(-0.900)	(-13.26)	(12.17)	(0.0939)	(-1.034)	(12.07)	(2.849)	(-14.50)	(1.199)	(0.699)	(-0.0383)	(-13.73)	(-12.27)	(14.13)	(-13.28)
635	589	501	425	635	494	499	635	497	570	570	589	635	635	635	589	497	589	495
1.000	0.999	0.999	1.000	1.000	0.998	0.997	1.000	0.969	1.000	0.955	0.997	1.000	1.000	1.000	0.999	0.982	1.000	0.993