Exchange Traded Funds Market Reactions to Option Introduction

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We utilize option introduction on Exchange Traded Funds (ETFs) to examine market efficiency using event-study methodology and time series regressions to test security returns, bid-ask spreads, trading volume, and return volatility. We find evidence via positive abnormal returns, lower bid-ask spreads, and higher trading volume that option introduction improves market efficiency. ETFs unique shorting characteristic seems related to the results as are different ETF types.

JEL classification: G14; G11

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1. Introduction

We examine the impact of an option's introduction on the underlying exchange traded fund (ETF). Our study adds to the literature by examining option introduction on an asset class that earlier works do not consider. However, more important than just adding to such a list is the fact that our study examines option introduction on an asset class with limited short sale restrictions. We explain this distinction below.

We consider option introduction impacts on the ETFs by examining returns, bid-ask spreads, price volatility, and trading volume. Following in the lines of empirical papers examining the impact of option introduction on equity securities, our study re-asks the basic market efficiency question: Does the introduction of options impact the underlying asset - ETFs in this case - and, by extension, investors and the financial markets? If we find an impact, then is it beneficial or harmful?

ETFs started trading in the U.S. in 1993 and in Europe in 1999 with the first option to trade based on an ETF in August 2000. ETFs are similar to open-end mutual funds in allowing investors to trade an underlying basket of investments (such as stocks, bonds, and/or commodities) at, roughly, the net asset value (NAV) of the basket. Most ETFs are index funds tracking a specific set of investments (for example, the S&P 500), but actively managed ETFs exist. Also, ETFs allow the investor to trade throughout the day like ordinary stock shares or closed-end investment funds. Thus, an ETF has a potential advantage over open-end mutual funds which usually only trade at the NAV at the end of each business day. Additionally, ETFs have a potential advantage over closed-end funds which have set limits on the number of shares authorized while ETFs do not. The method behind this potential advantage is that institutional investors trade "creation units" in the primary market while non-institutional investors trade ETF shares in the secondary market. As such, there is no set supply of ETF shares as in a closed-end fund. These distinct characteristics of ETFs make them of interest.

However, the unique feature of ETFs that leads us to ponder the impact of option introductions is that ETFs do not face short sale restrictions similar to stocks. Interestingly, an ETF can actually have a "net short" position where the cumulative shares sold short are greater than the existing secondary market shares. In theory, the limited short sale constraint will affect ETF's reaction to option introduction.

In a perfect market a la Black and Scholes (1973) there would be no impact from the introduction of an option on the underlying asset's risk or return. However, if the market is not perfect, the option introduction can have positive or negative impacts. The explanations of why there will be an economic impact start from the same theorized point of some improvement in an imperfect market. The first market improvement is increased information. Ross (1976) and Arditti and John (1980) explain how an option's introduction can lead to a higher price for the underlying asset. The reason is that the option allows a more complete asset market by allowing an expanded opportunity set. This improved investment set should lead to new investors who increase the demand for the underlying asset. This increased demand drives the underlying asset's price higher, all else held constant.

Miller (1977) and Faff and Hillier (2005) provide an explanation for why the increased information can lead to a lower price for the underlying asset. The argument is that the new option improves the opportunity set by allowing a synthetic short on the underlying asset for investors who do not own it. A synthetic short eliminates short sale constraints which would have lead to an imbalance in the underlying asset market. An imbalance from short sale constraints would have created a higher price level for the asset in the past. Thus, the removal of the constraints results in a lower equilibrium price for the underlying asset after the option introduction.

Faff and Hillier (2005) also discuss two related ideas, but whose outcomes are not clearly higher or lower prices. The first idea is that the option introduction can decrease transaction cost frictions and, especially, short sale restrictions as discussed above. The lessening of these efficiency constraints improves the usefulness of information and provides an incentive for investors to gain added information to earn abnormal profits through trades that previously would have proven too expensive (from transaction costs) or impossible (given short-sell constraints on the underlying assets) without the option's existence (Jarrow, 1980).

The second Faff and Hillier (2005) idea follows the same route to lower efficiency constraints and the incentive for information as in the above paragraph. However, in the second variation, the emphasis is on the incentive for investors to trade on private information. Since private information is not always good, there is no a priori reason to expect a price reaction in a particular direction.

Grossman (1988) explains another reason related to the opportunity set for option introduction having a positive price reaction on the underlying asset. This explanation focuses on volatility. Simply stated, the model holds that a world with no options would make it more difficult for an investor to infer the number of investors following a given investment strategy, thus, providing no inference on volatility. If the model holds, the introduction of options would provide information on other investors' strategies and an estimation of implied volatility. Investors could then create investments that were likely more efficient given the better estimation of risk.

Option introductions can also have detrimental market impacts based on volatility- and liquidity-based ideas. If the option's introduction moves trading away from the underlying asset, the result could be an increase in volatility and a decrease in the liquidity for the underlying asset (Faff and Hillier, 2005). There could also be an increase in trading from uninformed traders given lower transaction costs. The added noise from the uninformed traders would be a destabilizing feature that increases volatility (Stein, 1987).

Based on the theory discussed above, we expect two ETF characteristics will limit the impact of option introductions. First, since many ETFs are index funds, the underlying assets should be close to the theoretical efficient frontier. Any improvement from a more efficient risk/return tradeoff is unlikely as compared to a single company's stock. Thus, this ETF characteristic leads to the expectation of little impact on the underlying asset's price, volatility, or liquidity in line with the different theories advanced by Ross (1976), Miller (1977), Arditti and John (1980), Grossman (1988), and Faff and Hillier (2005).

Second and more importantly, the effectively unlimited shorting of ETFs should eliminate the Miller (1977) and Faff and Hillier (2005) argument of a decrease in the underlying asset's price based on the ability to create a synthetic short with the option. We will return to this idea again within the literature review section.

Thus, theory does not provide a clear picture as to whether options should be beneficial or detrimental for the underlying asset market.[1] Researchers use empirical studies examining market data to find what has actually taken place with various option introductions and we add to this area by examining the impact of option introductions on ETFs. We find evidence that the option introduction is a market-improving event via positive abnormal returns, lower bid-ask spreads, and higher trading volume. We make sure to note, however, that the results are not uniform across all ETF types.

Section 2 provides a literature review to present the findings of other researchers to date. Section 3 details our data and Section 4 presents methodology to examine option introduction impact on the ETFs. Section 5 reports results and Section 6 summarizes the paper and provides concluding comments.

2. Literature Review

Most empirical studies examining the impact of option introduction on the underlying assets focus on option introductions on equity shares.[2] Recent studies widen the research to include real estate investment trusts (Diavatopoulos, et al., 2009) and depositary receipts (Benrud and Smirnova, 2010). We begin our literature review with studies examining equity shares.

2.1. Studies Examining Equity Shares

Early empirical analyses of U.S. markets generally find positive abnormal returns for stock for associated option listings. For example, Conrad (1989) uses data from 1974 to 1980 and event-study methodology. Her evidence shows positive and long-lasting excess returns for the stock associated with the introduction of the option, but no significant changes at the announcement date itself. Thus, it is not the knowledge that the option will begin trading that is deemed significant by the market, but the actual ability to trade that option. Conrad also tests for differences in the returns for options introduced in 1980 versus 1974-1979 and finds no meaningful differences. We mention this result given that it presages later studies that find differences between returns for option introductions after 1981.

Studies examining later option introductions find opposite or less-clear results. For example, Sorescu (2000) examines data from 1973 to 1995. He replicates the findings of Conrad (1989) and others as to positive abnormal returns associated with options introduced before 1981. However, he finds negative abnormal returns for the underlying asset with options introduced starting in 1981. One possible reason for the difference is that most early options were calls. Sorescu finds call options have positive abnormal returns while put options have negative abnormal returns. However, call option introduction abnormal returns turn negative or, at least, non-positive, after 1981 as well.

Sorescu puts forward three potential reasons for the switch in abnormal returns. First, the introduction of index options occurred in 1982 which would likely reduce some of the usefulness of an option on a particular stock as the index option would provide an indirect method to accomplish what the direct option could do. Second, he notes that firm characteristics were changing over time and that later option introductions are generally for smaller and "less seasoned" firms. Sorescu notes that options allow negative information to be used in trading more easily (by getting around the possibly tighter short sale restrictions on the smaller firms). Third, he notes multiple regulatory/market changes. For example, options began trading on Philadelphia and Pacific exchanges along with AMEX and CBOE markets. Also, options began trading for stocks listed on NASDAQ and not just AMEX and NYSE. His tests do not provide consistent support for any of the above possible reasons as explanations for the generally lower returns after 1981.

Studies looking at non-U.S. markets also provide conflicting results (see Sahlstrom, 2001). Faff and Hillier (2005) provide a possible explanation linked to firm characteristics along the line of the

[1] The interested reader should see Hiremath (2009) for a more extensive review of theoretical model variations and the theorized impact on underlying asset prices.

[2] For the interested reader, Damodaran and Subramanyam (1992) provide a review of early studies and Hiremath (2009) extends the review to later works.

argument in Sorescu (2000). Their study examines option introductions for equities traded on the London Stock Exchange over the period 1978 to 1999. Unlike the results using U.S. data, the authors find the underlying stock prices in their study experience positive abnormal returns with introduction during all time periods. They opine that the U.S. results can be explained by the condition that the earliest option introductions in the U.S. were for strongly performing companies with, most likely, strong future prospects and the option introductions lead to positive returns for the underlying stocks. However, as the option introductions began to be made for weaker performing companies, the abnormal returns began to lessen and/or turn negative. The authors' explanation for the continued positive abnormal returns for the London-traded stocks is that the British regulators limited option introductions to only the best performing companies.

Based on the above empirical evidence, the introduction of ETF options would likely produce negative price reactions just because the ETF option introductions are well after 1981. However, the ETF characteristics that allow unlimited shorting point to non-negative price reaction based on the theoretical review above.

The second area explored in option introduction research beyond returns is volatility. Theory holds that changes in volatility also impact investment efficiency. Early works examining U.S. markets (e.g. Ma and Rao, 1988, Bansal, Pruit, and Wei, 1989, and Damodaran and Subramanyam, 1992) report a general consensus of decreased volatility for the underlying asset where volatility is measured as the underlying asset's standard deviation of returns and/or systematic risk (Beta). Studies examining markets outside the U.S. also generally find decreased volatility for the underlying asset. Examples include Draper, Yadav, and Watt (1992), Chaudhury and Elfakhani (1995), and Sahlstrom (2001) for UK, Canadian, and Finnish markets, respectively.

However, the results are not uniform. Using U.S. data, Ma and Rao (1988) report different volatility results for underlying assets depending on the beginning volatility level of the underlying asset. Specifically, they find the introduction of options decreases the volatility for stable stocks, but increases the volatility of unstable stocks. Faff and Hillier (2005) also find evidence of greater volatility in the underlying assets valuation after options introduction using UK data.

A third area of empirical research related to option introduction is basic market efficiency measures such as volume and bid-ask spreads. Examples of U.S.-based studies examining these issues are Skinner (1989) and Damodaran and Lim (1991). They find bid-ask spreads to be lower after option introduction with mixed evidence concerning trading volume. Faff and Hillier (2005) report greater trading volume and a decreased bid-ask spread with evidence of greater market depth for the underlying assets in their study of the UK market. Sahlstrom (2001) examines the underlying stocks for options introduced in Finland over 1992-1995 and finds bid-ask spreads to be lower for stocks having option introduction.

2.2. Studies Examining Other Investment Types

Studies examining option introduction on underlying assets other than stocks can provide added insight to option introduction for ETFs. Benrud and Smirnova (2010) examine the impact of option listings on Depositary Receipts (DRs) in the U.S. over the period 2000-2007 using event study methodology. In general, their study finds that the introduction has a negative impact on the DRs in agreement with post-1981, U.S.-based studies as discussed above. The authors compare the returns for stocks with options and DRs to a matched sample of stocks with options, but without DRs, and find the impact is less for the stocks with DRs. The authors conclude that their results are in agreement with the idea that options on stocks increase market efficiency.[3]

In a similar manner, Diavatopoulos et al. (2009) consider the impact of option introductions on Real Estate Investment Trust (REIT) securities. They use a 1997-2006 period sample drawn to compare REITs with option introductions to those without during the test period and report

[3] In a related idea, Chern et al. (2008) report that companies reporting stock splits have lower positive impact on the underlying stock if options trade on that stock. This result also supports the idea that options increase market efficiency.

negative returns for the REITs with option introduction over both short- and longer-term intervals. The study also finds evidence of increased trading volume, but no change in volatility of returns. As such, the authors conclude that REITs respond to option introductions in a manner similar to other equities in the after-1981 period.

3. Data

We use Commodity Systems, Inc to obtain a list of 1,109 ETFs and the Option Clearing Corporation (OCC) to search for exchange-traded options. The first ETF option introduction is August 2000, but our first useable data are from February 2001. We match 541 ETFs with option introduction from January of 2001 through the end of 2010. We identify 233 ETFs with complete data and categorize the ETFs into the following types: stock-/non-stock-based, domestic/foreign, and bull/bear (whether the ETF makes money when the underlying asset increases or decreases in value, respectively). Table 1, Panel A reports the number of option introductions by year and the number of observations in each category.

We first divide the ETFs by stock- or non-stock-based. This distinction will allow us to address if there is any difference in the results based on the assets underlying the ETFs themselves. Given results from the DR and REIT option introductions, we have little reason to expect differences in reactions, but we cannot know unless we test. We utilize domestic and foreign ETFs given the differences in results for returns for U.S. and non-U.S. data sets. Finally, we examine both bull and bear ETFs since the issue of the ability to short seems likely to be a driving factor in explaining returns. Since a bear fund is an expectation of lower prices on the underlying asset, the ability to short the ETF would seem to be superfluous in such a case. Difference between the two groups' returns would point to future empirical research questions.

Given the wide dispersion of observations, we do not believe results will be driven by a time-clustering effect. Of the 233 options, 197 are stock-based ETFs. These 197 ETFs consist of 59 and 138 associated with foreign and domestic stocks, respectively. While all the foreign stock-based funds and 119 domestic options are for bull ETFs, 19 of the domestic stock-based ETFs are for bear funds. Finally, we identify 36 non-stock ETFs which are all bull funds. Of these non-stock ETFs, 26 focus on non-commodity investments such as real estate, currencies, and fixed-income securities (U.S. Treasury and/or corporate bonds). We label this category "other". The remaining 10 non-stock ETFs (which we label "commodity" ETFs) follow commodities such as gold, silver, oil, gas, and/or crops (e.g. wheat).

Panel B of Table 1 reports summary statistics for the ETF groups related to bid-ask spread (which we present in "ask minus bid" form so it is a positive value), average trading volume, and Beta (as a measure of volatility). The disparity of values shows the need to break the ETFs into groups. Commodity ETFs have the smallest nominal spread for both mean and median measures - roughly half or less of the other sub-groups' spreads. Mean trading volume is the greatest for bull domestic stock ETFs, but the median volume is greatest for commodity ETFs. As such, commodity ETFs would seem to be the least likely candidate for efficiency improvement. Finally, as expected, bear ETFs have a negative average Beta while all the various bull ETFs have positive average Betas.

4. Methodology

We use event study methodology to measure abnormal returns (ARs) and cumulative abnormal returns (CARs) for all ETFs and for each category. The event date, t_0, is the date of option introduction as stated on the OCC website. We calculate the abnormal returns for each date t in the event period as:

$$AR_{it} = R_{it} - (\alpha + \beta R_{mt}) \qquad (1)$$

where AR_{it} is the abnormal return for security i, R_{it} is the daily return for security i, R_{mt} is the daily return on the Center for Research in Security Prices (CRSP) value weighted index, and the parameters α and β are obtained from the market model estimated with daily returns from the period t_{-120} to t_{-20} relative to the introduction date. We then use Model (1) AR values to calculate

CARs over various test period intervals. We report Day -1, Day 0, and Day +1 individually and intervals [-1,1], [0,1], [-1,3], and [0,9]. We use the last two intervals to examine the CARs over a longer time period and examine the robustness of the results a la Diavatopoulos et al. (2009).

Table 1
Descriptive Statistics

Panel A:

Year	Bull Domestic Stock	Bull Foreign Stock	Bear Domestic Stock	Bear Domestic Other	Bull Commodity	Bull Total
2001	6	0	0	0	0	6
2002	19	2	0	1	0	22
2003	1	0	0	5	0	6
2004	2	0	0	1	0	3
2005	22	11	0	1	0	34
2006	18	11	0	1	0	30
2007	10	10	11	9	3	43
2008	22	8	3	2	3	38
2009	15	11	5	2	2	35
2010	4	6	0	4	2	16
Total	119	59	19	26	10	233

Panel B:

	All ETFs	Bull Domestic Stock	Bull Foreign Stock	Bear Domestic Stock	Bull Other	Bull Commodity
Spread ($)						
Mean	0.130	0.119	0.128	0.209	0.101	0.041
Median	0.060	0.080	0.070	0.070	0.060	0.030
Std Dev	1.996	0.128	0.178	0.509	0.128	0.044
Volume (# shares)						
Mean	4,714,368	7,437,606	1,643,168	3,670,657	211,502	3,049,684
Median	107,500	66,150	165,400	303,750	76,900	423,750
Std Dev	28,299,287	38,576,554	7,873,021	8,395,096	382,823	5,327,150
Beta						
Mean	0.839	1.229	1.228	-2.131	0.424	0.620
Median	0.994	1.098	1.102	-2.147	0.219	0.396
Std Dev	1.116	0.558	0.579	0.838	0.772	0.776

Note: Panel A table provides the timing of option introductions for the exchange traded funds (ETFs) along with fund type. Panel B: **S**ummary statistics for the ask-bid spread, trading volume (both variables estimated over the period -120 to +120 days relative to option introduction for each ETF), and the beta (estimated over the period -120 to -20 days before the option introduction).

After matching data with CSRP, our final sample includes 119 bull domestic stock, 59 bull foreign stock, 19 bear domestic stock, 26 non-stock ("other"), and 10 commodity ETFs as reported in Table 1. We also match two non-stock bear funds, but this small sample size precludes testing. If option trading began less than 120 days after the ETF's introduction, there is not enough time to estimate the market model parameters and we exclude such options from our sample.

To consider changes regarding trading efficiency, we adopt the relative spread measure of Sahlstrom (2001):

$$[(\text{ask quote} - \text{bid quote}) / \{(\text{ask quote} + \text{bid quote})/2\}] \times 100 \quad (2)$$

Without the benefit of Trade and Quote (TAQ) data, we use the closing bid and ask quotes from the CRSP database and compare the average and median spread 120 days before and after the option introduction date. The Kolmogorov-Smirnov test shows the spread series are not normally distributed, so we compare the differences using the Wilcoxon signed rank non-parametric test.

As an additional test on the difference in spreads before and after the option introduction date, we adopt the methodology of Faff and Hillier (2005). Using the same definition of the spread in (2) above, we measure the impact of option introduction on ETFs based on the following regression:

$$\text{Spread}_{it} = \alpha_i + \delta_i D_t + \varepsilon_{it} \quad (3)$$

where α is the intercept, D_t is a dummy variable equal to 1 for days 0 to + 120 and equal to 0 for days -120 to -1, and δ_i is the coefficient of interest for the efficiency argument.[4] A significant δ coefficient represents a statistically significant change in spreads. Improved efficiency, as expected based on the literature review above, would lead to reduced spreads – that is, δ would be negative.

As another measure of efficiency and similar to Sahlstrom (2001), we conduct tests on the difference in the ETFs volatility 120 days before and 120 days after option introduction. We measure the average standard deviation of raw returns and the excess return volatility and define excess return as in equation (1) with a parameter estimation period of (-120 to -20). As a robustness check, we also measure relative volatility in the manner of Diavatopoulos et al. (2009). We define relative volatility as the daily standard deviation of the ETF divided by the standard deviation of the CRSP value weighted index.

Once again, due to the non-normality of the data, we examine the difference between periods using the Wilcoxon signed-rank non-parametric test.

If the tests show less volatility, then we interpret that result as being in line with improving the completeness and, therefore, efficiency of the market. However, it is quite possible to find higher volatility. If trading costs decrease, for example through lower bid-ask spreads, then the Stein (1987) argument of easier trading access for poorly informed investors is met. In that case, the price would move away from its intrinsic value and show increased volatility.

As a final efficiency test in line with Faff and Hillier (2005) and Diavatopoulos et al. (2009), we compare ETF trading volumes before and after option introduction. We calculate the relative volume as:

$$[\text{ETF volume} / S\&P\ 500\ volume] * 100 \quad (4)$$

where we take the ETF volume from CRSP and the S&P volume from Yahoo Finance. We calculate the mean and median relative volumes for each ETF for the before (days -120 to -1) and after (days 0 to +120) option introduction periods. We group the ETFs together to test the differences of means ("mean after" – "mean before") and medians ("median after" – "median before"). Due to non-normality of the data, we use Wilcoxon signed rank tests to consider significance of any changes.

As a robustness test and in line with Faff and Hillier (2005), we also analyze the volumes using:

$$\text{RelativeVolume}_{it} = \alpha_i + \delta_i D_t + \varepsilon_{it} \quad (5)$$

where D_t is a dummy variable equal to 1 for days 0 to + 120 and equal to 0 for days -120 to -1, and δi is the coefficient of interest for the efficiency argument.[5] A significant δ coefficient is evidence of a change in efficiency. Improved efficiency should lead to increased volume – that is δ_i would be positive. We also note that we expect spread and volume changes to be negatively related.

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[4] We also test Equation (3) using the dummy variable, D_t, as equal to 1 for days 0 to +10 and equal to 0 for days -120 to -1.

[5] We also test Equation (5) using the dummy variable, D_t, as equal to 1 for days 0 to +10 and equal to 0 for days -120 to -1.

Greater trading volume can help lead to lower bid-ask spreads while lower spreads likely help increase volume.

5. Results

Table 2 reports results from the event study tests both for single day ARs (Day -1, Day 0, and Day +1) and CARs for intervals ([-1,1], [0,1], [-1, +3], and [0,+9]). The first impression is a paucity of significant results related to returns. The second thing to note is that nine results show positive abnormal returns with only two showing negative abnormal returns. Thus, the majority of significant results supports option introduction as helpful for underlying asset returns.

Table 2
Event Study Results

	ALL ETFs (233 options)		Bull Domestic Stock (119 options)		Bull Foreign Stock (59 options)	
Test Period	[C]AR(%)	%POS	[C]AR(%)	%POS	[C]AR(%)	%POS
-1	-0.042	52.8	0.115	55.5	-0.327	47.4
0	0.065	51.9	0.088	52.9	0.021	54.3
1	0.119*	57.1**	0.011	53.8	1.835*	61.0*
[-1,1]	0.142	51.1	0.214	48.7	-0.123	45.7
[0,1]	0.184	51.1	0.099	46.2	0.204	57.6
[-1,3]	0.415*	54.0	0.495**	52.9	-0.351	42.4
[0,9]	0.465	47.6	0.323	49.2	-0.623**	39.0**
	Bear Domestic Stock (19 options)		Bull Other (26 options)		Bull Commodity (10 options)	
Test Period	[C]AR(%)	%POS	[C]AR(%)	%POS	[C]AR(%)	%POS
-1	0.003	57.9	-0.001	53.8	-0.053	40.0
0	-0.112	52.6	-0.001*	38.4	0.933	60.0
1	0.362**	57.9	0.002	53.8	0.380**	80.0**
[-1,1]	0.256	63.2	-0.001	53.8	1.267	80.0***
[0,1]	0.253	57.9	0.042	50.0	1.314	60.0
[-1,3]	1.111	78.9**	0.002	53.8	3.179**	90.0**
[0,9]	2.782*	68.4*	-0.000	42.3	5.398**	80.0**

Note: This table reports abnormal returns (ARs) and cumulative abnormal returns (CARs) for the Exchange Traded Funds in our sample around the date of option introduction or event date, t_0. We calculate the abnormal returns for each date t in the event period as: $AR_{it} = RT_{it} - (\alpha + \beta R_{mt})$ where AR_{it} is the abnormal return, RT_{it} is the daily return, R_{mt} is the daily return on the value weighted index, and the parameters α and β are from the market model estimated with daily returns from the period t_{-120} to t_{-20} relative to the introduction date. CAR values use ARs over a given interval. The test statistic for AR and CAR values is the Boehmer t-statistic as from Faff and Hillier (2005). The test statistic for POS is for a sign-test of the percentage of security returns that were greater than zero upon option introduction. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 level, respectively.

We find significantly positive ARs on Day +1 for all ETFs, bull foreign stock, bear domestic stock, and bull commodity ETFs. Further support for a positive reaction comes from the CAR results from the [-1,3] interval for bull domestic stock and bull commodity ETFs, as well as from the [0,9] interval for bear domestic stock and bull commodity ETFs. These results are in keeping with U.S.-based stocks for pre-1981 data as well as studies using data from outside the U.S.

Sign test statistics are positive for bull foreign stock (Day 1), bear domestic stock ([-1,3] interval), and bull commodity ETFs (Day 1, and [-1,1], [-1,3], and [0,9] intervals). Thus, these non-parametric tests results support the conclusion that option introductions are a positive event for ETFs.

Based on earlier empirical studies' findings, we are not surprised that our results are not uniformly positive. We do find significant negative returns for bull foreign stock and bull other. The ARs are negative for Day 0 for bull other ETFs. CARs are also negative for the [0,9] interval for bull foreign stock ETFs with the group's sign test statistic also negative. These results finding evidence of negative reactions are in line with earlier studies finding negative returns after 1981 for U.S. data.

Our interpretation of these results is that there is support of improved efficiency from option introduction for ETFs (with some counter-evidence for bull foreign stock and bull other ETFs). We examine bid-ask spreads, volatility measures, and volume to gain further insights.

Table 3
Relative Spread

	All (233 ETFs)	Bull Domestic Stock (119 ETFs)	Bull Foreign Stock (59 ETFs)	Bear Domestic Stock (19 ETFs)	Bull Other (26 ETFs)	Bull Commodity (10 ETFs)
Average relative spread[1]						
Before	0.273	0.277	0.313	0.292	0.218	0.107
After	0.226	0.250	0.209	0.254	0.174	0.106
DIFF	-0.048***	-0.026***	-0.102***	-0.038	-0.044**	-0.001
Median relative spread [2]						
Before	0.238	0.248	0.266	0.236	0.186	0.094
After	0.201	0.227	0.184	0.212	0.148	0.097
DIFF	-0.037***	-0.021***	-0.081***	-0.024	-0.038*	0.002

Notes: Following Sahlstrom (2001), the relative spread is calculated as: (ask quote – bid quote) / [(ask quote + bid quote)/2]*100. The closing bid-ask quotes are from CRSP and the test compares 120 days before option listing versus 120 days later option listing. DIFF is calculated as (After – Before). The P-value is from the Wilcoxon signed rank test. Rounding accounts for cases where DIFF does not seem to be exactly the value reported in the table for (After – Before) values. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 level , respectively. [1] This test takes the average spread for each ETF over the 120 days, and then reports the mean of those averages. [2] This test takes the median spread for each ETF over the 120 days, and then reports the mean of those medians.

Table 3 reports comparisons of bid-ask spreads - a gauge of market efficiency - before and after option introductions. The Wilcoxon signed-rank tests show the difference between the average spread before and after the option introductions is lower (often at the 0.01 level) for all, bull domestic stock, bull foreign stock, and bull other ETFs. A check of this result's robustness using median instead of mean values finds similar results. Thus, these bid-ask spread tests support added trading efficiency in all cases where results are significant. Note that the possible interpretation of option introduction being harmful from the negative returns findings for bull foreign stocks and bull other in Table 2 is not supported by the bid-ask spread results in Table 3. To consider the results in Table 3 further, we examine the spreads before and after option introduction using methodology in Faff and Hillier (2005). Table 4 provides further evidence of improved efficiency. Using a regression method based on a time dummy, the results show a significant decrease in spreads after option introduction for all categories except bull commodity ETFs as seen by the significantly negative time dummy coefficient, δ.[6]

Table 4
The Impact of Option Introduction on Spreads

	Mean Coefficient
All EFTs	
Intercept	33.39***
δ	-8.88***
Bull Domestic Stock	
Intercept	27.427***
δ	-2.692**
Bull Foreign Stock	
Intercept	31.342***
δ	-9.914***
Bear Domestic Stock	
Intercept	29.303***
δ	-3.979***
Bull Other	
Intercept	21.783***
δ	-3.779***
Bull Commodity	
Intercept	10.700***
δ	-0.122

Note: As in Table 3, we calculate relative spread as: (ask quote – bid quote) / [(ask quote + bid quote)/2]*100 (following Sahlstrom, 2001) using closing bid-ask quotes from CRSP and comparing 120 days before option listing versus 120 days after option listing. We regress the spread following Faff and Hillier (2005) as: $Spread_{it} = \alpha_i + \delta_i D_t + \varepsilon_{it}$ where D_t is a dummy variable equal to 1 for days 0 to +120, and $D_t = 0$ for days -120 to -1. Values are in basis points (such that we have multiplied the spread calculated above by 100). We also estimate above models utilizing days -120 to +10. Results are quantitatively similar except the δ coefficient is not significant for the "Bull Other" group in the second test period. Results are available upon request. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 level , respectively.

Table 5 provides the results from tests comparing volatility measures before and after option introduction for the ETFs. In most cases, there is no difference in the volatility measures before and after options introduction. We do find return volatility increased for bear domestic stock and bull other ETFs**.** The results support the Stein (1987) argument that lower trading costs (reported in Table 3 and Table 4 for bull other ETFs) allowed more poorly informed traders to participate in the market which increased volatility.[7] We also note that while the signed rank tests show significance, the actual differences are minimal and may not be economically significant.

Table 6 and Table 7 examine trading volume. Given the general result of lower bid-ask spreads reported in Table 3, we expect to find higher trading volumes after option introduction. We find just such a result in every test for both mean and median volume measures except for bull commodity ETFs (see Table 6). Table 7 shows that all groups except bull commodity ETFs have significantly

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[6] We find similar results when using days -120 to +10 (instead of -120 to +120) as our test period. These results are available upon request.

[7] Two factors lower confidence in this interpretation. First, the bull domestic stock ETFs do not show an increase in volatility in Table 5 even though that group shows lower trading costs in Table 3 and Table 4. Second, bear domestic stocks do not show lower spreads in Table 3 although they do in Table 4.

higher time dummy coefficients, δ. We interpret the results from these tests as providing solid evidence of beneficial impacts on ETFs from the introduction of options. Also, the fact that bull other ETFs show lower trading costs with higher volume provides support to the Stein (1987) argument that poorly informed traders helped lead to the added volatility reported in Table 5.

Table 5
Volatility Tests

	All (N = 233)	Bull Domestic Stock (N = 119)	Bull Foreign Stock (N = 59)	Bear Domestic Stock (N = 19)	Bull Other (N = 26)	Bull Commodities (N = 10)
Average Standard Deviation of Raw Returns						
Before	0.018	0.019	0.016	0.031	0.010	0.022
After	0.019	0.018	0.016	0.035	0.010	0.019
DIFF	0.001	0.001	-0.001	0.005	0.000**	-0.003
Excess Return Volatility						
Before	0.009	0.009	0.009	0.012	0.008	0.020
After	0.010	0.009	0.009	0.015	0.008	0.017
DIFF	0.000	0.000	-0.000	0.003*	0.000*	-0.003
Relative Volatility						
Before	1.501	1.427	1.657	2.247	0.812	1.744
After	1.497	1.434	1.615	2.304	0.992	1.404
DIFF	-0.004	-0.007	-0.043	0.056	0.180	-0.341

Note: The methodology to calculate average standard deviation of raw returns and the standard deviation of excess returns are from Sahlstrom (2001). The excess returns use an estimation period of -120 to -20 and the CRSP value weighted index. The relative volatility is the standard deviation of the ETF divided by the standard deviation of the value weighted index. This technique follows Diavatopoulos et al. (2009), but we use daily data from -120 to + 120. DIFF reports the after volatility measurement less the before measure (After - Before). The P-value is from the Wilcoxon signed rank test. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 level , respectively.

Table 6
Relative Volume

	All (N = 233)	Bull Domestic Stock (N = 119)	Bull Foreign Stock (N = 59)	Bear Domestic Stock (N = 19)	Bull Other (N = 26)	Bull Commodity (N = 10)
Average relative volume[1]						
Before	0.127	0.171	0.042	0.071	0.005	0.064
After	0.107	0.190	0.062	0.118	0.010	0.067
DIFF	0.019***	0.019***	0.020***	0.046***	0.005***	0.003
Median relative volume[2]						
Before	0.098	0.159	0.037	0.067	0.004	0.053
After	0.118	0.180	0.053	0.107	0.008	0.057
DIFF	0.019***	0.021***	0.016***	0.040***	0.004***	0.004

Note: We calculate relative volume as [(ETF volume) / (S&P 500 volume)] *100 using ETF volume from CRSP and S&P 500 volume from Yahoo Finance. We compare mean and median values for 120 days before option listing versus 120 days after option listing. The P-value is from Wilcoxon signed rank test. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 level , respectively. [1]This test is taking the average relative volume for each ETF over the 120 days, and then averaging the average of the ETFs. [2]This test is taking the median relative volume for each ETF over the 120 days, and then averaging the medians of the ETFs.

Table 7
The Impact of Option Introduction on Volume

	Mean Coefficient
All EFTs	
Intercept	0.045***
δ	0.009**
Bull Domestic stock	
Intercept	0.169***
δ	0.021**
Bull Foreign Stock	
Intercept	0.039***
δ	0.021***
Bear Domestic Stock	
Intercept	0.071***
δ	0.047***
Bull Other	
Intercept	0.005***
δ	0.004***
Bull Commodity	
Intercept	0.063***
δ	0.004

Note: We calculate the relative volume as [ETF volume) / (S&P 500 volume)] *100 using ETF volume from CRSP and S&P 500 volume from Yahoo Finance. We regress the relative volume following Faff and Hillier (2005) as: Relative $Volume_{it} = \alpha_i + \delta_i D_t + \varepsilon_{it}$ where D_t is dummy variable equal to 1 for days 0 to +120, and D_t = 0 for days - 120 to -1. We also estimated the same models as above, but utilizing only days - 120 to +10. Results are quantitatively similar except the δ coefficient is not significant for the Bull Domestic Stock group in the second test period. Results are available upon request. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 level , respectively.

6. Summary and Conclusion

We study whether the introduction of options on ETFs is beneficial or detrimental to financial markets. Examining 233 such option introductions provides considerable evidence that these introductions are beneficial for the underlying assets. We find support for positive abnormal returns for the ETFs as well as lower bid-ask spreads and higher trading volumes. Our explanation for the results is that securities which can be shorted, such as ETFs, are less likely to be overvalued. However, options can still allow a less expensive method to short than via the asset – ETF in this case – and, thus, improve market efficiency. Greater trading volume and lower spreads – as we find in general, support the improved efficiency argument. Thus, we find evidence that ETF option introduction removes frictions beyond short sale restrictions that constrain other financial assets.

The one area where our results do not support improved efficiency is in terms of volatility where, in general, our tests show no change, but with significant increases in volatility for one ETF type. That one result is in agreement with Stein's (1987) argument that lower trading costs can lead to increased activity by poorly informed traders who increase volatility.

The impact on ETFs is similar across types. For instance, bull and bear domestic stock ETFs have more results in common than different. Also, all test result differences for these two groups are situations where one group's statistical test shows significance, but the other group's does not. Thus, in no case does one group show significance test results counter to the other.

Foreign bull and domestic bull ETFs test results are similar as well with one exception. Foreign bull ETFs show significantly negative abnormal returns upon option introduction. Thus, while both ETF types show evidence of improved market efficiency via lower spreads and higher trading volumes, only domestic bull ETFs also show support for improved efficiency via the returns process.

We also find similar spread and volume results between stock ETFs and bull other ETFs. However, we do find one case where bull other ETFs show marginally negative returns upon option introduction and higher volatility. Thus, our decision to separate the ETFs by asset types provides evidence that all ETF reactions to option introductions are not uniform.

Our findings for commodity ETFs are quite interesting. While we find these ETFs have positive return reaction to option introduction, we find no significant change in spread, volume, or volatility. Thus, there is evidence of improved market efficiency from the returns, but no supporting result from any market microstructure tests. We conjecture that the nominally lower bid-ask spreads and higher trading volumes we report in Table 1 for the commodity ETFs are the reason. While the values reported in Table 1 are averages over the entire test period, the lower values indicate improved spreads, volume, and volatility in the commodity markets are more difficult given their nominally lower numbers as compared to the other ETF types.

In sum, our findings support the position that option introduction is a positive event for ETFs and that reduced trading costs combined with higher trading volume drives the improved efficiency. We find little evidence of increased volatility. We believe the positive reaction is related to the fact the ETFs do not face the same short sale restrictions that stocks do. Future research can examine this issue more closely while also considering if later ETF option introductions will show negative reactions in line with studies on U.S. stocks.

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