Will Trading Location Dominate in Pricing Dynamics? Evidence from international ETFs on U.S. market

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Abstract:

Exchange Traded Funds (ETFs) are rapidly developing in the US market and their components are expanding to markets all over the world. Although ETFs closely track on the NAVs of the component holdings but their pricing dynamics are decided largely by trading market. In this study, we investigate the joint dynamics of returns and trading volume of international ETFs based on 23 countries but listed in the US. Basing on comprehensive analysis of daily and intraday data, we find that the trading market (US market) significantly and strongly impacts the pricing behavior of international ETFs and this impact is persistent over time; the trading location effect grows gradually over the non-overlapping hours in the US market after home markets close, this pattern is persistent over time as well; until the end of the trading day, impact from the trading market rather than from the home markets is dominant in the pricing dynamics of international ETFs. Also, we find evidence that trading volumes in the US market will impact on return spillover to home markets.

Keyword: country-specific ETFs, trading location effect, intraday pricing behavior

I. Introduction

Exchange Traded Funds (ETFs) have become increasingly important in the US market. They now account for more than half of the daily trading volume on the American Stock Exchange. Earlier studies (Tse et al., 2006; Engle and Sarkar, 2006) have examined the price discovery of ETFs and the rationale behind their discounts and premiums. However, as they are still developing in every way and their components are expanding to international markets, there has been a lack of studies for international ETFs, business locations of which are different from their trading locations.

International ETFs offer considerable convenience for investors to get access to foreign markets, especially the emerging markets which have attractive growth while limitation of participation. Because the business hours and trading hours overlap in the home markets where firm-specific information is released, the home markets naturally become most influent for the trading assets. It is different, however, for the international ETFs. Although they are traded actively in, for example, the US market, the components maintain their core business in their home countries. Evidences (Engle and Sarkar,2006) in literature show that the premiums or discounts for international ETFs are much larger and more persistent than domestic ones, which indicates that the pricing of international ETFs differ from traditional domestic ones and may be largely affected by the trading locations. Therefore, it is interesting to investigate how trading location affects the pricing behavior of ETFs and tell which market effect is dominant in the pricing. The results will be informative for both investors and the financiers.

Trading location effect for pricing is shown by several studies (Gagnon and Karolyi. (2009,2010); Chan et al. (2003); Werner and Keidon (1996); etc.), however, they all focused on individual stocks which are dual-listed in different markets. One of the main issues inducing the pricing difference for the cross-listing securities is market-based barriers which include direct and indirect investment barriers faced by foreigners. Investment restrictions constitute the most important direct, market-based source of international capital market segmentation likely to impede inter-market arbitrage activity across jurisdictions. Potentially important sources of indirect market-based barriers for pricing differentials between cross-listed and home-market shares include differences in accounting standards and legal protections for minority shareholders across countries. However, the market barriers do not apply to the case of ETFs as ETFs actually facilitate investments in markets different from home markets by avoiding the cross-border restrictions and regulation differences, and simply tracking the NPVs of the component securities in their home markets.

What's more, difference in IPO process is another key issue which will affect investors' choices (Rosenthal and Young 1990; Bedi, Richards and Tennant 2003; de Jong, Rosenthal and van Dijk 2003). For example, significant difference in analyst coverage and average trade size suggest remarkably different investor bases for the stocks. And, the higher information gathering costs for foreign stocks brings more ambiguity in the pricing in the different trading market. Moreover, the net assets for a stock in domestic market and foreign market may be different as sometimes a company spares a good part to conduct IPO in foreign market which might have stricter standards. One of the reasons is that there are too many barriers in the processes of stock public offering in a market away from business location in home country.

Difference after being listed publicly also matters for the pricing deviations. Froot, Dabora (1999) explained the reasons for violation of the law of one price for cross-listing shares in several ways, for instance, the discretionary use of dividend income by home companies, differences in home company expenditures and voting rights, currency fluctuations, ex-dividend date timing issues and tax-induced investor heterogeneity. Focuses of those studies are more on reporting market integration for dual-listed stocks in different markets but not on the claim that location of trading matters.

The international ETFs offers a natural experiment for examining how price behavior is affected by trading location not only because the trading location is separated from its business location but also because those factors other than specific trading location that drive the difference between prices in domestic and foreign markets for stocks might be mitigated by the natural characteristics of ETFs.

Exchange Traded Funds are equity issues of companies whose assets consist entirely of cash and shares of stock approximating particular indexes. Thus the components of international ETFs have exactly the same net assets as what they are in their home markets. Different from cross-listed individual stocks, ETF share prices tend to closely track the value of their holdings in their original markets. That is, the share price of an ETF is not generated by the new public offering process of the new market; however, it is by definition generated from the value weighted average of the component holdings. Thus, if international ETFs share prices are still diverge from their net asset values in home markets, the trading location bias effect would be significant and important.

Market reports (TheStreet, 2006) in the US interestingly showed a significant phenomenon about the trading place bias. Although the average ETF has been selling within a whisper of its NAV, some have been averaging premiums and discounts nearly

10 times higher. The premium or discount matters because investors can get burned if they buy an ETF at a premium to its net asset value and sell at a discount. Interestingly, the list is dominated by ETFs that invest in non-U.S. stocks. The fact is consistent with the finding by Engle and Sarkar (2006) that compared to domestic ETFs, international ETFs premiums and discounts are much larger and more persistent, frequently lasting several days rather than only several minutes. Thus, it becomes interesting to examine trading place bias itself.

In this paper, we use daily and intraday data of worldwide non-U.S. based ETFs, and the corresponding home markets indices, and the S&P500 market index which represents the return dynamics of U.S. market, to investigate whether returns and trading activities in the U.S. market affect the pricing dynamics of an international ETF, to what extent the effect is, and in what way the effect happens. For our research purpose to specifically identify the effect of trading location on pricing compared to home market effect, we chose the country-specific equity ETFs as our research targets rather than those region or industry specific ones. We examined the trading location effect on all the 36 countries that have ETFs produced and traded in the US market. According to the ETF database of ETF guide (www.etfguide.com), there are 36 different countries that have equity ETFs traded in the US market. For each specific country, we chose one ETF which follows the broadest index of that country. Thus our sample contains 36 all-cap and all industry ETFs whose constituents cover almost all the fields of the economy of a country. We mainly report the results on the 23 country ETFs that have more than 3 years history and whose pricing behavior is mature and stable in the market. We got several interesting and significant findings of the trading location effect. We found that compared with their corresponding home replicated portfolios, returns on non-US based ETFs have significantly higher systematic comovements with U.S. market indexes and significantly lower systematic comovements with home market indexes. Although ETFs returns are not surprisingly closely related to the changes of both home markets and the US market, what is surprising is that the trading market instead of the home market will even dominate the pricing of the ETFs using the close-to-close returns at the end of the trading day.

Also, the trading location effect is more pronounced in the trading hours of the trading market and the non-trading hours of the home market. That is, when US market opens and the original market closes, the prices of non-US based ETFs prices should be much more affected by US market than when both markets are open.

Further, to examine the developing of trading location effect on the ETF returns, we use ETF intraday levels and US market intraday corresponding levels to get a better idea about how trading market affects the ETFs. We find that after the home markets close while the US market is still open, the impact from the US market is growing hour by hour. Until near the end of the trading day, US market finally "beats" the home markets to dominate in the returns of the ETFs. On the contrary, as home markets are frozen during the second half of the trading day, the impact from home markets weakens during the non-overlapping hours.

As we focus on the mature ETFs which have long history, we are also able to examine how the trading location develops over time. We find impact from the US trading market has an upward trend while the home markets' impacts bear a downward trend. The strengthening of US impact daily and the pattern of US growing impact are both persistent over time through the ETFs' history.

What's more, as one source of how the trading activities in the trading market impacts the ETFs, volumes of each country specific ETF in the trading market will affect its pricing behavior. Large volume of the ETFs will significantly cause return reversal in their home markets. On the contrary, small volumes may not have that affect.

This paper proceeds as follows. We review the literature and raise questions in section II. In Section III we develop our hypotheses and introduce our empirical methodology. In Section IV we describe our data and present our empirical findings, and in Section V we provide our concluding remarks and further continuing research.

II. Literature Review

We identified two streams of theoretical background for the trading place effect on pricing and international ETFs. The first stream of literature is how to price an ETF. And the second stream is how important the trading place might be for an asset.

i) General Pricing of ETFs

Engle and Sarkar (2006) illustrated the pricing of an ETF and investigated the extent and properties of the resulting premiums and discounts of ETFs from their fair market value. ETF tracks on the NAV but with premium and discount which is decided by market. If there is strong investor demand for an ETF, its share price will temporarily rise above its net asset value per share, giving arbitrageurs an incentive to purchase additional creation units from the ETF and sell the component ETF shares in the open market. The additional supply of ETF shares increases the ETF's market capitalization and reduces the market price per share, generally eliminating the premium over net asset value. A similar process applies when there is weak demand for an ETF and its shares trade at a discount from net asset value.

ETFs resemble closed end funds except for the unique feature that additional shares can be created or redeemed by a number of registered entities. Unlike closed-end funds, which are also bought and sold on an exchange but can trade at big discounts or premiums to their net asset values, ETF share prices tend to closely track the value of their holdings. Engle and Sarkar(2006) found that the spread of ETFs is much smaller than that of close-end funds.

Traditional research (Boudreaux, 1973; Rosenfeldt, 1973; Roll 1984; Stoll and Whaley 1990) attributed some of the premiums and discounts to errors in measurement. The measurements can be misleading because the net asset value of the portfolio is not accurately represented or because the price of the fund is not accurately recorded. Engle and Sarkar (2006) incorporated these features into a model with errors-in-variables that accounts for these effects and measures the standard deviation of the remaining pricing errors. What's more, they examined domestic and international ETFs using intra-day data and found significant differences in both magnitude and persistence of premiums or discounts between domestic and international ETFs.

The overall finding is that the premiums/discounts for the domestic ETFs are generally small and highly transient, once mismatches in timing are accounted for. Large premiums typically last only several minutes. For international ETFs, premiums and discounts are much larger and more persistent, frequently lasting several days. This finding is insensitive to the timing of overlap with the foreign market, the use of futures data, or different levels of time scale. The implication is that the pricing of ETFs is highly efficient for the domestic products and somewhat less precise for the international funds. It is partly because they face more complex financial transactions and risks as what are faced by those cross-listing stocks.

ii) Trading Location Effect on Pricing Cross-listing Securities

The classical finance paradigm predicts that an asset's price is unaffected by its location of trade. If international financial markets are perfectly integrated, then a given set of risky cash flows has the same value and risk characteristics when its trade is redistributed across markets and investors. However, some research showed anomalies when the trading locations of assets are different from their business locations.

Froot, Dabora (1999) examined pairs of large “Siamese Twin” whose stocks are traded around the world but have different trading and ownership habitats. Twins pool their cash flows, so, with integrated markets, twin stocks should move together. However, the difference between the prices of twin stocks appears to be correlated with the markets, on which they are traded most, i.e. a twin's relative price rises when the market on which it is traded relatively intensively rises. They explained the reasons in different payout police and shareholders’ rights between each pair but did not highlight how the trading market matters.Similarly, Chan et al (2003) examined the price behavior and market activity of the Jardine Group companies after they were delisted from Hong Kong in 1994. Although the trading activity of the Jardine Group moved to Singapore, the core businesses remained in Hong Kong and Mainland China. Evidence indicates the Jardine stocks are correlated less (more) with the Hong Kong (Singapore) market after the delisting.

A similar phenomenon lies in closed-end country funds (Thaler et al 1993; Bodurtha, Kim and Lee 1995).The closed-end country funds invest in emerging markets but are financed by issuing shares on developed-country markets. It is well known that the prices of these shares differ from the net asset values of the fund portfolios, which suggests that country fund stock prices are affected by an additional risk factor which does not affect their NAVs. They explained that premiums of individual funds move together because their stock prices reflect time-varying sentiments of U.S. investors while their NAVs do not. They used an index of country fund premiums to represent the differential sentiment of U.S. investors relative to their foreign counterparts and fund that when the premiums are higher (U.S. investors are more bullish), future share price returns on country funds tend to be lower. However, this proxy of investor sentiment has large endogeneity problem. They did not highlight the trading place bias and illustrate how the pricing changes with the trading activities in the trading location.

A recent test of trading place bias is conducted by Cheng, Fung and Tse (2008). They analyzed the pricing relations in the US between two exchange traded funds, the iShares FTSE/Xinhua China 25 Index (FXI) and the S&P 500 Index Fund (IVV). And the results indicate that Hong Kong home market basically drives the FXI returns in the US. The problem is that FXI is composed by 25 mainland firms which lised in the HK market. It is not a direct test between home market effect and trading location effect. Moreover, whether it is a special case between Chinese markets and U.S market is to be studied. This bias needs to be proved in more general cases and supported by more evidence. Thus in our study we use all the country specific ETF data to examine this trading location effect.

When the question comes to how the trading location impacts the pricing of cross-listed securities, we need to focus on the characteristics of the trading activities. Conrad et al. (1994) find empirical support for predictions about trading activity and autocorrelations in weekly returns of individual NASDAQ stocks: High-transaction stocks experience return reversals, while low-transaction stocks experience positive return autocorrelations, or continuations. This finding about trading activity and pricing is consistent with CGW's (1993) model. In CGW's (1993) model, risk-averse utility-maximizing agents act as market makers for liquidity or non-informational investors in a market environment characterized by symmetric information. This model implies that "price changes accompanied by high volume will tend to be reversed; this will be less true of price changes in days with low volume". Thus we will examine how the trading volume in the trading market impacts the ETF corresponding home returns.

ETFs naturally track their NAVs closely. The share price of an ETF is not generated by a new public offering process of a new market; however, it is by definition generated from the value weighted average of the component holdings. The international ETFs offers a natural experiment for examining how price behavior is affected by trading location not only because the trading location is separated from its business location but also because those factors other than specific trading location driving the difference between prices in domestic and foreign markets for stocks might be mitigated by the natural characteristics of ETFs.

III. Hypotheses and Methodology

As illustrated in ETF pricing literature (Engle, Sarkar 2006; TheStreet report 2006), the ETFs with the biggest premiums or discounts reported are dominated by non-US-based ones. For each international ETF in our sample, we obtained daily ETF transaction prices, NAVs, home index levels and volumes in the US market from the ETF providers' database (Ishares, SPDR, GlobalX) and that information is included also in DataStream. Daily and intraday transaction prices of all the country specific ETFs and IVV, the US-based SP500 fund which represents the trading market, can be obtained from TAQ. By examining the pricing relationship of the non-US-based country specific ETFs, the US and the home markets using daily and intraday data, we expect:

- Not only that home market impacts the pricing behavior of an ETF, the offshore trading market also impacts the pricing behavior of the ETF remarkably. The trading market instead of the home market will even dominate the pricing of the ETFs as the trading continues in the open trading day.
- Returns on non-US-based ETFs have significantly higher systematic comovements with U.S. market indexes and significantly lower systematic comovements with home market indexes, compared with their home replicated portfolios.
- The trading location effect on returns is more pronounced in the trading hours of the trading market and the non-trading hours of the home market. That is, when US market opens and the original market closes, the prices of non-US based ETFs should be much more affected by US market than when both markets are open. The trading location effect will grow gradually after the home markets close and US market is still open until the end of the trading day.

- Contemporaneous price deviations (premium/discount) from the home market NAVs should be significantly impacted by the dynamics in trading market. The impact from the trading market on the price deviations may be stronger than from home markets.
- Trading activity is an important issue in determining the non-US based ETF pricing behaviors. Large volume of the ETFs will significantly cause return reversal in their home markets. On the contrary, small volumes may not have that affect.

No doubt that the pricing of non-US based ETFs is both closely correlated with their home market corresponding index returns which are the foundations of the ETFs. And also, the pricing behavior which is vulnerable to trading activities must be affected by the trading location-US market. Thus, we firstly want to see how much each of the market affects the ETF pricing and which market has more power in generating the returns. We apply multivariate linear regression using our ETF panel data with multiple country specific ETFs and their daily price data over nearly ten years.

$$DR^{E}_{ius,t} = \alpha_0 + \alpha_1 DR^{US}_{t} + \alpha_2 DR^{US}_{t-1} + \alpha_3 DR^{H}_{i,t} + \alpha_4 DR^{H}_{i,t-1} + e_{1t} \quad (1)$$

$$DR^{E}_{ih,t} = \beta_0 + \beta_1 DR^{US}_{t} + \beta_2 DR^{US}_{t-1} + \beta_3 DR^{H}_{i,t} + \beta_4 DR^{H}_{i,t-1} + e_{2t} \quad (2)$$

Where $DR^{E}_{ius,t}$ is the daily return (close-to-close) of the i^{th} non-US-based ETF traded on the U.S. market at trading day t, $DR^{E}_{ih,t}$ is the daily return (close-to-close) of home NAVs of the i^{th} non-US-based ETF, $DR^{H}_{i,t}$ is the cross-market daily return of the i^{th} replicated indexes of the non-US-based ETFs in their home markets, and DR^{US}_{t} is the daily return of the SP500 index. The objective is to test the impact of cross-market returns of home traded non-US-based ETFs and returns of the U.S. market on the international ETFs traded on the U.S. market.

Using the country specific ETF returns in the US market as dependent variable in model (1), we expect that US market will impact the ETFs returns more than their home markets. Using the sample ETF US returns in (1) and their home returns each as dependent variable in model (2), we expect that compared with their corresponding home replicated portfolios, returns on non-US based ETFs have significantly higher systematic comovements with U.S. market indexes and significantly lower systematic comovements with home market indexes.

Next, we use Vector Autoregression (VAR) Granger Test to investigate the causality relationship among the three daily returns- returns of sample non-U.S. based country ETFs, the home market index returns and US market index returns (S&P500). One of the groups of Granger Test regressions is as follows:

$$DR^{E}_{ius,t} = \gamma_0 + \gamma_1 \sum DR^{E}_{ius,t-k} + \gamma_2 \sum DR^{H}_{i,t-k} + \gamma_3 \sum DR^{US}_{t-k} + e_{3t} \quad (3)$$

$$DR^{E}_{ih,t} = \tau_0 + \tau_1 \sum DR^{E}_{ih,t-k} + \tau_2 \sum DR^{H}_{i,t-k} + \tau_3 \sum DR^{US}_{t-k} + e_{4t} \quad (4)$$

Where k is the number of lags, the default number in STATA is 2. Other variables are defined before . The objective is to test whether impact of home-market index and U.S. market index returns on the non-US based ETFs traded on the U.S. market is as strong as a causality relationship. The above equation is one of the groups of regressions by Granger causality test. In this equation, three tests will be conducted in the vector autoregression (VAR) Granger causality test process. The first is a Wald test that the coefficients on the two lags of $DR^{H}_{i,t}$ that appear in the equation for$DR^{E}_{ius,t}$ ($DR^{E}_{ih,t}$)are jointly zero. The null hypothesis that $DR^{E}_{ius,t}$($DR^{H}_{i,t}$) does not Granger-cause $DR^{E}_{ih,t}$cannot be rejected. Similarly, the second is to test that the coefficients on the two lags of DR^{US}_{t} in the equation for $DR^{E}_{ius,t}$ ($DR^{E}_{ih,t}$)are jointly zero, so we can reject or not the hypothesis that DR^{US}_{t} does not Granger cause $DR^{E}_{ih,t}$. The third test is with respect to the null hypothesis that the coefficients on the two lags of all the other endogenous variables are jointly zero. That is, we can reject or not the null hypothesis that $DR^{H}_{i,t}$ and DR^{US}_{t}, jointly, do not Granger-cause $DR^{E}_{ius,t}$ ($DR^{E}_{ih,t}$). As there are three main variables, we can use Vector Granger Test to investigate the causality relationship among them. We expect that the US market where the trading of the ETFs happens will remarkably impact ETF returns i.e. US market returns will cause the ETF returns. On the contrary, the home market will exhibit less power on the pricing of ETFs.

However, trading hours in different international markets and the U.S. do not overlap, so intraday data that captures more detailed information will help us understand better how the international ETFs are priced during non-trading hours in its home market while during the trading hours in U.S. market. Shares of ETFs that invest abroad are traded primarily during U.S. trading hours. If the underlying shares can only be bought or sold on a foreign market in a different time zone, it could be more difficult to keep the fund's price in close line with its net asset value. Thus, shortening the trading interval to real-time transaction data will provide more evidence on the intraday pricing behavior of international ETFs. Using the closing time of each ETF’s home market as a benchmark point, at and before which each pair of home market and US market are open, after which only the US trading market is running. We can find the corresponding time in NYSE to those home markets closing times, and from TAQ we can get the intraday level of US market indicators such as the S&P 500 fund (IVV) and also the ETF intraday levels at the corresponding time. Using intraday US market data, we will examine how the US market impact the ETF returns when both home and US markets are open and when US market is still open but home market is closed. During the second part of the US trading day, the home NAVs for most international ETFs are frozen, yet the market prices for these funds continue to fluctuate to reflect new information. Following the same structure of above multivariate model and Vargranger test, we want to see whether both the impact and causality relationship with ETF returns especially US returns become stronger when only US market open than when both markets are open.

$$DR^{Eintra}_{ius,t} = \varphi_0 + \varphi_1 DR^{USintra}_{i,t} + \varphi_2 DR^{USintra}_{t-1} + \varphi_3 DR^{H}_{i,t} + \varphi_4 DR^{H}_{i,t-1} + e_{5t} \quad (5)$$

$$DR^{E}_{ih,t} = \varepsilon_0 + \varepsilon_1 DR^{USintra}_{i,t} + \varepsilon_2 DR^{USintra}_{t-1} + \varepsilon_3 DR^{H}_{i,t} + \varepsilon_4 DR^{H}_{i,t-1} + e_{5t} \quad (6)$$

$$DR^{Eintra}_{ius,t} = \pi_0 + \pi_1 \sum DR^{Eintra}_{ius,t-k} + \pi_2 \sum DR^{H}_{i,t-k} + \pi_3 \sum DR^{USintra}_{t-k} + e_{1t} \quad (7)$$

$$DR^{E}_{ih,t} = \omega_0 + \omega_1 \sum DR^{E}_{ih,t-k} + \omega_2 \sum DR^{H}_{i,t-k} + \omega_3 \sum DR^{USintra}_{t-k} + e_{1t} \quad (8)$$

Where $DR^{USintra}_{i,t}$ is the daily return of IVV in NYSE using the bid-ask midpoints of IVV at which time the i^{th} ETF home market closes. It is calculated as $\log(Price^{USintra}_{i,t}/Price^{USintra}_{i,t-1})$, where $Price^{USintra}_{i,t}$ is the bid-ask midpoint of ith ETF at which time the home market closes in day t. $DR^{Eintra}_{ius,t}$ is the daily return of ith ETF traded in US using its bid-ask midpoints at which time its home market closes. It is calculated as $\log(Price^{Eintra}_{ius,t}/Price^{Eintra}_{ius,t-1})$, where $Price^{Eintra}_{ius,t}$ is the bid-ask midpoint of ith ETF at which time its home market closes in day t. We call it “intraday daily returns” so forth to differentiate from “closing daily returns” which are calculated with closing prices. Other return variables are defined as before.

Thus, model (5) and (6) is different from model (1) and (2) in that (5) and (6) test how US market impact the ETF returns when both markets are open while (1) and (2) deal with the impact during gap hours. Similarly, model (3) and (4) test whether US market causes ETF net returns when only the US market is open; model (7) and (8) test the causality relationship among the returns when both the two markets in one pair is open.

For models (1)-(8), we also use the daily changes of ETF returns denoted as $\Delta \mathrm{DR}^{\mathrm{E}}_{\mathrm{ius,t}}$ and $\Delta \mathrm{DR}^{\mathrm{E}}_{\mathrm{ih,t}}$ as dependent variables to examine the trading location effect. We believe that if returns of non-US based ETFs are significantly affected by the US market. Then the difference of ETF returns should also be affected by US market returns and even its lags. And we expect that the change of the trading location impact due to the trading hours on the daily return differences will behave in a similar pattern as that on the daily returns.

Further, we will examine how the US market impact on ETF pricing dynamics is changing intraday. We believe the US market impacts on the ETFs are more pronounced in the non-overlapped trading hours and this impact is growing gradually after the home markets close. This is based on our knowledge that during the left part of the US trading day, the ETF home replicated index levels are frozen because home markets are closed, yet the market prices in US continue to fluctuate to reflect new information. Moreover, when both markets are open the ETF pricing behaviors are also largely influenced by their home markets, which will distract and mitigate the return spillover from the US market. The trading location effect will grow stronger after the home markets close leaving only the US market affecting the ETF pricing behaviors. Meanwhile, the home market effect will become weaker after the home markets close. Basing on this intuition, we can obtain the intraday levels of ETFs at every specific time we need, and test how the US market returns at the same time impact them. All the intraday levels can be represented by the bid-ask midpoints at the wanted time. The models are as following:

$$\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra}} = \varphi_0 + \varphi_1 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra}} + \varphi_2 \mathrm{DR}_{\mathrm{t-1}}^{\mathrm{USintra}} + \varphi_3 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{H}} + \varphi_4 \mathrm{DR}_{\mathrm{i,t-1}}^{\mathrm{H}} + \mathrm{e}_{5\mathrm{t}} \quad (5)$$

$$\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra1}} = \varphi_0 + \varphi_1 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra1}} + \varphi_2 \mathrm{DR}_{\mathrm{t-1}}^{\mathrm{USintra1}} + \varphi_3 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{H}} + \varphi_4 \mathrm{DR}_{\mathrm{i,t-1}}^{\mathrm{H}} + \mathrm{e}_{5\mathrm{t}} \quad (5a)$$

$$\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra2}} = \varphi_0 + \varphi_1 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra2}} + \varphi_2 \mathrm{DR}_{\mathrm{t-1}}^{\mathrm{USintra2}} + \varphi_3 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{H}} + \varphi_4 \mathrm{DR}_{\mathrm{i,t-1}}^{\mathrm{H}} + \mathrm{e}_{5\mathrm{t}} (5b)$$

$$\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra3}} = \varphi_0 + \varphi_1 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra3}} + \varphi_2 \mathrm{DR}_{\mathrm{t-1}}^{\mathrm{USintra3}} + \varphi_3 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{H}} + \varphi_4 \mathrm{DR}_{\mathrm{i,t-1}}^{\mathrm{H}} + \mathrm{e}_{5\mathrm{t}} (5c)$$

$$\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra4}} = \varphi_0 + \varphi_1 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra4}} + \varphi_2 \mathrm{DR}_{\mathrm{t-1}}^{\mathrm{USintra4}} + \varphi_3 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{H}} + \varphi_4 \mathrm{DR}_{\mathrm{i,t-1}}^{\mathrm{H}} + \mathrm{e}_{5\mathrm{t}} (5d)$$

$$\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra5}} = \varphi_0 + \varphi_1 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra5}} + \varphi_2 \mathrm{DR}_{\mathrm{t-1}}^{\mathrm{USintra5}} + \varphi_3 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{H}} + \varphi_4 \mathrm{DR}_{\mathrm{i,t-1}}^{\mathrm{H}} + \mathrm{e}_{5\mathrm{t}} (5e)$$

$$\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra6}} = \varphi_0 + \varphi_1 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra6}} + \varphi_2 \mathrm{DR}_{\mathrm{t-1}}^{\mathrm{USintra6}} + \varphi_3 \mathrm{DR}_{\mathrm{i,t}}^{\mathrm{H}} + \varphi_4 \mathrm{DR}_{\mathrm{i,t-1}}^{\mathrm{H}} + \mathrm{e}_{5\mathrm{t}} (5f)$$

Where $\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra1}}$ is the daily return of i^{th} ETF in the US market using intraday prices one hour after its home market closes. $\mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra1}}$ is the daily return of IVV in NYSE using intraday prices one hour after the i^{th} home market closes. $\mathrm{DR}_{\mathrm{ius,t}}^{\mathrm{Eintra2}}$ is the daily return of i^{th} ETF in the US market using intraday prices two hours after its home market closes. $\mathrm{DR}_{\mathrm{i,t}}^{\mathrm{USintra2}}$ is the daily return of IVV in NYSE using intraday prices two hours after the i^{th} home market closes. Similarly, intra3,4,5,6 define for daily returns using intraday prices 3,4,5 and 6 hours after corresponding home markets close, respectively.

Other variables are defined as before. The earliest corresponding home closing time in NY time is 9:30 am in the morning. Thus we collect the intraday levels up to six hours after home markets close, i.e. until half an hour before the US trading market closes. Each time we use the specific time intraday IVV and ETF levels, we exclude those who already reach the US closing time. For example, home closing time of EWC and EWW is 4pm in New York time, and then when we use the "one hour later" intraday levels, we exclude these two ETFs in our regression sample. Home closing time of EWZ is 3pm in New York time, so when we use the "two hour later" intraday levels, we will exclude not only EWZ but also EWC and EWW in our regression sample. This sampling procedure will leave only those ETFs that are still traded in the US market after each specific time we assumed in each regression analysis and exclude the noisy ETFs which are resting in the close time.

What's more, investors do care about the premium/discount of an ETF, i.e. how much the ETF price deviates from its NAV. Nobody wants to buy a security in a large premium with a huge risk of selling with a big discount in the future. As premiums/discounts are really generated in trading activities, we expect that the trading market will impact ETF price deviations much more than its home market. To control for the price deviations generating from time lags, we use the intraday ETF price in the US market which is at the same time of its home market closing time to calculate the contemporaneous price deviations from NAV. We can find the corresponding time in NYSE to those home markets closing times, and from TAQ we can get the intraday level of ETF prices and US market indicators (i.e. the S&P 500 fund (IVV)) at the corresponding intraday time. Both intraday ETF price level and market index fund level are midpoints of the prevailing bid and ask quotes at that time recorded in TAQ. To estimate the impact from the trading market and home market to the ETF contemporaneous premium/discount, we have model (7) and (8) as follows:

$$PD^{E}_{iintra,t} = \delta_0 + \delta_1 DR^{USintra}_{t} + \delta_2 DR^{USintra}_{t-1} + \delta_3 DR^{H}_{i,t} + \delta_4 DR^{H}_{i,t-1} + e_{7t} \quad (9)$$

$$PD^{E}_{iintra,t} = \rho_0 + \rho_1 \sum PD^{E}_{iintra,t-k} + \rho_2 \sum DR^{H}_{i,t-k} + \rho_3 \sum DR^{USintra}_{t-k} + e_{8t} \quad (10)$$

Where $PD^{E}_{iintra,t}$ is the contemporaneous price deviations (premium/discount) of i^{th} ETF from the home market NAVs market at trading day t, and it is calculated as log (P_{us}/P_{home}).P_{us} is the ETF intraday price in the US market and P_{home} is ETF home NAV value at the home closing time. $DR^{USintra}_{i,t}$ is the return of IVV in NYSE at which time the ith ETF home market closes at day t. $DR^{H}_{i,t}$is the cross-market daily return of the ith replicated indexes of the non-US-based ETFs in their home markets at trading day t. We identify the closing times for each market from the Dow Jones Indexes Pricing and Exchanges Table, compute the corresponding New York time, and obtain the midpoint of the prevailing bid and ask quotes for the U.S. S&P 500 fund (IVV) and for the ETFs as their intraday level. Model (9) is to test whether and to what extent ETF price deviations are affected by home-market and U.S. market returns. We can get clear indication from the coefficients about whether up and down movements of the trading market and home market will sharpen or mitigate the price deviations.

Model (10) is to further test whether impact of home-market index and U.S. market index returns on the non-US based ETFs traded on the U.S. market is as strong as a causality relationship. Model (10) is one of the groups of regressions by Granger causality test. The logic and steps of the tests are same as what is described before for model (3) and (4). We expect that the US market where the trading of the ETFs happens will remarkably impact ETF price deviations from their home NAVs. Up movements in the trading market may support the price deviations in the trading market while up movements in the home market may mitigate the difference. The analysis will also be similarly applied to daily changes of the price deviations.

As trading activities in home and US markets can affect the return differences, we follow the literature (CGW, 1993; Conrad et al, 1994; Gagnon and Karolyi, 2009) examining the relationship between the trading volume dynamics and security returns and will explore this trading location effect hypothesis by incorporating trading volume into the multivariate models We hypothesize that there will be a significant influence of volume on US-to-home ETF return spillovers.

$$\mathrm{DR}^{\mathrm{E}}_{\mathrm{ih,t}} = \theta_0 + \theta_1 \mathrm{DR}^{\mathrm{E}}_{\mathrm{ih,t-1}} + \theta_2 \mathrm{DR}^{\mathrm{E}}_{\mathrm{ius,t-1}} + \theta_3 \mathrm{DR}^{\mathrm{E}}_{\mathrm{ius,t-1}} * \mathrm{V}^{\mathrm{E}}_{\mathrm{ius,t-1}} + \theta_4 \mathrm{DR}^{\mathrm{US}}_{\mathrm{t-1}} + \theta_5 \mathrm{DR}^{\mathrm{H}}_{\mathrm{i,t-1}} + \mathrm{e}_{7\mathrm{t}} \quad (11)$$

Where $\mathrm{V}^{\mathrm{E}}_{\mathrm{ius,t-1}}$ is the lag trading volume of i^{th} ETF in the US market and other variables are defined as before. θ_1 measures the ETF's return autocorrelation. θ_2 is a cross-autocorrelation parameter that captures the return spillover effect from the U.S. market to the home market. The parameter θ_3 measures the influence of trading volume on the magnitude of return spillovers from the U.S. market to the home market. θ_4 and θ_5 capture the impacts on ETF returns from both US and home market returns. Basing on the literature, we would expect that θ_3 is negative which means large volume ETFs will bear less return deviations i.e. more return reversal.

IV. Preliminary Results

According to the ETF database of ETF guide (www.etfguide.com), there are 13 broad international equity ETFs, 26 regional equity ETFs, 60 (up to 2010 Oct) country-specific equity ETFs, 32 international equity sector ETFs and 16 size specific international equity ETFs. For our research purpose to specifically identify the effect of trading location on pricing, we choose the country-specific equity ETFs as our research targets. The 60 country-specific equity ETFs include ETFs from 36 countries, some of which have more than 1 ETF either because they are different products from different ETF companies or because they cover different ranges of firm capitalization and industry. For each specific country, we choose one ETF which follows the broadest index of that country. Thus our original sample contains 36 all-cap and all-industry ETFs whose constituents cover almost all the fields of the economy of a country. We exclude the ETFs which are too young to have a stable pricing behavior crossing markets when we apply the panel regression and tests. Most of our research is focused on the mature country specific ETFs which have history of more than three years, however we still keep the young for other further analysis. For panel data regressions (model (1)-(8)) and tests, we have 48371 ETF-daily observations which covers 23 countries over all the continents (except Antarctica), over 15 different time zones and over different developing progresses.

Table 1 describes the composition of our whole sample by country of origin and the newest (up to Jul 2010) number of holdings for each of them. The sample ETFs from 36 countries are listed in stock exchanges in the United States (NYSEArca) with their constituents stocks listed in their home markets. Among the 36 country-specific ETFs, 13 of them are less than or just about 2 years old up to Jul.2010.

(Table 1 here.)

We plot summary statistics of basic variables of all 23 mature country specific ETFs which have history more than 3 years in Table 2. The 23 mature ETFs sample is composed of all cap and all industry country specific ETFs with daily price, trading volume, and net NAVs coverage from the ETF providers' website (Ishares, SPDR, GlobalX) and those information is also included also in DataStream. Our sampling period for the mature ETFs starts on Jan 1, 2001 and ends on Jan 1, 2010.

(Table 2 here.)

Table 3 reports the comparison of US market and home market impacts on all the 23 mature country specific ETFs. We apply model (1), (2), (5) and (6) on the mature country specific ETFs and get the results consistent with theory and our expectation.

(Table 3 here.)

From model (1) results, a one-standard-deviation increase in US market return (1.41% per day) is associated with a 0.87% (.6718*1.41%) increase in the ETF return in the US trading market, which corresponds to about 43% of ETF US return's standard deviation across all ETF-days. The ETF US returns' comovements with the US market are very strong and economically significant. However, model (2) results show that ETF home returns only has a coefficient of 0.0142 with the US market. In other words, ETF home return only increases 0.02% (.0142*1.41%) with a one-standard-deviation increase. Although the comovements of ETF home returns with US market are still significant, they are much weaker than that of ETF US returns.

On the contrary, model (2) gives much bigger coefficients for home market index return than model (1). ETF home returns are 0.9710 correlated with their home markets while ETF US returns are only 0.6473 correlated with the home market. And both correlations are strongly significant. Clearly, home markets have stronger power on the home returns of ETF than on the US returns of ETF. Therefore, comparing model (1) and (2), we found that returns on non-US based ETFs have significantly higher systematic comovements with U.S. market indexes and significantly lower systematic comovements with home market indexes than their corresponding home replicated portfolios.

Another interesting finding from model (1) and (2) results is that, US market impacts ETF US returns more than their home markets does. This conclusion comes from comparing the coefficients inside model (1), taking model (2) aside. One unit increase in US market return is associated with 0.6718 unit increase in ETF US returns. The correlation is larger than the correlation (0.6473) between home market and ETF US returns. Thus we can conclude that the pricing and returns of ETF in the US market is more impacted by the US market rather than by their home markets. In other words, the trading market instead of the home market will even dominate the pricing of the traded ETFs. However, this phenomenon is opposite in the home market returns. When we compare the coefficients inside model(2),we find that the replicated same ETFs net NAV returns are more affected by their own home markets rather than by US market.

If we use the returns daily difference as all the dependent variable to conduct the panel analysis, the indications would be the same. Within model (1) and (2) separately, we consistently find that US returns daily difference is impacted more by the US trading market rather than by home markets. Between model (1) and (2), there is similar pattern that returns daily difference on ETFs in US market have significantly higher systematic comovements with U.S. market indexes and significantly lower systematic comovements with home market indexes than their corresponding home returns daily difference.

A fact needs to be highlighted is that trading hours in different international markets and the U.S. do not overlap, so intraday data that captures more detailed information will help us understand better how the international ETFs are priced during non-trading hours in its home market while during the trading hours in U.S. market. We are not able to measure how ETF home intraday data affect ETFs, however we can get the US market intraday information and examine how US market impact ETFs in different time slots during a day. The ETF home prices (NAVs) are calculated using the home market closing prices of all the constituents. We identify the closing times for each market from the Dow Jones Indexes Pricing and Exchanges Table, compute the corresponding New York time, and obtain the midpoint of the prevailing bid and ask quotes for the U.S. S&P 500 fund (IVV) and all the ETFs. Using intraday price level of IVV as a proxy for the US market, we examine how the US market impact the ETF closing daily returns and intraday daily returns when both home and US markets are open and when US market is still open but home market is closes through Model (5), (6), (7) and (8). The results are also reported in Table 3 and Table 4.

In model (5) and (6), the ETF US intraday daily returns are calculated with the available midpoint of bid ask quotes in the trading market at corresponding New York time the closing time in their home markets, ETF home returns (NAVs) are calculated at the last available price (closing price) in their home markets and the US intraday level is the IVV price at the same time. Thus, the US and home market are both open in these two models. However, in model (1) and (2), ETF returns are calculated using closing prices on both markets and the US market index level is the closing level in NYSE. Thus, here only the US market is open while home markets are closed. Comparing results of model (5) and model (1) in Table 3, we can see that the US market impact on ETF returns is much weaker for model (5). ETF intraday daily returns are only .2620 correlated with the US market return when both markets are open in model (5). However, the correlation coefficient is .6718 when only the US market is still open in model (1). Opposite pattern happens in the coefficients for home markets. Therefore, we could conclude that the US market impacts on the ETFs are more pronounced in the non-overlapped trading hours. This is consistent with our knowledge that during the left part of the US trading day, the ETF home NAVs are frozen because home markets are closed, yet the market prices in US continue to fluctuate to reflect new information. What's more, when both markets are open the ETF pricing behaviors are also largely influenced by their home markets, which will distract and mitigate the return spillover from the US market. The trading location effect will grow stronger after the home markets close leaving only the US market affecting the ETF pricing behaviors. Meanwhile, the home market effect will become weaker after the home markets close. This is also consistent with the correlation coefficients for home markets. For example, in closing time model (1), ETF returns has a correlation coefficient of .6743 for home market, which is smaller than .7879 in intraday model (5). For robustness, the pattern is same in the returns daily difference case also reported in table 3. Model (2) and (5) examines how ETF home returns change with different hours of the US and home markets, there is not a significant difference of the US impacts in different hours.

Furthermore, we want to confirm that the trading location of ETFs dominates their pricing dynamics in the trading market by examining whether all the lags of the trading market returns jointly impact the ETF returns. In that case, we can conclude whether the trading market dynamics has a causality relationship with ETF pricing dynamics. Table 4 reports the vector autoregression (VAR) granger analysis of how US market and home market impact on all the 23 mature country specific ETFs using closing daily returns and intraday daily returns.

(Table 4 here.)

The Vargranger results show us that for ETFs traded in the US market, their closing returns (close-to-close) in the market is strongly caused by US market index returns. Although the ETF US returns are also jointly caused by US market and the corresponding home market, the home market itself does not cause ETF returns in the trading market. For ETF returns in their home market, the US market returns and home market returns separately cause ETF returns and the two markets jointly causes ETF return as well. Notice that the causality from the US market is stronger than that from home market. Thus, for both ETF returns in the trading market and their replicated NAV returns in the home market, US trading market dominates home market in the causality relationship with ETF daily returns.

To test the causality relationship with the return daily changes, we get similar conclusion that US market dominates the home markets in causing the pricing dynamics of ETFs. Model (3) and model (4) results both show that the US market returns and home market returns separately cause ETF return changes and the two markets jointly causes ETF return changes as well. The causality from US market is stronger than from home markets for both models.

The causality relationship for ETF US intraday daily returns is quite different with the closing returns. Generally speaking, the causality relationship with the US market is weaker in the intraday case. For the US intraday market's impact on ETF home returns, the results of model (8) in Table 4 show us that for ETFs net NAV returns are significantly caused by same-time-intraday US market returns. They are also jointly caused by US market and home market, the home market itself does not cause ETF net NAV returns. Thus, when both US and home markets open, US market is still very powerful in affecting ETF home returns. However, the Wald Test Chi2 Stats for US market in model (8) is 12.038 which is much smaller than 65.18 in model (4). This shows that for ETF home returns, the causality from the US market is weaker when both markets are open than in model (4) where only the US market is still open and the home markets close.

For Vargranger tests for the ETF US intraday daily returns in model (7), we cannot even conclude that US market returns cause ETF intraday daily returns at which time the corresponding home markets close in either return case or return daily change case. Home markets together with the US market jointly cause the ETF intraday daily returns in the US market and home markets' causality is stronger at that time. Thus, when both US and home markets open, US market seems to be less important in affecting ETFs' pricing dynamics in the US market than home markets do at that time.

To test the causality relationship changes with the return daily changes, results in Table 4 panel B show that almost all the causality from the US market returns and home market returns on ETF US and home returns are stronger and more significant. We believe the reason is that returns differences are more affected by lag values of the markets. Lag returns of US and home markets affect ETF returns daily difference strongly (Table 3 panel B), which contributes to the strong causality power from all the markets for the ETF returns daily difference. And we can clearly get a similar conclusion that US impacts dominate in the causality relationship for the ETF US close returns (close-to-close), but the impact power is much weaker for the ETF US intraday pricing when both the trading market and home markets are open.

Observing a dominant effect from US market on ETF US returns at the US closing time and a significant but not dominate trading market effect intraday at home markets' closing time, we expect that the US impact on ETF US returns will grow after the home markets close while the US market is still operating towards its closing time. We believe that the impact from the US market on the ETF pricing dynamics in US is growing gradually towards a dominant effect at the end of the trading day. We test this growing effect for each ETF from each home closing time as benchmark to the US closing time. And then we examine the effects one hour, two hours and until six hours after the home markets close.

Results of intraday growing trading market effect are shown in table 5. Consistent with our expectation, we can see the impact from the US market is growing hour by hour in our analysis.

(Table 5 here.)

In this comprehensive intraday analysis, we also control the impacts from the closing home market index returns. As we can see from table 5, the longer after the home markets close while the US market is still running, the weaker the home markets closing level will impact on the ETF US pricing dynamics. On the contrary, the US impacts become stronger and stronger, until dominating the home impact at the end of the trading day. For example, one hour after the home markets close, the same-time US market has a coefficient of only .2924 with the ETF returns in the trading market at that time. This coefficient is smaller than that for two hours later, but bigger than the "benchmark effect", i.e. the time when home markets close. Clearly, the coefficient between the same-time-US market levels the ETF intraday dynamics are bigger and bigger each time we delay one hour in the trading market. Until six hours after the home markets close, which is also half hour before the US market closes, the US coefficient exceed the home coefficient which means US market finally "beats" the home markets in affecting the ETF pricing dynamics. This is consistent with our original results using the close returns where the US market has a stronger impact on ETF close returns and even a stronger causality relationship due to the Vargranger analysis. Therefore, US market does dominate in affecting the international pricing behavior in the US trading market, and this dominant effect is not an instant one but a developing process through a trading day.

Another finding may contribute to our conclusion that trading location of the ETFs will dominate their pricing dynamics. When we apply the panel analysis of US and home markets' impacts on ETF contemporaneous price deviations from their home NAVs, we also find that the US trading market returns have stronger power in the impact.

(Table 6 here.)

The price deviations from NAVs are calculated in a way where time difference concern is controlled. The deviations are the contemporaneous differences between intraday ETF values and their home market closing values. Results for model (9) in table

6 show that, both price deviations and daily changes of them are more impacted by the US market return dynamics. A one unit increase in the US intraday daily market return will enlarge the price deviation from its home NAV for 0.1914 units while the home market return only has a coefficient of -0.1123. The signs are also consistent with our intuition that up movements in the trading market will support the prices of the ETFs traded in the market, which may further enlarge the positive price deviation from their home NAVs. On the contrary, the up movements of the home markets will drive up the home values and mitigate the positive deviations in the trading market. The impacts from both US market and home markets for daily changes of the price deviations are more significant and stronger than that for price deviations. Next, we apply the Vargranger analysis through model (10) for US and home markets returns and the price deviations. We can see that the ETF price deviations in the trading market are caused by same-time-intraday US market dynamics. They are also jointly caused by US market and home market, the home market itself does not cause ETF net NAV returns. These causality relationships also hold strongly for daily changes of price deviations. From these facts, we can further confirm that the trading location is so important in the pricing dynamics of the international ETFs.

As we focus on the mature ETFs which have long history, we are also able to examine how the trading location develops over time. We plot the time series impact from the US market and home markets by year for all the ETFs in Figure 1. We find impact from the US trading market has an upward trend while the home markets' impacts bear a downward trend. We also plot the intraday pattern of trading market effect for the ETFs by year in Figure 2. All the six lines have an upward trend over time, which means, US intraday impacts are growing as time goes by. Also, the magnitude order among the different levels is consistent with our expectation. Everywhere in the history, i.e. the impact line is higher with one hour later. In other words, the US intraday impacts on the intraday levels grow hour by hour in the open US market after home markets close along the history. Therefore, we conclude that the strengthening of US impact daily and the pattern of US growing impact are both persistent over time through the ETFs' history.

Other than finding that trading location effect is strongly significant and that this effect is growing until dominant intraday as one market closes while another market is still open, we also try to examine in what way the trading of ETFs in the trading market affects the pricing dynamics of ETFs. We use volumes of each country specific ETF in the trading market as one source of how the trading activities impacts the ETFs to test the volume influence on return spillovers from one market to another. Results are reported in Table 5.

(Table 7 here.)

As shown in Table (7), ETF returns in their markets are significantly positive correlated with their US lag returns. This shows the return spillover from US market to home market is positive. In other words, when ETF returns increases in the US market, their home returns will increase accordingly next day. However, this spillover effect might be influenced by the trading volume in the trading market. In model (11), the coefficient in front of the interaction of return spillover effect is insignificantly negative. Then we divide the sample by both mean and median of daily trading volume of all ETF observations into "Large Volume ETFs" and "Small Volume ETFs". Interestingly, the negative effect becomes significant when we apply the analysis of influence of volume on spillover in sample ETFs with larger daily volumes. A negative sign of the interaction variable means that, when trading volume of the ETF in the US market increases the day before, then the ETF home returns will be less affected by the return spillover from US market the next day. Thus, ETF portfolio values will less deviate from their NAVs in the home markets the next day. This is consistent with the return reversal phenomenon caused by large trading volume. Small volume ETF observations do not exhibit this return reversal. Those volume effects also involve information issue. We will use information asymmetry proxies in the future research to further explore the trading volume effect on return spillover from one market to another.

V. Conclusions and Future Research

By the comprehensive analysis for the country specific ETFs, we conclude that prices do have a trading place bias when their trading location is different from their business home locations. The impact from the trading location is quite strong. The strengthening of trading market impact on ETF daily dynamics and the pattern of trading market's growing impact intraday are both persistent over time through the ETFs' history (Figure 1 and 2). This trading location effect is strong and significant and even dominates the home effect when determining the pricing dynamics in the trading market. It happens in the pattern that the trading location effect is more pronounced in the trading hours of the trading market and the non-trading hours of the home market. To put it in another way, when the different trading market opens and the home market closes, the prices should be affected by the trading market much more remarkably. And this trading location effect is growing gradually after the home markets close and until the end of the

US trading day. On the contrary, the impact from home markets is bearing a downward trend. Trading volume as one important feature of the trading activities does impact on the pricing dynamics of the international ETFs. As we show returns from the trading market spillover to their home markets, volumes in the trading market will ease the return spillover to the home markets and thus lead to return reversals in their home NAVs.

We also apply the similar analysis to the young country-specific ETFs. They did not exhibit same pricing pattern with trading location. Although their US returns are to some extent commove with the US market, the trading location effect does not dominate in their pricing. Results are not reported in the tables. One possible reason is that young ETFs' pricing behaviors are still not stable since investors in the US market may hold their investment until they get more familiar with these new products. Further comparison with mature and young ETFs will be made in future research.

We believe trading characteristics including volume also involves other important issues such as information asymmetry. In the continuing research, we will find information asymmetry proxies using both macro and micro indicators to further analyze the return spillover from one market to another.

Moreover, the trading place bias will not only affect the returns, but also the volatilities over time. We expect volatility may also spill over from the trading location to the trading securities. For variance relationship between each international ETF and IVV (representing for U.S. market), we can set up a group of volatility spillover models for each pair of all the country specific ETFs and the IVV, and from the signs and values of the parameters we can get a lot information about how the trading market- U.S. market affect the pricing behavior of international ETFs through volatility spillover.

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Table 1: Summary Statistics on Firm Sample of Cross-listings by Country, Year and Industry

This table describes the composition of our sample by country of origin and the newest (up to Jul 2010) number of holdings for each of them. The sample ETFs from 36 countries are listed in stock exchanges in the United States (NYSEArca) with their constituents stocks listed in their home markets. Our final sample is composed of all U.S.-listed all cap country specific ETFs with daily price, trading volume, and net NAVs coverage from the ETF providers' website(Ishares, SPDR, GlobalX) and they are included also in Datastream. The intraday information of all the ETFs are included in TAQ. TAQ data is available until July 31, 2010. Our sampling period starts on Jan 1, 2001 and ends on Jul 31, 2010.

Country	Ticker Symbol	Number of Constituents	Year Age (up to Jul,2010)	Closing Time Corresponding NY time
Australia	EWA	73	14	9:30am
Austria	EWO	30	14	11:35am
Belgium	EWK	44	14	11:35am
Brazil	EWZ	70	10	3:00pm
Canada	EWC	93	14	4:00pm
Chile	ECH	34	2	3:30am
China	GXC	141	3	9:30am
Colombia	GXG	15	1	1:00pm
Egypt	EGPT	27	0	9:30am
France	EWQ	77	14	11:30am
Germany	EWG	50	14	11:30am
Hong Kong	EWH	41	14	9:30am
India	INP	60	4	9:30am
Indonesia	IDX	29	1	9:30am
Ireland	EIRL	22	0	9:30am
Isreal	EIS	79	2	9:30am
Italy	EWI	30	14	11:35am
Japan	EWJ	324	14	9:30am
Malaysia	EWM	39	14	9:30am
Mexico	EWW	42	14	4:00pm
Netherlands	EWN	25	14	11:45am
New Zealand	ENZL	23	0	10:30am
Norway	NORW	30	0	11:30am
Peru	EPU	26	1	2:00pm
Poland	EPOL	58	0	10:20am
Russia	RBL	39	0	10:00am
Singapore	EWS	31	14	9:30am
South Africa	EZA	45	7	10:00am
South Korea	EWY	98	10	9:30am
Spain	EWP	27	14	11:35am
Sweden	EWD	33	14	11:30am
Switzerland	EWL	37	14	11:30am
Taiwan	EWT	118	10	9:30am
Thailand	THD	86	2	9:30am
Turkey	TUR	92	2	10:00am
UK	EWU	106	14	11:30am

Table 2: Summary Statistics on Mature ETFs used in Multivariate and Vargranger Analysis by Country

This table describes all the 23 mature country specific ETFs which have history more than 3 years. The 23 mature country-specific ETFs are listed in stock exchanges in the United States (NYSEArca) with their constituents stocks listed in their home markets. This mature ETF sample is composed of all cap and all industry country specific ETFs with daily price, trading volume, and net NAVs coverage from the ETF providers' website (Ishares, SPDR, GlobalX) and those information is also included also in Datastream. Our sampling period for the mature ETFs starts on Jan 1, 2001 and ends on Jan 1, 2010. $DR^{E}_{ius,t}$ is the daily return (close-close) of the ith non-US-based ETF traded on the U.S. market at trading day t, $DR^{E}_{ih,t}$is the daily return (close-close) of home NAVs of the ith non-US-based ETF at trading day t, $DR^{H}_{i,t}$is the cross-market daily return of the ith replicated indexes of the non-US-based ETFs in their home markets at trading day t, and $DR^{US}_{t}$is the daytime return of the SP500 index at trading day t,. $V^{E}_{ius,t}$ is the trading volume of i^{th} ETF in the US market at time day t. ETF-days is the number of observations for each country ETF in this sample.

Panel A: Country Specific ETFs in the US market

Country	*ETF daily returns in US market* ($DR^{E}_{ius,t}$)					*ETF returns daily difference in US market* ($\Delta DR^{E}_{ius,t}$)					*ETF trading volumes in the US market* ($V^{E}_{ius,t}$)					ETF-days
	mean	*median*	*Std. dev*	*1%*	*99%*	*mean*	*median*	*Std. dev*	*1%*	*99%*	*mean*	*median*	*Std. dev*	*1%*	*99%*	
Australia	0.000517	0.001341	0.0193	-0.0593	0.0496	-0.000008	-0.000032	0.0290	-0.0823	0.0781	1.01E+06	2.38E+05	1.58E+06	2200	6.80E+06	2262
Canada	0.000351	0.001085	0.0168	-0.0518	0.0446	-0.000006	-0.000101	0.0243	-0.0676	0.0665	7.45E+05	2.55E+05	1.16E+06	1100	5.64E+06	2262
Sweden	0.000181	0.000514	0.0234	-0.0686	0.0652	-0.000008	-0.000001	0.0343	-0.0999	0.0972	1.21E+05	4.39E+04	2.24E+05	100	1.07E+06	2262
Germany	0.000106	0.000810	0.0187	-0.0589	0.0496	-0.000011	-0.000263	0.0272	-0.0722	0.0760	5.59E+05	2.31E+05	8.60E+05	7600	4.37E+06	2262
Hong Kong	0.000236	0.000000	0.0198	-0.0547	0.0556	-0.000030	-0.000880	0.0305	-0.0895	0.0840	2.26E+06	6.89E+05	3.07E+06	10800	1.32E+07	2262
Italy	0.000043	0.000488	0.0172	-0.0554	0.0460	-0.000004	-0.000089	0.0253	-0.0725	0.0811	9.60E+04	2.51E+04	2.89E+05	100	1.03E+06	2262
Japan	-0.000033	0.000000	0.0165	-0.0410	0.0470	-0.000023	-0.000115	0.0246	-0.0639	0.0626	1.37E+07	1.05E+07	1.34E+07	180500	5.71E+07	2262
Belgium	0.000101	0.000000	0.0179	-0.0591	0.0473	-0.000005	-0.000006	0.0259	-0.0755	0.0771	7.38E+04	3.05E+04	1.75E+05	0	7.48E+05	2263
Switzerland	0.000145	0.000447	0.0156	-0.0478	0.0416	-0.000018	-0.000394	0.0233	-0.0611	0.0654	9.89E+04	4.46E+04	1.90E+05	900	7.29E+05	2262
Malaysia	0.000432	0.000000	0.0156	-0.0434	0.0394	-0.000002	-0.000047	0.0237	-0.0615	0.0673	1.06E+06	4.57E+05	1.63E+06	4000	7.19E+06	2262
Netherlands	0.000043	0.000000	0.0182	-0.0569	0.0500	-0.000019	-0.000377	0.0268	-0.0810	0.0773	5.74E+04	2.36E+04	1.12E+05	0	5.59E+05	2262
Austria	0.000480	0.000913	0.0185	-0.0630	0.0423	-0.000002	-0.000027	0.0265	-0.0702	0.0823	1.18E+05	6.42E+04	2.10E+05	0	1.12E+06	2262
Spain	0.000391	0.000411	0.0176	-0.0518	0.0488	-0.000016	-0.000220	0.0260	-0.0704	0.0692	1.08E+05	3.18E+04	2.08E+05	0	1.06E+06	2262
France	0.000075	0.000514	0.0176	-0.0552	0.0464	0.000002	-0.000342	0.0259	-0.0703	0.0798	1.19E+05	4.26E+04	2.52E+05	900	1.18E+06	2262
Singapore	0.000371	0.000000	0.0200	-0.0565	0.0563	-0.000032	-0.000094	0.0305	-0.0847	0.0834	1.42E+06	3.13E+05	2.05E+06	5700	8.61E+06	2262
Taiwan	0.000151	0.000000	0.0233	-0.0645	0.0644	-0.000039	-0.000122	0.0348	-0.0927	0.0966	4.45E+06	1.10E+06	6.30E+06	2900	2.57E+07	2262
UK	0.000067	0.000474	0.0168	-0.0517	0.0460	-0.000012	-0.000028	0.0252	-0.0752	0.0693	4.25E+05	2.03E+05	6.70E+05	8800	3.37E+06	2262
Mexico	0.000664	0.001297	0.0203	-0.0580	0.0562	-0.000038	-0.000663	0.0287	-0.0754	0.0800	1.51E+06	5.39E+05	1.84E+06	2700	7.30E+06	2263
South Korea	0.000615	0.001456	0.0258	-0.0681	0.0657	-0.000046	-0.000771	0.0378	-0.0966	0.1017	1.30E+06	4.76E+05	1.77E+06	1100	7.53E+06	2262
Brazil	0.000763	0.001979	0.0282	-0.0762	0.0732	-0.000033	-0.000746	0.0402	-0.1084	0.1079	5.94E+06	1.34E+06	8.19E+06	400	3.13E+07	2263
South Africa	0.000734	0.002040	0.0251	-0.0731	0.0636	-0.000007	-0.000212	0.0375	-0.1000	0.1045	2.17E+05	1.51E+05	2.40E+05	400	1.04E+06	1663
China	0.000446	0.001302	0.0348	-0.0856	0.1074	-0.000004	-0.001887	0.0535	-0.1386	0.1725	9.76E+04	7.58E+04	8.51E+04	5600	3.96E+05	701
India	0.000323	0.001079	0.0336	-0.0977	0.0811	0.000002	-0.001802	0.0493	-0.1202	0.1506	6.39E+05	5.75E+05	3.53E+05	140700	1.91E+06	763

Panel B: Country Specific replicated ETFs in the home markets

Country	*ETF daily returns market* $(DR^E_{ih,t})$					*ETF returns daily difference in home market* $(\Delta DR^E_{ih,t})$					*ETF-days*
	mean	*median*	*Std. dev*	*1%*	*99%*	*mean*	*median*	*Std. dev*	*1%*	*99%*	
Australia	0.000386	0.001037	0.0172	-0.0490	0.0458	0.000006	-0.000479	0.0245	-0.0710	0.0750	2261
Canada	0.000318	0.001060	0.0159	-0.0466	0.0392	-0.000015	-0.000508	0.0220	-0.0602	0.0622	2261
Sweden	0.000124	0.000469	0.0208	-0.0606	0.0553	0.000025	-0.000615	0.0289	-0.0833	0.0857	2261
Germany	0.000065	0.000796	0.0176	-0.0537	0.0456	-0.000001	-0.000593	0.0250	-0.0708	0.0739	2261
Hong Kong	0.000140	0.000000	0.0151	-0.0403	0.0411	0.000014	-0.000643	0.0214	-0.0526	0.0604	2261
Italy	-0.000061	0.000561	0.0158	-0.0509	0.0378	0.000011	-0.000583	0.0223	-0.0631	0.0602	2261
Japan	-0.000063	0.000000	0.0155	-0.0416	0.0386	-0.000003	-0.000078	0.0226	-0.0582	0.0598	2261
Belgium	-0.000012	0.000891	0.0155	-0.0481	0.0413	0.000010	-0.000089	0.0206	-0.0598	0.0636	2262
Switzerland	0.000120	0.000443	0.0133	-0.0405	0.0401	0.000003	-0.000517	0.0186	-0.0516	0.0533	2261
Malaysia	0.000342	0.000000	0.0111	-0.0308	0.0277	0.000009	-0.000004	0.0148	-0.0402	0.0423	2261
Netherlands	-0.000048	0.000556	0.0163	-0.0487	0.0440	0.000006	-0.000185	0.0230	-0.0625	0.0687	2261
Austria	0.000416	0.000929	0.0169	-0.0501	0.0433	0.000010	-0.000087	0.0231	-0.0603	0.0653	2261
Spain	0.000318	0.000443	0.0160	-0.0465	0.0417	-0.000004	-0.000490	0.0227	-0.0657	0.0663	2261
France	0.000029	0.000537	0.0168	-0.0490	0.0449	0.000011	-0.000609	0.0239	-0.0717	0.0661	2261
Singapore	0.000251	0.000000	0.0151	-0.0417	0.0408	0.000010	-0.000039	0.0211	-0.0525	0.0646	2261
Taiwan	0.000089	0.000000	0.0178	-0.0479	0.0476	0.000015	-0.000037	0.0248	-0.0629	0.0669	2261
UK	-0.000042	0.000604	0.0154	-0.0450	0.0421	0.000012	-0.000562	0.0222	-0.0603	0.0670	2261
Mexico	0.000583	0.001318	0.0179	-0.0527	0.0485	-0.000018	-0.000520	0.0241	-0.0651	0.0649	2262
South Korea	0.000597	0.000851	0.0477	-0.0672	0.0603	-0.000002	-0.001153	0.0782	-0.0924	0.0879	2261
Brazil	0.000661	0.001505	0.0258	-0.0723	0.0660	-0.000026	-0.000795	0.0357	-0.1031	0.0955	2262
South Africa	0.000645	0.001633	0.0207	-0.0589	0.0510	0.000006	-0.000480	0.0286	-0.0788	0.0827	1662
China	0.000441	0.000889	0.0276	-0.0702	0.0767	0.000016	-0.002209	0.0390	-0.1043	0.1094	700
India	0.000319	0.000159	0.0268	-0.0746	0.0682	0.000003	-0.002182	0.0371	-0.0939	0.0919	762

Table 3: Analysis of How US market and home market impact ETF daily returns and return differences

This table reports the comparison of US market and home market impacts on all the 23 mature country specific ETFs which have history more than 3 years. The 23 mature country-specific ETFs are listed in stock exchanges in the United States (NYSEArca) with their constituents stocks listed in their home markets. This mature ETF sample is composed of all-cap and all-industry country specific ETFs with daily price, trading volume, and net NAVs coverage from the ETF providers' website (Ishares, SPDR, GlobalX) and those information is also included also in DataStream. The intraday information of the US market is included in TAQ. Sampling period for multivariate panel analysis of the mature ETFs starts on Jan 1, 2001 and ends on Jan 1, 2010. $DR^{E}_{ius,t}$ is the daily return (close-close) of the ith non-US-based ETF traded on the U.S. market at trading day t, $DR^{E}_{ih,t}$is the daily return (close-close) of home NAVs of the ith non-US-based ETF at trading day t, $DR^{H}_{i,t}$is the cross-market daily return of the ith replicated indexes of the non-US-based ETFs in their home markets at trading day t, and $DR^{US}_{t}$is the daytime return of the SP500 index at trading day t,. $V^{E}_{ius,t}$ is the trading volume of ith ETF in the US market at time day t. $DR^{USintra}_{i,t}$ is the return of IVV in NYSE at which time the ith ETF home market closes. We identify the closing times for each market from the Dow Jones Indexes Pricing and Exchanges Table, compute the corresponding New York time, and obtain the midpoint of the prevailing bid and ask quotes for the U.S. S&P 500 fund (IVV) and for the ETFs as their intraday level.

$$DR^{E}_{ius,t} = \alpha_0 + \alpha_1 DR^{US}_{t} + \alpha_2 DR^{US}_{t-1} + \alpha_3 DR^{H}_{i,t} + \alpha_4 DR^{H}_{i,t-1} + e_{1t} \quad (1)$$

$$DR^{E}_{ih,t} = \beta_0 + cDR^{US}_{t} + \beta_2 DR^{US}_{t-1} + \beta_3 DR^{H}_{i,t} + \beta_4 DR^{H}_{i,t-1} + e_{2t} \quad (2)$$

$$DR^{Eintra}_{ius,t} = \varphi_0 + \varphi_1 DR^{USintra}_{i,t} + \varphi_2 DR^{USintra}_{t-1} + \varphi_3 DR^{H}_{i,t} + \varphi_4 DR^{H}_{i,t-1} + e_{5t} \quad (5)$$

$$DR^{E}_{ih,t} = \varepsilon_0 + \varepsilon_1 DR^{USintra}_{i,t} + \varepsilon_2 DR^{USintra}_{t-1} + \varepsilon_3 DR^{H}_{i,t} + \varepsilon_4 DR^{H}_{i,t-1} + e_{5t} \quad (6)$$

All regressions are controlled for country-fixed effects.

Panel A	*ETF daily returns in US market* ($DR^{E}_{ius,t}$)		*ETF daily returns in home market* ($DR^{E}_{ih,t}$)	
Variables	Model(1)	Model(5)	Model(2)	Model(6)
US market return	**.6718*****		**.0142*****	
	(175.26)		(3.97)	
Lag US market return	-.3207***		.0038	
	(-79.77)		(1.00)	
Home market return	**.6473*****	**.7879*****	**.9710*****	**.9697*****
	(201.18)	(196.15)	(322.63)	(301.02)
Lag home market return	.0979***	.0902***	.0022	.0027
	(32.81)	(22.83)	(0.80)	(0.85)
US intraday market return		**.2620*****		**.0146*****
		(51.36)		(3.54)
Lag US intraday market return		-.0966***		-.0003
		(-18.90)		(-0.08)
Country fixed effects	Yes	Yes	Yes	Yes
Obs	47625	47569	47625	47583
R2	.7288	.6398	.7540	0.7537
Panel B	*ETF returns daily difference in US market* ($\Delta DR^{E}_{ius,t}$)		*ETF returns daily difference in home market* ($\Delta DR^{E}_{ih,t}$)	
Variables	Model(1)	Model(5)	Model(2)	Model(6)
US market return	**.6997*****		**.0186*****	
	(109.20)		(3.08)	
Lag US market return	-1.0171***		-.0050722	
	(-151.34)		(-0.80)	
Home market return	**.5464*****	**.7307*****	**.9627*****	**.9613*****
	(101.58)	(109.83)	(189.07)	(176.40)
Lag home market return	-.4618***	-.6836***	-.9710***	-.9672***
	(-92.63)	(-103.62)	(-205.73)	(-178.98)
US intraday market return		**.2825*****		**.01436****
		(33.17)		(2.06)
Lag US intraday market return		-.3671***		-.0141**
		(-43.01)		(-2.01)
Country fixed effects	Yes	Yes	Yes	Yes
Obs	47625	47562	47625	47583
R2	.6513	.5316	.6733	.6730

Table 4: VARgranger Analysis of How US market and home market impact ETF daily returns and return differences

This table reports the vector autoregression (VAR) granger analysis of how US market and home market impact on all the 23 mature country specific ETFs which have history more than 3 years. The 23 mature country-specific ETFs are listed in stock exchanges in the United States (NYSEArca) with their constituents stocks listed in their home markets. This mature ETF sample is composed of all-cap and all-industry country specific ETFs with daily price, trading volume, and net NAVs coverage from the ETF providers' website (Ishares, SPDR, GlobalX) and those information is also included also in DataStream. The intraday information of the US market is included in TAQ. Sampling period for multivariate panel analysis of the mature ETFs starts on Jan 1, 2001 and ends on Jan 1, 2010. $DR^{E}_{ius,t}$ is the daily return (close-close) of the ith non-US-based ETF traded on the U.S. market at trading day t, $DR^{E}_{ih,t}$is the daily return (close-close) of home NAVs of the ith non-US-based ETF at trading day t, $DR^{H}_{i,t}$is the cross-market daily return of the ith replicated indexes of the non-US-based ETFs in their home markets at trading day t, and $DR^{US}_{t}$is the daytime return of the SP500 index at trading day t,. $V^{E}_{ius,t}$ is the trading volume of ith ETF in the US market at time day t. $DR^{USintra}_{i,t}$ is the return of IVV in NYSE at which time the ith ETF home market closes. We identify the closing times for each market from the Dow Jones Indexes Pricing and Exchanges Table, compute the corresponding New York time, and obtain the midpoint of the prevailing bid and ask quotes for the U.S. S&P 500 fund (IVV) and for the ETFs as their intraday level.

$$DR^{E}_{ius,t} = \gamma_0 + \gamma_1 \sum DR^{E}_{ius,t-k} + \gamma_2 \sum DR^{H}_{i,t-k} + \gamma_3 \sum DR^{US}_{t-k} + e_{3t} \quad (3)$$

$$DR^{E}_{ih,t} = \tau_0 + \tau_1 \sum DR^{E}_{ih,t-k} + \tau_2 \sum DR^{H}_{i,t-k} + \tau_3 \sum DR^{US}_{t-k} + e_{4t} \quad (4)$$

$$DR^{Eintra}_{ius,t} = \pi_0 + \pi_1 \sum DR^{Eintra}_{ius,t-k} + \pi_2 \sum DR^{H}_{i,t-k} + \pi_3 \sum DR^{USintra}_{t-k} + e_{1t} \quad (7)$$

$$DR^{E}_{ih,t} = \omega_0 + \omega_1 \sum DR^{E}_{ih,t-k} + \omega_2 \sum DR^{H}_{i,t-k} + \omega_3 \sum DR^{USintra}_{t-k} + e_{1t} \quad (8)$$

Panel A	*ETF daily returns in US market* ($DR^E_{ius,t}$)				*ETF daily returns in home market* ($DR^E_{ih,t}$)			
Variables	Model(3)		Model(7)		Model(4)		Model(8)	
	Causality relationship	Wald Test Chi2 Stats	Causality relationship	Wald Test Chi2 Stats	Causality relationship	Wald Test Chi2 Stats	Causality relationship	Wald Test Chi2 Stats
US market return	Yes	26.241*** (p=0.000)	No	4.2206 (p=0.121)	Yes	65.18*** (p=0.000)		
Home market return	No	2.9047 (p=0.234)	Yes	7.7734** (p=0.021)	Yes	4.9796 * (p=0.083)		
Both market returns	Yes	26.96*** (p=0.000)	Yes	15.251*** (p=0.004)	Yes	65.632 *** (p=0.000)		
US intraday market return							Yes	12.038 *** (p=0.002)
Home market return							No	1.2446 (p=0.537)
Both market returns							Yes	12.442** (p=0.014)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B	*ETF returns daily difference in US market* ($\Delta DR^E_{ius,t}$)				*ETF returns daily difference in home market* ($\Delta DR^E_{ih,t}$)			
Variables	Model(3)		Model(7)		Model(4)		Model(8)	
	Causality relationship	Wald Test Chi2 Stats	Causality relationship	Wald Test Chi2 Stats	Causality relationship	Wald Test Chi2 Stats	Causality relationship	Wald Test Chi2 Stats
US market return	Yes	83.333*** (p=0.000)	No	.761 (p=0.684)	Yes	57.692*** (p=0.000)		
Home market return	Yes	33.104*** (p=0.000)	Yes	36.401*** (p=0.000)	Yes	204.68 *** (p=0.000)		
Both market returns	Yes	160.08 *** (p=0.000)	Yes	55.989*** (p=0.000)	Yes	239.36 *** (p=0.000)		
US intraday market return							Yes	11.371*** (p=0.003)
Home market return							Yes	155.56*** (p=0.000)
Both market returns							Yes	175.96*** (p=0.000)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: Further Analysis of How US market and home market impact ETF daily returns and return differences intraday in different hours

This table reports the comparison of US market and home market impacts on all the 23 mature country specific ETFs which have history more than 3 years. The 23 mature country-specific ETFs are listed in stock exchanges in the United States (NYSEArca) with their constituents stocks listed in their home markets. This mature ETF sample is composed of all-cap and all-industry country specific ETFs with daily price, trading volume, and net NAVs coverage from the ETF providers' website (Ishares, SPDR, GlobalX) and those information is also included also in DataStream. The intraday information of the US market is included in TAQ. We identify the closing times for each market from the Dow Jones Indexes Pricing and Exchanges Table, compute the corresponding New York time, and obtain the midpoint of the prevailing bid and ask quotes for the U.S. S&P 500 fund (IVV) and for the ETFs as their intraday level. Sampling period for multivariate panel analysis of the mature ETFs starts on Jan 1, 2001 and ends on Jan 1, 2010. $DR_{i,t}^{H}$is the cross-market daily return of the ith replicated indexes of the non-US-based ETFs in their home markets at trading day t. $DR_{i,t}^{USintra}$ is the return of IVV in NYSE at which time the ith ETF home market closes. $DR_{ius,t}^{Eintra}$ is the return of ith ETF traded in US at which time its ETF home market closes. $DR_{ius,t}^{Eintra1}$ is the intraday return of ith ETF in the US market one hour after its home market closes. $DR_{i,t}^{USintra1}$ is the intraday return of IVV in NYSE one hour after the ith home market closes. $DR_{ius,t}^{Eintra2}$ is the intraday return of ith ETF in the US market two hours after its home market closes. $DR_{i,t}^{USintra2}$ is the intraday return of IVV in NYSE two hours after the ith home market closes. Similarly, intra3,4,5,6 define for intraday returns 3,4,5 and 6 hours after home markets close, respectively.

$$DR_{ius,t}^{Eintra} = \varphi_0 + \varphi_1 DR_{i,t}^{USintra} + \varphi_2 DR_{t-1}^{USintra} + \varphi_3 DR_{i,t}^{H} + \varphi_4 DR_{i,t-1}^{H} + e_{5t} \quad (5)$$

$$DR_{ius,t}^{Eintra1} = \varphi_0 + \varphi_1 DR_{i,t}^{USintra1} + \varphi_2 DR_{t-1}^{USintra1} + \varphi_3 DR_{i,t}^{H} + \varphi_4 DR_{i,t-1}^{H} + e_{5t} \quad (5a)$$

$$DR_{ius,t}^{Eintra2} = \varphi_0 + \varphi_1 DR_{i,t}^{USintra2} + \varphi_2 DR_{t-1}^{USintra2} + \varphi_3 DR_{i,t}^{H} + \varphi_4 DR_{i,t-1}^{H} + e_{5t} (5b)$$

$$DR_{ius,t}^{Eintra3} = \varphi_0 + \varphi_1 DR_{i,t}^{USintra3} + \varphi_2 DR_{t-1}^{USintra3} + \varphi_3 DR_{i,t}^{H} + \varphi_4 DR_{i,t-1}^{H} + e_{5t} (5c)$$

$$DR_{ius,t}^{Eintra4} = \varphi_0 + \varphi_1 DR_{i,t}^{USintra4} + \varphi_2 DR_{t-1}^{USintra4} + \varphi_3 DR_{i,t}^{H} + \varphi_4 DR_{i,t-1}^{H} + e_{5t} (5d)$$

$$DR_{ius,t}^{Eintra5} = \varphi_0 + \varphi_1 DR_{i,t}^{USintra5} + \varphi_2 DR_{t-1}^{USintra5} + \varphi_3 DR_{i,t}^{H} + \varphi_4 DR_{i,t-1}^{H} + e_{5t} (5e)$$

$$DR_{ius,t}^{Eintra6} = \varphi_0 + \varphi_1 DR_{i,t}^{USintra6} + \varphi_2 DR_{t-1}^{USintra6} + \varphi_3 DR_{i,t}^{H} + \varphi_4 DR_{i,t-1}^{H} + e_{5t} (5f)$$

Panel A	*ETF intra returns in US market* ($DR_{ius,t}^{Eintra}$)					
Variables	Model(5a)	Model(5b)	Model(5c)	Model(5d)	Model(5e)	Model(5f)
	1 hour after ($DR_{ius,t}^{Eintra1}$)	2 hours after ($DR_{ius,t}^{Eintra2}$)	3 hour after ($DR_{ius,t}^{Eintra3}$)	4 hours after ($DR_{ius,t}^{Eintra4}$)	5 hour after ($DR_{ius,t}^{Eintra5}$)	6 hours after ($DR_{ius,t}^{Eintra6}$)
US intraday market return	**.2980*****	**.3674*****	**.4375*****	**.5290*****	**.6318*****	**.7637*****
	(61.02)	(73.34)	(86.14)	(104.51)	(80.09)	(96.34)
Lag US intraday market return	-.1231***	-.1658***	-.1762***	-.2580***	-.3317***	-.4172***
	(-25.10)	(-32.81)	(-34.20)	(-49.37)	(-40.42)	(-49.18)
Home market return	**.7647*****	**.7277*****	**.6942*****	**.6781*****	**.6871*****	**.6873*****
	(200.81)	(179.37)	(170.08)	(165.23)	(106.39)	(106.16)
Lag home market return	.0686***	-.0843***	.0699***	.0762***	-.0696***	.0520***
	(18.27)	(21.21)	(17.58)	(19.47)	(11.33)	(8.68)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs	43065	40804	40825	40825	18329	18239
R2	.6671	.6475	.6313	.6274	.5909	.6043
Panel B	*ETF returns daily difference in US market* ($\Delta DR_{ius,t}^{E}$)					
Variables	Model(1)	Model(5)	Model(5c)	Model(5d)	Model(5e)	Model(5f)
	1 hour after ($\Delta DR_{ius,t}^{Eintra1}$)	2 hours after ($\Delta DR_{ius,t}^{Eintra2}$)	3 hour after ($\Delta DR_{ius,t}^{Eintra3}$)	4 hours after ($\Delta DR_{ius,t}^{Eintra4}$)	5 hour after ($\Delta DR_{ius,t}^{Eintra5}$)	6 hours after ($\Delta DR_{ius,t}^{Eintra6}$)
US market return	**.3056*****	**.3715*****	**.4476*****	**.5246*****	**.5897*****	**.7131*****
	(37.67)	(44.59)	(53.09)	(62.13)	(45.27)	(51.14)
Lag US market return	-.4314***	-.5455***	-.6198***	-.7928***	-.9688***	-1.1891***
	(-52.97)	(-64.94)	(-72.49)	(-90.94)	(-71.50)	(-84.38)
Home market return	**.6815*****	**.6364*****	**.5916*****	**.5709*****	**.5599*****	**.5840*****
	(107.73)	(95.37)	(87.33)	(83.41)	(52.50)	(54.30)
Lag home market return	-.6829***	-.6213***	-.5989***	-.5503**	-.5437***	-.5195***
	(-109.37)	(-93.99)	(-90.77)	(-84.27)	(-53.59)	(-52.23)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs	43065	40804	40825	40825	18329	18329
R2	.5646	.5453	.5281	.5231	.4865	.5058

Table 6: Analysis of How US market and home market impact ETF price deviations from the home NAVs and daily changes of the price deviations (including Vargranger Analysis)

This table reports in panel A the comparison of US market and home market impacts on the ETF price deviations from the home NAVs and daily changes of the price deviations of all the 23 mature country specific ETFs which have history more than 3 years. In panel B, Vargranger Analysis is given. The 23 mature country-specific ETFs are listed in stock exchanges in the United States (NYSEArca) with their constituents stocks listed in their home markets. This mature ETF sample is composed of all-cap and all-industry country specific ETFs with daily price, trading volume, and net NAVs coverage from the ETF providers' website (Ishares, SPDR, GlobalX) and those information is also included also in DataStream. The intraday information of the US market is included in TAQ. Sampling period for multivariate panel analysis of the mature ETFs starts on Jan 1, 2001 and ends on Jan 1, 2010. $\mathrm{PD}^{\mathrm{E}}_{\mathrm{iintra,t}}$ is the contemporaneous price deviations (premium/discount) of i^{th} ETF from the home market NAVs market at trading day t, $\mathrm{DR}^{\mathrm{USintra}}_{\mathrm{i,t}}$ is the return of IVV in NYSE at which time the ith ETF home market closes at day t. $\mathrm{DR}^{\mathrm{H}}_{\mathrm{i,t}}$is the cross-market daily return of the ith replicated indexes of the non-US-based ETFs in their home markets at trading day t. We identify the closing times for each market from the Dow Jones Indexes Pricing and Exchanges Table, compute the corresponding New York time, and obtain the midpoint of the prevailing bid and ask quotes for the U.S. S&P 500 fund (IVV) and for the ETFs as their intraday level.

$$\mathrm{PD}^{\mathrm{E}}_{\mathrm{iintra,t}} = \delta_0 + \delta_1 \mathrm{DR}^{\mathrm{USintra}}_{\mathrm{t}} + \delta_2 \mathrm{DR}^{\mathrm{USintra}}_{\mathrm{t-1}} + \delta_3 \mathrm{DR}^{\mathrm{H}}_{\mathrm{i,t}} + \delta_4 \mathrm{DR}^{\mathrm{H}}_{\mathrm{i,t-1}} + \mathrm{e}_{7\mathrm{t}} \quad (9)$$

$$\mathrm{PD}^{\mathrm{E}}_{\mathrm{iintra,t}} = \rho_0 + \rho_1 \sum \mathrm{PD}^{\mathrm{E}}_{\mathrm{iintra,t-k}} + \rho_2 \sum \mathrm{DR}^{\mathrm{H}}_{\mathrm{i,t-k}} + \rho_3 \sum \mathrm{DR}^{\mathrm{USintra}}_{\mathrm{t-k}} + \mathrm{e}_{8\mathrm{t}} \quad (10)$$

Panel A Impact Analysis	*ETF daily* price deviations from the home NAVs ($PD^{E}_{iintra,t}$)	Daily changes of the ETF price deviations from the home NAVs ($\Delta PD^{E}_{iintra,t}$)
Variables	Model(9)	Model(9)
US intraday market return	**.1914***** (8.22)	**.2474***** (38.58)
Lag US intraday market return	.0677** (2.90)	-.0963*** (-14.98)
Home market return	**-.1123***** (-6.18)	**-.1877***** (-37.47)
Lag home market return	-.0094 (-0.52)	.0875*** (17.61)
Country fixed effects	Yes	Yes
Obs	47576	47569
R2	.0138	.508

Panel B Vargranger Analysis	*ETF daily* price deviations from the home NAVs ($PD^{E}_{iintra,t}$)		Daily changes of the ETF price deviations from the home NAVs ($\Delta PD^{E}_{iintra,t}$)	
	Model(10)		Model(10)	
Variables	Causality relationship	Wald Test Chi2 Stats	Causality relationship	Wald Test Chi2 Stats
US intraday market return	Yes	8.3331** (p=0.016)	Yes	4.8228* (p=0.090)
Home market return	No	1.514 (p=0.445)	No	1.4279 (p=0.490)
Both market returns	Yes	10.725 ** (p=0.030)	Yes	8.4042* (p=0.078)
Country fixed effects	Yes	Yes	Yes	Yes

Table 7: The Influence of Trading Volume in the US market on US-to-Home ETF Return Spillovers

This table reports how the trading volume of ETFs in the US market impacts return spillovers and how the next day volumes affect the return reversals. The analysis includes all the 23 mature country specific ETFs which have history more than 3 years. The 23 mature country-specific ETFs are listed in stock exchanges in the United States (NYSEArca) with their constituents stocks listed in their home markets. This mature ETF sample is composed of all-cap and all-industry country specific ETFs with daily price, trading volume, and net NAVs coverage from the ETF providers' website (Ishares, SPDR, GlobalX) and those information is also included also in DataStream. The intraday information of the US market is included in TAQ. Sampling period for multivariate panel analysis of the mature ETFs starts on Jan 1, 2001 and ends on Jan 1, 2010. $DR^{E}_{ius,t}$ is the daily return (close-close) of the ith non-US-based ETF traded on the U.S. market at trading day t, $DR^{E}_{ih,t}$ is the daily return (close-close) of home NAVs of the ith non-US-based ETF at trading day t, $DR^{H}_{i,t}$ is the cross-market daily return of the ith replicated indexes of the non-US-based ETFs in their home markets at trading day t, and DR^{US}_{t} is the daytime return of the SP500 index at trading day t,. $V^{E}_{ius,t}$ is the trading volume of ith ETF in the US market at time day t.

$$DR^{E}_{ih,t} = \theta_0 + \theta_1 DR^{E}_{ih,t-1} + \theta_2 DR^{E}_{ius,t-1} + \theta_3 DR^{E}_{ius,t-1} * V^{E}_{ius,t-1} + \theta_4 DR^{US}_{t-1} + \theta_5 DR^{H}_{i,t-1} + e_{7t} \quad (11)$$

All regressions are controlled for country-fixed effects.

Variables	*ETF returns in home market*				
	Total	*Large Volume ETFs(by mean)*	*Small Volume ETFs(by mean)*	*Large Volume ETFs(by median)*	*Small Volume ETFs(by median)*
Lag ETF returns in home market	-.4204*** (-48.81)	-.2084*** (-3.70)	-.4275*** (-50.82)	-.0137 (-0.99)	-.7708*** (-77.75)
Lag ETF returns in US market	.2033*** (26.21)	.2296*** (11.04)	.1927*** (21.92)	.2282*** (18.81)	.1471*** (14.97)
US to home spillover	-.0008 (0.00)	-.1700** (-2.23)	.2460 (0.31)	-0.1570*** (-2.59)	.0538* (1.96)
Lag US market return	.2782*** (32.38)	.2942*** (12.73)	.2740*** (29.81)	.2818*** (20.26)	.2726*** (27.41)
Lag home market return	.1934**** (18.27)	-.0226 (-0.41)	.2071*** (18.58)	-.2233*** (-13.77)	.5731*** (43.16)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Obs	47625	8526	39099	24045	23580
R2	0.1329	0.1349	0.1331	0.1130	0.2513

Figure 1: US and Home Impacts on ETF Closing returns, from 2001 to 2009.

This figure summarizes the impact from the trading market on the international ETFs traded in the US market for different years. We can see there is an upward trend for the trading market (US) impact, but a downward trend for the home impact. The US market's impact becomes dominant from the second half of the year 2005.

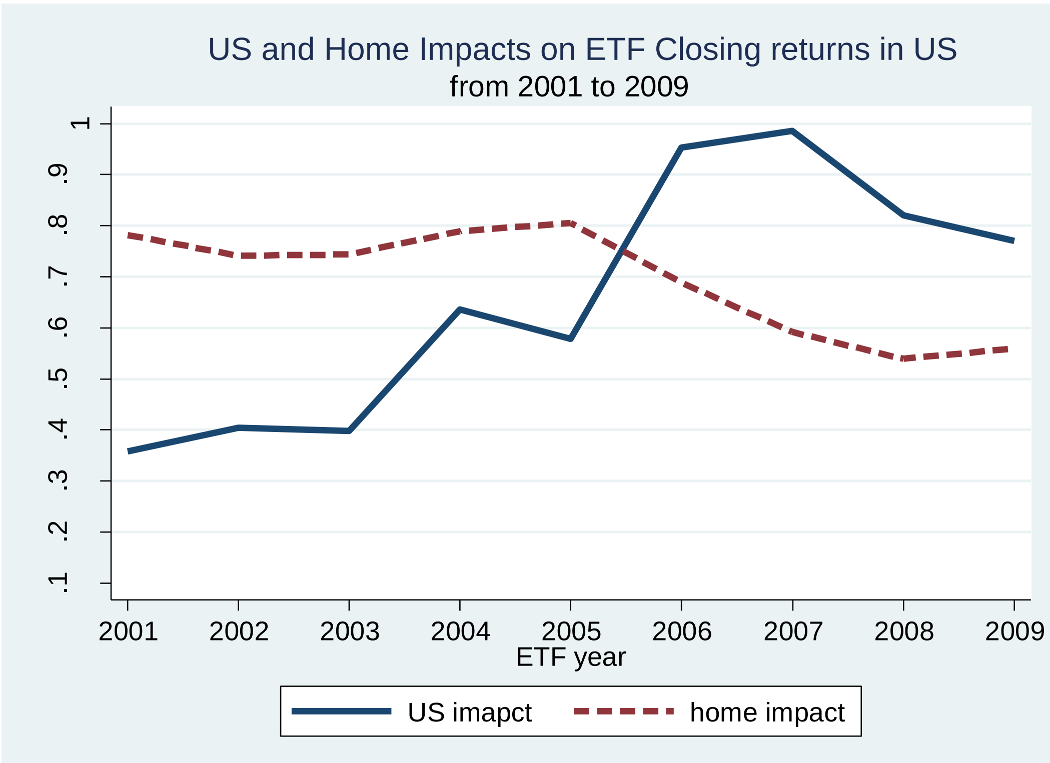

Figure 2: Intraday Impacts from US Market, from 2001 to 2009.

This figure shows the intraday impacts on the same-time ETF returns from the US market. Each line defines X hours after home markets close during the opening of the US market. All the six lines have an upward trend over time, which means, US intraday impacts are growing as time goes by. Also, the magnitude order among the different levels is consistent with our expectation. Everywhere in the history, i.e. the impact line is higher with one hour later. The US intraday impacts on the intraday levels grow hour by hour in the open US market after home markets close. This pattern is persistent over time.