On the Impact of Country ETFs' Premiums and Discounts over Feedback Trading

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Abstract

In view of the established presence of wide deviations of US-listed country ETFs' prices from their net asset values, we study whether feedback trading exists in this category of ETFs and whether it varies with their premiums and discounts. Using a sample of nineteen country ETFs for the 2000-2016 window, we find that feedback trading is present in several of them, particularly those targeting Asia Pacific markets. Feedback trading varies with the sign (i.e. premiums and discounts), level, and nature (observed/forecast) of these deviations, as well as prior to and after the outbreak of the 2008 crisis.

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1. Introduction

Research (Deville, 2008) on exchange traded funds (ETFs, hereafter) has denoted the presence of significant deviations of US-listed country ETFs' prices from their underlying net asset values (NAV, hereafter), leading these ETFs to document substantial premiums and discounts. This has been fundamentally attributed to the non-synchronicity in trading between these ETFs (traded in the US) and their underlying benchmark portfolios' stocks (most country ETFs cover markets in Europe and the Asia-Pacific, whose trading sessions overlap partially or not at all with trading times in the US). As a result, deviations of these ETFs' prices from their NAVs cannot be arbitraged away real-time (e.g. via the established creation and redemption mechanism for ETFs), since the US market and the markets of these ETFs' underlying benchmarks are not simultaneously open for trading. An interesting question arising here is whether these documented deviations (premiums and discounts) prevailing in country ETFs can foment behavioural trading patterns among these ETFs' investors. Our study addresses this issue by first investigating whether US-listed country ETFs accommodate significant feedback trading, considering the extensive evidence supporting the presence of feedback traders in ETFs internationally (Madura and Richie, 2004; Chau et al., 2011; Chen et al., 2012; Charteris et al., 2014). Second, we examine whether the presence of feedback trading in US-listed country ETFs varies with their premiums/discounts, motivated by Charteris et al. (2014), who explored the link between feedback trading and ETFs' premiums/discounts in the context of emerging markets' ETFs. However, whereas Charteris et al. (2014) employed only observed premiums/discounts in their tests, our research extends the scope of this investigation by assessing the effect of both *observed* and *forecast* premiums/discounts over feedback trading in US-listed country ETFs. Third, we examine whether our findings vary prior to versus after the 2008 global financial crisis' outbreak.

To begin with, feedback trading is an umbrella-term encompassing any trading strategy based on the identification of trends in historical market data, primarily past prices and other aggregate gauges, such as volume. Feedback traders believe that prices exhibit inertia (Farmer, 2002), are characterized by trends of a repetitive (and, hence, predictable) nature and, as such, can be profitably exploited via *ad hoc* trading rules. The prevalence of feedback trading in the market can amplify existing price-trends, leading prices to depart from fundamentals (De Long et al., 1990) and enhance serial correlation (Cutler et al., 1990) and excess volatility (Farmer, 2002; Farmer and Joshi, 2002) in the return-generation process, thus being detrimental for market efficiency.[1] Overall, feedback traders are distinguished into two types, namely “positive” (those who trade in the direction of the observed trend in the market) and “negative” (those who aim at bucking the market trend) feedback traders.

Feedback trading can be motivated by a notably wide array of factors of both rational, as well as behavioural, nature. From a rational perspective, *rational speculation* (De Long et al., 1990) can lead informed investors to profitably exploit their uninformed counterparts by launching price-trends in the market in anticipation of uninformed (“noise”) investors riding on them. Investors also tend to engage in feedback trading believing they can extract useful information from historical prices when the *information risk* of their investments is high, in particular when the information available is either very little or hard to access/process. This is the case, for example, when funds invest in small capitalization stocks, about which little information is normally available (Lakonishok et al., 1992; Wermers, 1999; Sias, 2004; Voronkova and Bohl, 2005) and foreign stocks (given the perceived informational superiority of overseas markets’ indigenous traders - see Brennan and Cao, 1997 and Lin and Swanson,

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[1] Feedback trading runs counter to the weak form of market efficiency (Fama, 1991) in two ways. On the one hand, its proponents base their strategies on historical prices (rather than fundamentals), even though, by virtue of weak form market efficiency, historical prices entail no news-content that has not already been reflected in the price-formation process. On the other hand, the fact that feedback traders can amplify price-trends in the market leads returns to exhibit serial correlation that enhances return-predictability.

2008). *Style investing* (Bennett et al., 2003) is a key driver of feedback trading, since several investment styles popular among institutional investors, including momentum and contrarian strategies (see Galariotis, 2014 for an excellent review on both), are based on historical prices. *Technical analysis* (see e.g. Fong and Yong, 2005) is another key expression of feedback trading, while the latter can also be driven by traditional trading practices, including *portfolio insurance* (Kodres, 1994), *stop-loss orders* (Osler, 2005), and *margin trading* (Watanabe, 2002; Hirose et al., 2009). *Professional reasons* are conducive to feedback trading as well, with fund managers often buying stocks with positive recent performance in order to generate a positive impression as regards their skills, a practice known as "window-dressing" (Lakonishok et al., 1992).

From a behavioural perspective, investors resort to feedback trading primarily due to *observational learning*: prices provide a statistical summary of market activity (Holmes and Kallinterakis, 2014) that indirectly allows them insight into the trades of other market participants, without the need to actively monitor the latter.[2] The *representativeness heuristic* (i.e., inferring the properties of a population based on a small sample of recent observations) can motivate trend-chasing (Barberis et al., 1998), since it can prompt investors to buy (sell) a stock after only a few days of positive (negative) performance. This can be further reinforced by the *availability bias* (Barberis and Thaler, 2003), according to which more (less) recent events are more (less) easily retrievable by human memory and enjoy a higher (lower) weight in decision-making. *Anchoring* (Barberis and Thaler, 2003) is also relevant here, since using reference points in trading is very common among feedback-style strategies[3], while the *disposition effect*, namely the propensity to sell (keep) winning (losing) stocks, can enhance negative feedback trading (Brown et al., 2006). Finally, a series of recent profits generated

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[2] This is important, because the active monitoring of other investors' trades is both costly and constrained by the obvious boundaries imposed on human perception by limited attention (Hirshleifer and Teoh, 2003; Hirshleifer et al, 2011).

[3] The case e.g. of relative strength strategies like momentum; see Jegadeesh and Titman (2001).

from the employment of feedback strategies can lead their users to fall prey to *overconfidence* (Barber and Odean, 2000), prompting them to trade more actively on their premises.

Empirical evidence on feedback trading overall confirms its presence internationally across several markets, asset classes and investor types. As far as studies using micro data are concerned, positive feedback trading has been found to be popular among US fund managers, with its magnitude being greater during more recent time periods (Sias, 2004; Froot and Teo, 2008; Choi and Sias, 2009) compared to earlier ones (Lakonishok et al., 1992; Grinblatt et al., 1995; Wermers, 1999). US retail investors engage less in positive feedback trading compared to their institutional counterparts (Nofsinger and Sias, 1999), while the sign of feedback trading of retail investors in Germany varies with the order-type they employ (Dorn et al., 2008).[4] Walter and Weber (2006) report significant positive feedback trading among German mutual funds; conversely, Kremer and Nautz (2013) show that German funds are contrarian traders, similar to UK funds (Wylie, 2005). Choe et al. (1999) report significant positive feedback trading for overseas investors in South Korea prior to the Asian crisis, with this feedback trading largely dissipating following the crisis' outbreak. On the other hand, Kim and Wei (2002a; b) find that foreign institutional investors exhibit more positive feedback trading in the South Korean market in the aftermath (as opposed to before) the Asian crisis' outbreak, while Bowe and Domuta (2004) report very limited evidence of feedback trading for foreign and domestic investors in Indonesia before, during and after the Asian crisis. Hung et al. (2010) find that mutual funds tend to negative feedback trade in Taiwan, while Feng and Seasholes (2004) detect no evidence of feedback trading among retail investors in China. Finally, the global study by Choi and Skiba (2015) presents evidence indicating the prevalence of positive feedback trading among institutional investors internationally (31 out of 41 markets). Turning now to evidence from studies using aggregate (i.e., price) data,

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[4] Market orders (executed limit orders) follow positive (negative) feedback trading patterns.

significant positive feedback trading has been documented in international (both developed and emerging) equity markets by Sentana and Wadhwani (1992), Koutmos (1997), Koutmos and Saidi (2001), Watanabe (2002), Bohl and Reitz (2004; 2006), Koutmos (2006), Bohl and Siklos (2008), Schuppli and Bohl (2010) and Chau and Deesomsak (2015). Results in the vast majority of these studies further confirm that positive feedback trading is characterized by directional asymmetry, manifesting itself more boldly during market slumps, as opposed to market upswings. Evidence of feedback trading of either sign has also been produced for international currency (Aguirre and Saidi, 1999; Laopodis, 2005) and energy (Chau et al., 2015) markets, while Antoniou et al. (2005) find that the introduction of index futures has depressed positive feedback trading in the spot segments of several developed capital markets.[5]

An asset class that has experienced exponential growth since the late 1990s is that of ETFs, which represent a financial innovation of huge popularity among both retail and institutional investors. In the US, the world's largest ETF market, there exist 1,680 ETFs of multiple types with a combined value of just over USD 2.374 trillion[6], while the number of ETFs globally amounts to 9,804[7] with a combined market value of USD 2.877 trillion.[8] ETFs are essentially hybrid instruments, entailing features of open-end and closed-end funds, in the sense that they both track a benchmark index[9] (similar to traditional mutual funds) and are publicly listed and traded (much like closed-end funds), thus allowing their holders to trade their index of choice via a single security. ETF-holders can, thus enter long or short positions in ETFs using any order-type (market, limit, stop-loss etc.), just like they would on any other common

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[5] Antoniou et al. (2005) also find that feedback trading appears to be less pronounced in the index futures segment, while similar results are presented by Chau et al. (2008) for single stock futures.

[6] Source: Investment Company Institute (https://www.ici.org/etf_resources/research/etfs_08_16).

[7] The figure pertains to August 2016; source: World Federation of Exchanges.

[8] Source: Investment Company Institute (https://www.ici.org/research/stats/worldwide/ww_q2_16). The figure refers to the second quarter of 2016.

[9] ETFs track various investment targets, including equity markets, sectors, fixed-income markets, currencies, commodities, metals, natural resources and investment styles.

stock, while authorized participants (primarily funds and market makers) can in-kind create/redeem ETF-units in the primary market.[10] ETFs possess a series of attractive properties, including low expense fees[11], instant exposure[12], transparency[13], dividend-treatment[14], risk management[15], and tax-efficiency[16], which have been delineated in a series of studies (Gastineau, 2001; Kostovetsky, 2003; Deville, 2008) and which help explain the wide popularity ETFs have been enjoying among both retail and institutional investors (Charteris et al., 2014).

Evidence on the behaviour of ETF-traders has indicated that they subscribe to feedback-style strategies. Drawing on high frequency data from US ETFs during the internet bubble, Madura and Richie (2004) demonstrate the presence of intraday overreaction patterns in their trading dynamics that correct themselves within the same day, thus presenting profitable opportunities to traders with intraday horizons. Chau et al. (2011) find that the US' three largest ETFs ("Spiders"; "Cubes"; "Diamonds") are characterized by significant positive feedback trading, whose presence grows more pronounced during bullish sentiment periods,

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[10] ETF units are created in-kind when an authorized participant borrows batches of shares and deposits them with the ETF's holding company, receiving ETF-shares in return. ETF units are redeemed in-kind when an authorized participant returns his in-kind created ETF units to the ETF's holding company, receiving in return the batch of stocks he deposited upon the in-kind creation of these units.

[11] ETFs are "trackers", engaging in passive investment strategies (they track benchmarks), thus requiring no active management on behalf of their managers; as a result, their management expense fees are far smaller than those of traditional mutual funds. Normally, less liquid ETFs (those e.g. investing in illiquid markets/sectors) are harder to manage (order-execution may take longer and transaction costs may be higher), thus commanding higher management expense fees.

[12] Aside from the obvious benefit of enabling their holders to trade an index or a sector through a single instrument (also known as tactical portfolio allocation; Ünal, 2009), ETFs also facilitate access to markets, entry into which would either be difficult *per se* (due e.g. to regulatory restrictions) or costly (due e.g. to the information costs involved). The recent surge of ETFs focusing on frontier equity markets (De Groot et al., 2012) is one such example.

[13] ETFs disclose their portfolio-structure in terms of assets and net asset value intraday, as opposed to traditional mutual funds, whose portfolio-holdings are disclosed at very low frequencies (often quarterly).

[14] Dividends received by the ETF via its investments in equities are deposited with the accounts of its investors, who are offered the option to invest these dividends into their ETF-position; conversely, open-end funds invest dividends automatically in the holder's position.

[15] Investors trading in a market (e.g. the UK) can use an ETF linked to that market's index (e.g. the FTSE100) for hedging purposes (Curcio et al., 2004).

[16] In the event of redemption of a holder's share in an open-end fund, its manager will have to sell shares from the fund's portfolio to undertake the redemption; assuming this sale leads to a profit, the manager has to pay capital gains' taxes, whose amount is levied over all remaining holders of the fund. Conversely, an ETF-holder can sell his ETF-shares without his trade imposing any taxes on his fellow holders, though, of course, he will be subject to capital gains' tax in case he sells at a profit.

while Chen et al. (2012) show that US institutional investors negative feedback trade when investing in ETFs, with that pattern being accompanied by significant herding.

A factor that has been found to affect feedback trading in ETFs is the latter's tracking error, i.e., the deviations (positive/negative) of their price from their net asset value (i.e., the value of their benchmark portfolio). Charteris et al. (2014) study feedback trading in emerging markets' ETFs and find that it tends to grow in significance in the presence of high lagged premiums. Although the findings of Charteris et al. (2014) are important in highlighting the relationship between feedback trading and ETFs' tracking errors, their study focused on ETFs that are simultaneously trading *and* investing in their home country. Extant literature (Harper et al., 2006; Deville, 2008; Blitz and Huij, 2012) however, has unearthed substantial premiums/discounts for the specific category of country ETFs, the latter referring to ETFs listed in US markets and investing in overseas markets' equities. These deviations are, largely, the products of differential trading times; country ETFs investing in Asia Pacific, for example, will start trading long after Asia Pacific markets have closed, thus rendering the arbitrage of these tracking errors an impossibility. In view of Charteris et al. (2014)'s findings above, the issue arising is whether feedback traders are present in US-listed country ETFs and whether the widely documented premiums/discounts of the latter cast an effect over their feedback trading; to the best of our knowledge, this has never been explored in the relevant literature.

Our study addresses this issue by investigating the presence of feedback trading in a sample of nineteen US-listed country ETFs whose investments cover a wide cross section of both developed and emerging markets for the 20/6/2000 – 27/4/2016 period. We aim at addressing the following research questions:

a) Is feedback trading present in country ETFs?

b) Do country ETFs' observed premiums/discounts affect the presence of their feedback trading?

c) Do country ETFs' forecast premiums/discounts affect the presence of their feedback trading?

d) Do our findings hold when controlling for the outbreak of the 2008 global financial crisis?

Overall, our results reveal that feedback trading is present in several US-listed country ETFs, with its presence being sensitive to the time period examined and the sign and level of the (observed and forecast) percentage deviations of each ETF's price from its NAV (i.e., premiums and discounts). Feedback traders are active the most in those ETFs targeting Asia Pacific markets, with very little (no) evidence of their presence documented in ETFs targeting European (Latin American) markets. We attribute our findings to the noise trading often encountered in Asia Pacific markets (leading ETFs investing there to exhibit feedback trading either due to them mirroring these markets' price-trends, or due to these ETFs' investors choosing to feedback trade as a rational strategy given the noise trading levels of these markets) and the lack of overlapping trading sessions due to time-difference between the US and Asia (leading these country ETFs' NAVs to be known –and possibly used as reference points – before the start of trading in the US). Our research produces original contributions to the extant literature, as it showcases that the widely documented premiums/discounts of US-listed country ETFs are related to feedback trading, with this relationship appearing more pronounced for ETFs targeting markets with no overlap in their trading with the US. Although the causal direction of this relationship (i.e., whether feedback trading motivates these premiums/discounts or vice versa) cannot be established, its implications are nevertheless important for these ETFs' investors, who can use it to inform their trading strategies.

The rest of this paper is organized as follows: the next section introduces the data used with descriptive statistics and delineates the methodology employed. Section 3 presents and discusses the results and section 4 concludes by summarizing the study's main findings and outlining their implications.

2. Data-Methodology

Our data includes daily observations of the closing prices and net asset values of nineteen iShares MSCI ETFs, which are presented in Table 1 (panel A). The data covers the period between June 20th, 2000 and April 27th, 2016 and has been obtained from Thomson-Reuters DataStream (closing prices) and Black Rock iShares (NAVs), with the observations from both databases matched. The choice of June 20th, 2000 as the starting date of our sample coincides with the launch-date of the iShares MSCI Taiwan ETF (the ETF with the latest launch date out of all nineteen ETFs) and the reason for this is that we aimed at including in our sample all US-listed country ETFs launched before 2001 in order to have a sufficiently long pre crisis window when testing for the effect of the 2008 crisis over our results.

Table 1 (panel B) provides a series of descriptive statistics (mean; standard deviation; skewness; kurtosis; Jarque-Bera normality test; Ljung–Box test statistic for returns and squared returns for ten lags) pertaining to the log-differenced returns of our sample ETFs. Fifteen (four) ETFs exhibit negative (positive) skewness, while all nineteen ETFs present us with rather large Jarque-Bera test-statistics and leptokurtosis in their returns' distributions. To gauge whether these departures from normality are the products of temporal dependencies in the series' structures, we apply the Ljung–Box portmanteau test on the first and second moment of all ETFs' returns. All Ljung-Box test-statistics on ETFs' returns are significant (at least at the 5 percent level), indicating the presence of significant autocorrelations in our

ETFs' return-distributions; this, however, is not in itself evidence in support of feedback trading, since dependencies in the first moment of returns can also be due to market inefficiencies, such as thin trading. In view of the documented (see e.g. Farmer and Joshi, 2002) ability of feedback traders to accentuate volatility in capital markets, we test for higher moment temporal dependencies by calculating the Ljung-Box test-statistic for squared returns. As our results indicate, all of these test-statistics are significant (at the 1 percent level) and always higher in value than the Ljung-Box test-statistics calculated previously for returns, thus confirming the presence of time-varying volatility in our ETFs. The presence of significant first- and second-order temporal dependencies in financial time series is well-established in the literature (Bollerslev et al., 1994) and in the next section we shall investigate whether they are related to feedback trading.

Panel C in Table 1 presents some statistics on each ETF's percentage price deviations from its net asset value contingent on their sign (premiums, if the sign is positive; discounts, if it is negative). The average percentage deviation of ETFs' prices from their NAVs is positive (0.087%), denoting that US-listed country ETFs traded on average at a premium during the full sample period, with almost all ETFs[17] having traded on average at a premium over the entire sample period. On average, our sample ETFs traded 55.3% (44.7%) of the time at a premium (discount) with emerging country ETFs tending to trade more often at a discount compared to developed country ETFs. The average premium across all nineteen ETFs[18] stands at 0.71% and tends to vary, with the lowest (highest) average premium value being detected for the iShares MSCI Austria Capped ETF (iShares MSCI Malaysia ETF) at 0.01%

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[17] The sole exception here is the iShares MSCI Austria Capped ETF, which traded on average at a discount.

[18] To calculate the average premium across all sample ETFs, we first calculate the average premium for each ETF by averaging all positive percentage deviations of its price from its NAV and then calculate the average value of all average premiums per ETF.

(2.17%). The average discount[19] across all sample ETFs also varies, with the lowest (highest) average discount value being observed for the iShares MSCI Austria Capped ETF (iShares MSCI Malaysia ETF) at -0.01% (-1.53%).

[PLEASE INSERT TABLE 1 HERE]

To empirically address the research questions of our study, we rely on the model developed by Sentana and Wadhwani (1992), which assumes the interaction of two groups of traders in the market. The first group consists of rational speculators who maximize their expected utility based on a mean-variance framework, as reflected in their demand function below:

$$Q_t = \frac{\mathbb{E}_{t-1}(r_t) - \alpha}{\theta \sigma_t^2} \tag{1}$$

In Equation (1) above, $\mathbb{E}_{t-1}(r_t)$ is the expectation in period $t-1$ of the ETF's return, r_t, in period t , α is the risk-free return, θ is the time-invariant coefficient of risk-aversion and σ_t^2 is the conditional variance (proxying for risk) at period t.

The second group comprises of feedback traders, who trade on the premises of historical prices, as reflected in their demand function:

$$Y_t = \gamma r_{t-1} \tag{2}$$

As Equation (2) suggests, feedback traders base their trades on the previous period's return, with the direction of their trades varying, depending on whether they positive (i.e., if $\gamma > 0$, in which case, they buy if $r_{t-1} > 0$ and sell if $r_{t-1} < 0$) or negative (i.e., if $\gamma < 0$, in which case, they buy if $r_{t-1} < 0$ and sell if $r_{t-1} > 0$) feedback traders. For the market to be in equilibrium, all shares must be held, in which case:

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[19] To calculate the average discount across all sample ETFs, we first calculate the average discount for each ETF by averaging all negative percentage deviations of its price from its NAV and then calculate the average value of all average discounts per ETF.

$$Q_t + Y_t = 1 \tag{3}$$

Substituting Equations (1) and (2) in Equation (3), we obtain:

$$\mathbb{E}_{t-1}(r_t) = \alpha - \gamma r_{t-1}\theta\sigma_t^2 + \theta\sigma_t^2 \tag{4}$$

To estimate Equation (4), we convert the expected return, $\mathbb{E}_{t-1}(r_t)$, into a realized one (r_t), by assuming the latter's rational expectation $[r_t = \mathbb{E}_{t-1}(r_t) + \varepsilon_t]$, where $\varepsilon_t$is a stochastic error term:

$$r_t = \alpha - \gamma r_{t-1}\theta\sigma_t^2 + \theta\sigma_t^2 + \varepsilon_t. \tag{5}$$

As Equation (5) shows, the first-order return-autocorrelation interacts both with risk (σ_t^2), and feedback trading (the first-order autocorrelation sign will be positive if $\gamma < 0$ and negative if $\gamma > 0$). However, autocorrelation can be the result of both inefficiencies in the market (such as, for example, thin trading) as well as feedback traders and Equation (5) does not allow us to disentangle between the two possibilities. To that end, Sentana and Wadhwani (1992) suggested the following *ad hoc* empirical specification of Equation (5):

$$r_t = \alpha + \theta\sigma_t^2 + (\phi_0 + \phi_1\sigma_t^2)r_{t-1} + \varepsilon_t. \tag{6}$$

Equation (6) distinguishes between the part of autocorrelation due to market inefficiencies (denoted by ϕ_0) and that due to feedback trading (denoted by ϕ_1). With $\phi_1 = -\theta\gamma$, significantly positive (negative) values for ϕ_1 will denote the presence of negative (positive) feedback trading.

To assess the interaction of feedback trading with the observed premiums/discounts of our sample ETFs, we employ Chau et al. (2011)'s empirical extension of the Sentana and Wadhwani (1992) model:

$$r_t = \alpha_0 D_{t-1} + \alpha_1(1 - D_{t-1}) + \theta_0 D_{t-1}\sigma_t^2 + \theta_1(1 - D_{t-1})\sigma_t^2 + D_{t-1}\left(\phi_{0,0} + \phi_{1,0}\sigma_t^2\right)r_{t-1} + (1 - D_{t-1})\left(\phi_{0,1} + \phi_{1,1}\sigma_t^2\right)r_{t-1} + \varepsilon_t \quad (7)$$

The term "D_{t-1}" in Equation (7) is a dummy variable assuming the value of unity if the ETF has posted a discount in period $t-1$, zero otherwise.[20] Equation (7) allows all terms of Equation (6) to shift with the observed lagged premiums/discounts of the ETF and permits us to gauge how feedback trading manifests itself when the ETF's price exhibits a positive (the case of a premium) or negative (the case of a discount) deviation from its NAV in period t-1.[21]

The conditional variance (σ_t^2) in all of the above equations follows an asymmetric GARCH specification (Glosten et al., 1993):

$$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2, \quad (8)$$

In Equation (8), the parameter δ reveals whether volatility responds asymmetrically to positive versus negative shocks. I_{t-1} is a dummy variable, assuming the value of unity if the lagged shock is negative, zero otherwise; significantly positive estimates for δ denote that volatility is higher following negative (compared to positive) shocks.

Given country ETFs' documented wide premiums and discounts, it is possible that feedback traders condition their feedback trading on forecast premiums/discounts when trading these ETFs. To explore this possibility, we assess the interaction between forecast

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[20] Given the daily frequency of our data, both the closing prices and NAVs employed are day-end observations; as a result, it is not possible for the feedback trader of Equation (7) to trade on the contemporaneous (period t) premium/discount, since he cannot observe it until the session is over (this would have been the case only if we were working on the premises of high frequency data), hence we rely on lagged premiums/discounts.

[21] Equation (7) combines the possibility of NAV-deviations interacting with feedback trading both *additively* and *multiplicatively*. As Chau et al. (2011) showed, the additive version of this interaction assumes the following feedback trading function: $Y_t = \gamma\, r_{t-1} + \kappa D_t$, in which case the combined function of rational and feedback traders becomes: $r_t = \alpha_0 D_t + \alpha_1(1 - D_t) + \theta_0 D_t\sigma_t^2 + \theta_1(1 - D_t)\sigma_t^2 + \left(\phi_{0,1} + \phi_{1,1}\sigma_t^2\right)r_{t-1} + \varepsilon_t$. The multiplicative version of this interaction assumes the following feedback trading function: $Y_t = [\gamma D_t + \kappa(1 - D_t)]r_{t-1}$, in which case the combined function of rational and feedback traders assumes the following form: $r_t = \alpha + \theta\sigma_t^2 + D_t\left(\phi_{0,0} + \phi_{1,0}\sigma_t^2\right)r_{t-1} + (1 - D_t)\left(\phi_{0,1} + \phi_{1,1}\sigma_t^2\right)r_{t-1} + \varepsilon_t$.

premiums/discounts and feedback trading, by first assuming that the dynamics of ETFs' percentage price deviations from their NAV follow a standard Ornstein-Uhlenbeck (OU) process[22], as follows:

$$dX_t = -\rho(X_t - \mu)dt + \xi dW_t, \tag{9}$$

X_t represents the percentage price deviation of the ETF from its NAV, ρ is the speed of mean reversion, W_t is a standard Brownian motion (on some probability space), and μ is the long term[23] equilibrium level of the ETF's percentage price deviation from its NAV. The solution of Equation (9) is provided by

$$X_{i+1} = X_i e^{-\rho t} + \mu(1 - e^{-\rho t}) + \xi\sqrt{\frac{1-e^{-\rho t}}{2\rho}}N_{0,1}, \tag{10}$$

where t denotes the fixed time steps and $N_{0,1}$ is the standard normal distribution. We then estimate the parameters using the maximum likelihood method, with the conditional probability density function derived as follows:

$$f\left(X_{i+1}|X_i;\mu,\rho,\hat{\xi}\right) = \frac{1}{\sqrt{2\pi\hat{\xi}^2}}exp\left(-\frac{\left(X_i - X_{i-1}e^{-\rho t} - \mu\left(1-e^{-\rho t}\right)\right)^2}{2\hat{\xi}^2}\right) \tag{11}$$

with

$$\hat{\xi}^2 = \xi^2\,\frac{1-e^{-2\rho t}}{2\rho}\,. \tag{12}$$

The log-likelihood function of a set of observations $(X_0, X_1, \dots, X_n)$ can be derived as:

$$\mathcal{L}\left(\mu,\rho,\hat{\xi}\right) = \sum_{i=1}^{n} lnf\left(X_{i+1}|X_i;\mu,\rho,\hat{\xi}\right) = -\frac{n}{2}ln(2\pi) - nln\left(\hat{\xi}^2\right) - \frac{1}{2\hat{\xi}^2}\sum_{i=1}^{n}\left(X_i - X_{i-1}e^{-\rho t} - \mu(1 - e^{-\rho t})\right)^2. \tag{13}$$

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[22] Applications of the OU-process in finance include Bormetti et al. (2010) and Griffin (2010).

[23] The long term equilibrium is equivalent here to a window of 252 days (i.e. a year's observations).

Algebraically, the following equations are derived from the above:

$$\mu = \frac{\sum_{i=1}^{n}\left(X_i - X_{i-1}e^{-\rho t}\right)}{n(1-e^{-\rho t})}, \tag{14}$$

$$\rho = -\frac{1}{t} ln \frac{\sum_{i=1}^{n}(X_i-\mu)(X_{i-1}-\mu)}{\sum_{i=1}^{n}(X_{i-1}-\mu)^2}, \tag{15}$$

and

$$\hat{\xi}^2 = \frac{1}{n}\sum_{i=1}^{n}[(X_i - \mu - e^{-\rho t})(X_{i-1} - \mu)]^2. \tag{16}$$

To gauge whether the forecast premiums/discounts generated from the OU-process affect feedback trading in our sample ETFs, we employ Equation (17), a close variant of Equation (7):

$$r_t = \alpha_0 D_t + \alpha_1(1 - D_t) + \theta_0 D_t \sigma_t^2 + \theta_1(1 - D_t)\sigma_t^2 + D_t\left(\phi_{0,0} + \phi_{1,0}\sigma_t^2\right)r_{t-1} + (1 - D_t)\left(\phi_{0,1} + \phi_{1,1}\sigma_t^2\right)r_{t-1} + \varepsilon_t \tag{17}$$

In the above equation, “D_t” is equal to one, if the OU-process forecasts a discount for day t, zero otherwise.

Finally, to test whether our findings hold in view of the outbreak of the 2008 global financial crisis, we partition our sample period into a pre (June 20th, 2000 - August 31st, 2008) and a post (September 1st, 2008[24] – April 27th, 2016) crisis-outbreak period and repeat all our estimations for both sub periods.

3. Results – Discussion

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[24] For more on the choice of September 2008 as the cut-off point in our sample window, see Charteris et al. (2014).

We begin our discussion with the presentation of the results from Equation (6), i.e., the original Sentana and Wadhwani (1992) model. The estimates outlined in Table 2 indicate that several US-listed country ETFs exhibit inefficiencies in their returns, as demonstrated by the significantly[25] negative (positive) values of the first-order autocorrelation coefficient (ϕ_0) for eight (two) ETFs. ϕ_1 assumes significantly negative values for six ETFs (iShares MSCI Australia ETF; iShares MSCI Hong Kong ETF; iShares MSCI Japan ETF; iShares MSCI Malaysia ETF; iShares MSCI Singapore ETF; iShares MSCI Taiwan ETF), denoting the presence of positive feedback trading in their dynamics. Although the above indicate that the majority (thirteen) of our sample's US-listed country ETFs accommodates no feedback trading, it is worth noting that the above six ETFs are all targeting markets in the Asia Pacific region, thus suggesting that feedback trading is more pronounced for country ETFs investing in markets whose trading times do not overlap with those of the US at all.[26] A key issue regarding several Asia Pacific markets is that retail investors command a substantial fraction of their turnover (Chou et al., 2011), thus amplifying noise trading (Barber et al, 2007; 2009; Kuo et al., 2015). As a result, the feedback trading documented for country ETFs targeting markets in that region may be due either to these ETFs mirroring (given their tracking nature) these markets' performance (which can often entail price-trends as a result of noise trading) or to these ETFs' investors opting for feedback trading as a rational strategy given the noise levels of these markets.[27] The large time difference between the Asia Pacific region and the US further facilitates feedback trading in those ETFs, since US investors trading them will be aware of their underlying benchmarks' NAVs for the day well before trading in the US has

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[25] In the interest of brevity, any reference to statistical significance in this section shall pertain to estimated coefficients, whose p-values are less than 0.1 (i.e. the 10 percent level of significance).

[26] The sole ETF in our sample focusing on an Asia Pacific market and not exhibiting any feedback trading is the iShares MSCI South Korea Capped ETF.

[27] The selection of feedback trading as a strategy by investors of country ETFs targeting Asia Pacific markets in this case can be motivated either by rational speculative reasons (to exploit the noise trading patterns in Asia Pacific markets' equity returns via those ETFs) or informational reasons (noise trading renders the public pool of information poorer and feedback trading has been shown – Brennan and Cao, 1997 – to be an option when trading in markets with informational uncertainty).

started, possibly choosing to use these NAVs as reference points.[28] As per the structure of their conditional variance, the significant (at the 1 percent level) λ values indicate that contemporaneous volatility is significantly related to lagged volatility, thus denoting its persistence. The volatility of most (sixteen) ETFs responds significantly to news (as the significant β values indicate), with this response being asymmetric in all cases, since the coefficient δ is always significantly positive. Overall, the structure of the conditional variance of our study's ETFs reflects similar properties to that reported in prior studies on ETFs' feedback trading (Chau et al., 2011; Charteris et al., 2014).

[PLEASE INSERT TABLE 2 HERE]

We now turn to assessing whether feedback trading varies in its presence in US-listed country ETFs with the sign of the observed lagged percentage price deviation of an ETF from its NAV (i.e. premium or discount). Table 3 presents the results from the estimation of Equation (7) for our sample's ETFs. Our estimations, overall, reveal a rather limited presence of feedback trading contingent upon the realization of a lagged premium or discount. More specifically, two ETFs (iShares MSCI Hong Kong ETF; iShares MSCI Taiwan ETF) exhibit positive feedback trading when a premium is observed on the previous day, while the iShares MSCI Belgium Capped ETF (iShares MSCI Malaysia ETF) exhibits negative (positive) feedback trading in the presence of a lagged discount. Again here, it is interesting to note that three of those four ETFs are targeting Asia Pacific markets (in line with the evidence presented previously on feedback trading being more pronounced for them), with some of these ETFs exhibiting some of the largest average premiums/discounts for the sample

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[28] Whereas the net asset value of a US ETF investing in domestic equities evolves throughout the session alongside its actual market price, the net asset value of an ETF investing e.g. in Malaysia will have evolved over a time window not corresponding to that ETF's trading times in the US. As a result, investors in that ETF would be aware of its net asset value at close (Malaysian time) long before that ETF's trading opens in the US.

period.[29] Several ETFs exhibit inefficiencies in their return-generating process irrespective of the presence of lagged premiums or discounts, as their significant $\phi_{0,0}$ and $\phi_{0,1}$ values indicate. When a discount has materialized on the previous day, $\phi_{0,0}$ is significantly positive (negative) for one (two) ETFs; conversely, the realization of a lagged premium is found to be associated with more cases of significant first-order autocorrelation, as it yields significantly positive (negative) $\phi_{0,1}$ values for five (two) ETFs. Regarding the volatility's structure, it appears highly persistent and asymmetric for all nineteen ETFs, in line with the results reported previously.

[PLEASE INSERT TABLE 3 HERE]

Table 4 presents the estimates from Equation (17), controlling for the presence of a predicted (as opposed to observed) premium or discount. Significant positive feedback trading exists for predicted premiums for three ETFs (iShares MSCI Hong Kong ETF, iShares MSCI Singapore ETF; iShares MSCI Taiwan ETF) and for predicted discounts for the iShares MSCI Malaysia ETF and the iShares MSCI Taiwan ETF; significant negative feedback trading is reported for the iShares MSCI France ETF and the iShares MSCI Spain Capped ETF for predicted discounts. Once more, our results show that feedback trading tends to be more prevalent among country ETFs investing in Asia Pacific markets, with evidence on its presence among country ETFs targeting European markets being rather limited. The majority of ETFs exhibit significant first-order autocorrelation for predicted discounts, with several of them doing so for predicted premiums as well, thus confirming the presence of widespread inefficiencies in their returns' structure. Again here, volatility appears highly persistent and asymmetric across all nineteen ETFs.

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[29] As Table 1 (panel C) shows, the iShares MSCI Malaysia ETF bears the highest average discount (-1.53%), while the iShares MSCI Taiwan ETF the second highest (1.13%) average premium.

[PLEASE INSERT TABLE 4 HERE]

To test whether the results reported in Tables 2-4 hold when controlling for the outbreak of the 2008 financial crisis, we repeat all of the above tests prior to (20/6/2000 – 31/8/2008) and after (1/9/2008 – 27/4/2016) the crisis' outbreak and report the results in Tables 5-7. Tables 5 and 6 present the estimates from the original Sentana and Wadhwani (1992) model (Equation (6)) pre and post crisis' outbreak, respectively. As the results indicate, feedback trading appears scant within each of the two sub periods; indeed, significant positive feedback trading exists in only three ETFs (iShares MSCI Malaysia ETF; iShares MSCI Singapore ETF; iShares MSCI Sweden ETF) before and two (iShares MSCI Australia ETF; iShares MSCI Hong Kong ETF) after the crisis' outbreak. Again here, the presence of feedback trading in country ETFs targeting Asia Pacific markets is confirmed, with four of the above mentioned five ETFs investing in markets from that region. Overall, the varying presence of feedback trading prior to and after the events of September 2008 is in line with the results reported on emerging markets' ETFs by Charteris et al. (2014) and confirms prior evidence (Antoniou et al., 2005; Laopodis, 2005; Schuppli and Bohl, 2010; Chau and Deesomsak, 2015) on the sensitivity of feedback trading to periods characterized by different market conditions. The presence of autocorrelation in the ETFs' structure is also confirmed, yet, much like with feedback trading, surfaces less frequently within each sub period (for six ETFs pre and five post crisis); as for the structure of our ETFs' volatility, it remains highly persistent and asymmetric[30] during both sub periods. Table 7 presents the results on the feedback coefficients ($\phi_{1,0}$; $\phi_{1,1}$) from the tests conditioning feedback trading on the lagged/predicted discounts/premiums before and after the crisis' outbreak. Results suggest

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[30] No asymmetry is detected for the volatility of the iShares MSCI Malaysia ETF pre crisis, as δ is found to be significantly negative there.

limited evidence in favour of feedback trading, the latter being mostly detected among country ETFs targeting Asia Pacific markets.

[PLEASE INSERT TABLES 5, 6 & 7 HERE]

As an additional robustness test, we assessed the effect of various lagged (forecast) premium[31] and discount[32] levels over feedback trading by setting the variable D_{t-1} (D_t) equal to one for each of these levels in Equation (7) (Equation (17)) and re-estimating it for the full sample period and the two sub periods (pre-/post-crisis). Our estimates reveal the presence of positive feedback trading across several premium/discount levels for country ETFs targeting Asia Pacific markets (particularly for the full sample period and post crisis' outbreak), while several ETFs targeting European markets also furnished us with evidence of (positive and negative) feedback trading.[33]

Overall, our study has shown that feedback traders are active in several US-listed country ETFs, with their presence being sensitive to the time period examined and the sign and level of the (observed and forecast) percentage deviations of each ETF's price from its NAV (i.e. premiums and discounts). The fact that country ETFs targeting Asia Pacific markets are more susceptible to feedback trading, both in its conditional and unconditional versions (i.e., both when we do/not condition it upon observed/predicted premiums/discounts), raises interesting issues for those investing in these ETFs. As mentioned before, most Asian markets are typified by the enhanced presence of retail traders in their equity segments, leading the latter to accommodate substantial noise trading. It is, thus, possible that the feedback trading reported here for those ETFs is either due to them tracking these markets' performance (which can often entail price-trends as a result of noise trading) or to these ETFs' investors

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[31] The premium-levels tested for are: +0.25%; +0.5%; +0.75%.

[32] The discount-levels tested for are: -0.25%; -0.5%, -0.75%.

[33] For brevity reasons these results are not reported here, but are available from the authors on request.

choosing to feedback trade as a rational strategy given the noise trading levels of these markets. Considering the relatively limited evidence of feedback trading for country ETFs targeting markets with complete or partial overlap of trading sessions with the US (the case of country ETFs targeting European and Latin American markets), it is likely that the time difference involved contributes to this. US investors of ETFs targeting Asia Pacific markets are faced with a non-synchronicity of these ETFs' prices with their NAVs as these ETFs never trade real-time with their underlying benchmarks: they begin their trading in the US with their NAV of the day already known. Although it is possible that this foments feedback tendencies among their clientele (who can use these ETFs' NAVs as anchors when trading them), the validity of the latter can only be confirmed using real-time micro data (i.e. data on investors' transactions).

An issue of interest to country ETFs' investors, however, that we can examine in the context of this study, is whether there exists a relationship between successful predictions of these ETFs' premiums/discounts and their feedback trading. If, for example, successfully predicted discounts in an ETF are accompanied by significant positive feedback trading, this would suggest that the predictive model (in our case, the Ornstein-Uhlenbeck process) is capable of, indirectly, offering insight into that ETF's trading dynamics as well. This is a rather interesting issue and, to that end, we set the dummy D_t in Equation (17) equal to 1 for those days when the predicted sign of the ETF's percentage price deviation from its NAV equals the actual one[34], zero otherwise, and estimate the equation for all nineteen ETFs for the full sample period, prior to and after the crisis' outbreak. Results from the feedback coefficients of interest ($\phi_{1,0}$;$\phi_{1,1}$) are presented in Table 8 and indicate that successful premium/discount predictions are accompanied by significant feedback trading on very few occasions: $\phi_{1,0}$ is significantly positive for the iShares MSCI Belgium Capped ETF for the full sample period

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[34] This is the case when the Ornstein-Uhlenbeck process predicts a discount (premium) for day t and the ETF posts a discount (premium) on day t.

and significantly negative for the iShares MSCI Austria Capped ETF pre crisis' outbreak, the iShares MSCI Singapore ETF pre crisis' outbreak and the iShares Taiwan ETF for the full sample period. The significance of $\phi_{1,1}$ (reflective of unsuccessful predictions) is linked with more (eight) cases of feedback trading significance, while the majority of coefficients reported in Table 8 are insignificant, thus showcasing the absence of a widespread relationship between successful predictions[35] of country ETFs' premiums/discounts and their feedback trading.

[PLEASE INSERT TABLE 8 HERE]

4. Conclusion

This study investigates whether feedback traders are active in US-listed country ETFs and whether their presence is affected by the significant premiums and discounts that have been documented for these ETFs in the literature. Drawing on a sample of nineteen ETFs from that category for the 2000-2016 period we report significant feedback trading for several of them, with its presence varying with these ETFs' observed/forecast premiums/discounts and the level of the latter, as well as before and after the 2008 crisis' outbreak. Country ETFs targeting Asia Pacific markets are found to be more prone to feedback trading (compared to those targeting European and Latin American markets) and we discuss how this might be related to the noise trading often encountered in these markets, as well as the non-synchronicity in trading times between them and their underlying benchmarks.

From a research perspective, our findings contribute substantially to the literature on both ETFs and feedback trading, as they offer novel insights into country ETFs' trading activity, by demonstrating how these ETFs' extensively documented wide premiums and discounts

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[35] This, however, does not imply that using a forecasting process other than Ornstein-Uhlenbeck will not yield such a relationship; the issue remains open for future research.

can be related to behavioural investment patterns (feedback trading). The evidence presented here is also of key relevance to investors, particularly those focusing on country ETFs, as it could be used to inform their trading strategies, by prompting them, for example, to utilize the relationship between feedback trading and country ETFs' premiums/discounts documented in this study when trading those ETFs.

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Table 1: Sample statistics.

Panel A: List of sample ETFs

iShares MSCI Australia ETF
iShares MSCI Austria Capped ETF
iShares MSCI Belgium Capped ETF
iShares MSCI Brazil Capped ETF
iShares MSCI Canada ETF
iShares MSCI France ETF
iShares MSCI Germany ETF
iShares MSCI Italy Capped ETF
iShares MSCI Hong Kong ETF
iShares MSCI Japan ETF
iShares MSCI Malaysia ETF
iShares MSCI Mexico Capped ETF
iShares MSCI Netherlands ETF
iShares MSCI Singapore ETF
iShares MSCI South Korea Capped ETF
iShares MSCI Spain Capped ETF
iShares MSCI Sweden ETF
iShares MSCI Switzerland Capped ETF
iShares MSCI Taiwan ETF

Panel B: Descriptive statistics

ETF	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera	LB(10)	LB^2(10)
iShares MSCI Australia ETF	0.0197	0.0182	-0.1430	12.1400	12350***	56.22***	3417.3***
iShares MSCI Austria Capped ETF	0.0141	0.0182	-0.6369	11.6014	11174***	7.57**	2514.5***
iShares MSCI Belgium Capped ETF	0.0129	0.0164	-0.5508	9.9403	7298***	5.58**	2407.8***
iShares MSCI Brazil Capped ETF	-0.0879	0.0201	-0.2495	9.4194	6857***	31.13***	2837.0***
iShares MSCI Canada ETF	0.0242	0.0148	-0.4438	9.4130	6194***	13.60**	3524.7***
iShares MSCI France ETF	0.0082	0.0174	-0.2503	9.1038	5543***	37.29***	2077.4***
iShares MSCI Germany ETF	0.0171	0.0177	-0.0643	10.9100	9244***	26.33***	1699.8***
iShares MSCI Hong Kong ETF	0.0243	0.0167	0.1328	12.2000	12518***	113.56***	3501.4***
iShares MSCI Italy Capped ETF	-0.0104	0.0189	-0.3989	9.0500	5501***	26.01***	1435.3***
iShares MSCI Japan ETF	0.0110	0.0144	0.1420	11.8631	11622***	39.87***	2223.4***
iShares MSCI Malaysia ETF	-0.0861	0.0203	-0.2649	22.2801	78469***	28.33***	506.0***
iShares MSCI Mexico Capped ETF	0.0326	0.0198	-0.0259	11.7451	16134***	27.6***	1443.0***
iShares MSCI Netherlands ETF	0.0103	0.0168	-0.4216	9.8133	6965***	24.12**	2613.5***
iShares MSCI Singapore ETF	0.0220	0.0168	0.0757	10.6823	8726***	95.56***	2866.9***
iShares MSCI South Korea Capped ETF	0.0248	0.0226	0.0954	12.2247	14234***	61.08***	2684.0***
iShares MSCI Spain Capped ETF	0.0080	0.0189	-0.3589	9.9694	7254***	27.20***	1302.5***
iShares MSCI Sweden ETF	0.0262	0.0207	-0.2652	9.9811	5328***	42.87***	2784.1***
iShares MSCI Switzerland Capped ETF	0.0243	0.0140	-0.3752	9.0499	5492***	42.27***	2278.8***
iShares MSCI Taiwan ETF	0.0805	-0.0266	-0.0931	7.5724	3476***	53.05***	1497.0***

Panel C: Statistics on percentage price deviations from NAV

	Average price deviation (%)	Average premium (%)	Average discount (%)	% of days when ETF trades at a premium	% of days when ETF trades at a discount
iShares MSCI Australia ETF	0.1284	0.7660	-0.8398	0.6036	0.3964
iShares MSCI Austria Capped ETF	-0.0029	0.0057	-0.0066	0.5318	0.4682
iShares MSCI Belgium Capped ETF	0.0734	0.5676	-0.5664	0.5647	0.4353
iShares MSCI Brazil Capped ETF	0.0357	0.7200	-0.6100	0.5503	0.4497
iShares MSCI Canada ETF	0.0669	0.3694	-0.2924	0.5445	0.4555
iShares MSCI France ETF	0.0537	0.5073	-0.5170	0.5577	0.4423
iShares MSCI Germany ETF	0.0475	0.4930	-0.5199	0.5607	0.4393
iShares MSCI Hong Kong ETF	0.0277	0.7404	-0.8570	0.5541	0.4459
iShares MSCI Italy Capped ETF	0.0534	0.5435	-0.5608	0.5566	0.4434
iShares MSCI Japan ETF	0.0799	0.8182	-0.8490	0.5576	0.4424
iShares MSCI Malaysia ETF	0.4426	2.1700	-1.5300	0.4782	0.5218
iShares MSCI Mexico Capped ETF	0.0542	0.5700	-0.6500	0.4899	0.5101
iShares MSCI Netherlands ETF	0.0504	0.5091	-0.5494	0.5670	0.4330
iShares MSCI Singapore ETF	0.0286	0.7259	-0.8846	0.5673	0.4327
iShares MSCI South Korea Capped ETF	0.0391	1.0100	-1.0500	0.5322	0.4678
iShares MSCI Spain Capped ETF	0.0486	0.5465	-0.5737	0.5559	0.4441
iShares MSCI Sweden ETF	0.1058	0.6634	-0.6576	0.5784	0.4216
iShares MSCI Switzerland Capped ETF	0.1585	0.5495	-0.4815	0.6221	0.3779
iShares MSCI Taiwan ETF	0.1622	1.1300	-0.9900	0.5418	0.4582

The table above contains a series of information on the sample of ETFs used in our study. The list of the nineteen ETFs employed here is outlined in panel A. Panel B presents a series of descriptive statistics on the log-differenced returns of our nineteen ETFs; these statistics include the mean, standard deviation, skewness, kurtosis, Jarque-Bera normality test-statistics and Ljung-Box test-statistics at ten lags for the return- and squared return-series of the nineteen ETFs. *, ** and *** represent significance at the 10, 5 and 1 percent levels, respectively. Panel C contains summary statistics on the observed percentage price deviations of each ETF from its NAV; these statistics include the average price deviation (%), the average premium (%), the average discount (%) and the percentage of days for which an ETF has traded at a premium/discount.

Table 2: Maximum likelihood estimates from the original Sentana and Wadhwani (1992) model.

	AU	AT	BE	BR	CA	FR	DE	HK	IT	JP
α	0.0085	0.0483	0.0203	-0.0058	0.0351	0.0053	0.0309	0.0350	0.0172	-0.0157
	(0.7926)	(0.1606)	(0.4629)	(0.9042)	(0.1811)	(0.8531)	(0.2976)	(0.2471)	(0.5990)	(0.6380)
θ	0.0047	-0.0050	0.0044	0.0024	-0.0015	0.0062	0.0005	-0.0019	-0.0043	0.0179
	(0.7292)	(0.7149)	(0.7963)	(0.8088)	(0.9304)	(0.6266)	(0.9632)	(0.8988)	(0.7321)	(0.3784)
ϕ_0	-0.0079	0.0188	-0.0563	0.0447	0.0168	-0.0728	-0.0442	-0.0201	-0.1014	-0.0369
	(0.7131)	(0.3821)	(0.0040)	(0.0398)	(0.4332)	(0.0011)	(0.0434)	(0.3402)	(0.0000)	(0.1084)
ϕ_1	-0.0067	-0.0040	0.0010	-0.0028	-0.0033	-0.0007	-0.0027	-0.0109	0.0008	-0.0120
	(0.0411)	(0.1850)	(0.7977)	(0.1569)	(0.5052)	(0.8610)	(0.5269)	(0.0054)	(0.8387)	(0.0551)
ω	0.0355	0.0363	0.0370	0.0681	0.0159	0.0293	0.0340	0.0310	0.0273	0.0578
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
β	0.0198	0.0082	0.0211	0.0122	0.0232	0.0083	0.0134	0.0278	0.0248	0.0436
	(0.0144)	(0.1047)	(0.0031)	(0.0382)	(0.0045)	(0.1523)	(0.0040)	(0.0000)	(0.0000)	(0.0001)
λ	0.9252	0.9385	0.9075	0.9290	0.9290	0.9274	0.9251	0.9200	0.9255	0.8815
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
δ	0.0753	0.0703	0.1040	0.0881	0.0738	0.1006	0.0907	0.0730	0.0792	0.0819
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	ML	MX	NL	SG	SK	SP	SW	CH	TW	
α	0.0151	0.0144	0.0194	-0.0070	-0.0014	0.0348	-0.0116	0.0315	0.0291	
	(0.6672)	(0.6490)	(0.4895)	(0.7957)	(0.9685)	(0.2918)	(0.7297)	(0.2357)	(0.3886)	
θ	0.0096	0.0030	-0.0005	0.0082	0.0082	-0.0046	0.0117	0.0008	-0.0046	
	(0.6539)	(0.8086)	(0.9693)	(0.5457)	(0.4100)	(0.7108)	(0.2157)	(0.9640)	(0.7011)	
ϕ_0	-0.0020	0.0430	-0.0398	-0.0464	0.0227	-0.0550	-0.0256	-0.0741	-0.0039	
	(0.9407)	(0.0341)	(0.0560)	(0.0278)	(0.3115)	(0.0138)	(0.2327)	(0.0009)	(0.8674)	
ϕ_1	-0.0321	-0.0048	-0.0048	-0.0083	-0.0028	-0.0020	-0.0047	-0.0069	-0.0101	
	(0.0001)	(0.1374)	(0.2616)	(0.0485)	(0.2469)	(0.6028)	(0.1008)	(0.2945)	(0.0079)	
ω	0.0148	0.0418	0.0276	0.0158	0.0252	0.0320	0.0403	0.0250	0.0197	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
β	0.0289	0.0014	0.0130	0.0235	0.0283	0.0114	0.0115	0.0275	0.0249	
	(0.0000)	(0.7802)	(0.0527)	(0.0001)	(0.0001)	(0.0394)	(0.1240)	(0.0000)	(0.0002)	
λ	0.9509	0.9209	0.9229	0.9344	0.9376	0.9283	0.9288	0.9163	0.9392	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
δ	0.0249	0.1245	0.1004	0.0704	0.0555	0.0979	0.0896	0.0780	0.0603	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

The table presents the maximum likelihood estimates from the set of the following equations for the full sample period (20/6/2000-27/4/2016):

$$r_t = \alpha + \theta\sigma_t^2 + (\phi_0 + \phi_1\sigma_t^2)r_{t-1} + \varepsilon_t,$$
$$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2.$$

ETFs appear in the table with the following abbreviations: AU (iShares MSCI Australia ETF), AT (iShares MSCI Austria Capped ETF), BE (iShares MSCI Belgium Capped ETF), BR (iShares MSCI Brazil Capped ETF), CA (iShares MSCI Canada ETF), FR (iShares MSCI France ETF), DE (iShares MSCI Germany ETF), HK (iShares MSCI Hong Kong ETF), IT (iShares MSCI Italy Capped ETF), JP (iShares MSCI Japan ETF), ML (iShares MSCI Malaysia ETF), MX (iShares MSCI Mexico Capped ETF), NL (iShares MSCI Netherlands ETF), SG (iShares MSCI Singapore ETF), SK (iShares MSCI South Korea Capped ETF), SP (iShares MSCI Spain Capped ETF), SW (iShares MSCI Sweden ETF), CH (iShares MSCI Switzerland Capped ETF), TW (iShares MSCI Taiwan ETF). Parentheses include p-values.

Table 3: Maximum likelihood estimates from the Sentana and Wadhwani (1992) model controlling for observed lagged premiums/discounts.

	AU	AT	BE	BR	CA	FR	DE	HK	IT	JP
α_0	0.0682	0.1554	0.0723	0.1500	0.0972	0.0540	0.0649	0.1205	0.1556	0.0109
	(0.2661)	(0.0021)	(0.0924)	(0.0638)	(0.0204)	(0.2307)	(0.1982)	(0.0278)	(0.0046)	(0.8459)
α_1	-0.0186	-0.0311	0.0108	-0.1404	0.0207	-0.0442	0.0073	-0.0098	-0.0780	-0.0076
	(0.6649)	(0.5743)	(0.7898)	(0.0262)	(0.5381)	(0.2820)	(0.8646)	(0.8131)	(0.0817)	(0.8876)
θ_0	-0.0042	0.0094	0.0560	0.0040	0.0017	0.0138	-0.0072	0.0144	0.0188	0.0419
	(0.8591)	(0.6061)	(0.0051)	(0.7982)	(0.9472)	(0.5154)	(0.4024)	(0.6008)	(0.3541)	(0.1998)
θ_1	0.0082	-0.0256	-0.0505	-0.0043	-0.0060	0.0044	-0.0072	-0.0191	-0.0232	-0.0214
	(0.6878)	(0.3302)	(0.0398)	(0.7519)	(0.7861)	(0.8254)	(0.7166)	(0.3993)	(0.2186)	(0.5605)
$\phi_{0,0}$	0.0116	0.0279	-0.0239	0.0312	0.0025	-0.0814	-0.0170	0.0280	-0.0531	-0.0122
	(0.7536)	(0.3960)	(0.4559)	(0.3633)	(0.9403)	(0.0210)	(0.6342)	(0.4355)	(0.1672)	(0.7363)
$\phi_{1,0}$	-0.0086	-0.0008	0.0082	-0.0024	0.0017	-0.0359	-0.0001	-0.0098	0.0027	-0.0097
	(0.1250)	(0.8188)	(0.0929)	(0.4460)	(0.8416)	(0.6537)	(0.9829)	(0.1804)	(0.6727)	(0.2978)
$\phi_{0,1}$	-0.0006	0.0558	-0.0355	0.0871	0.0592	-0.0359	-0.0053	0.0054	-0.0602	-0.0255
	(0.9844)	(0.0911)	(0.2433)	(0.0028)	(0.0416)	(0.2539)	(0.1731)	(0.8586)	(0.0878)	(0.5160)
$\phi_{1,1}$	-0.0073	-0.0057	0.0020	-0.0030	-0.0085	-0.0056	-0.0053	-0.0109	-0.0018	-0.0068
	(0.1402)	(0.4820)	(0.8072)	(0.3239)	(0.1995)	(0.4230)	(0.4598)	(0.0589)	(0.7903)	(0.6544)
ω	0.0356	0.0427	0.0360	0.0620	0.0154	0.0296	0.0347	-0.0109	0.0269	0.0596
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
β	0.0201	0.0179	0.0195	0.0145	0.0253	0.0082	0.0133	0.0297	0.0234	0.0426
	(0.1351)	(0.0019)	(0.1351)	(0.0058)	(0.0019)	(0.1758)	(0.0438)	(0.0000)	(0.0001)	(0.0000)
λ	0.9250	0.9280	0.9108	0.9332	0.9292	0.9270	0.9254	0.9174	0.9270	0.8792
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
δ	0.0751	0.0684	0.0751	0.0802	0.0698	0.1008	0.0913	0.0734	0.0787	0.0860
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	ML	MX	NL	SG	SK	SP	SW	CH	TW	
α_0	0.1071	0.0646	0.0903	-0.0220	-0.1115	0.1439	0.0036	0.0411	0.0263	
	(0.0348)	(0.1691)	(0.0416)	(0.6532)	(0.0300)	(0.0173)	(0.9513)	(0.3735)	(0.6135)	
α_1	-0.0566	-0.0265	-0.0122	0.0085	0.0391	-0.0135	0.0393	0.0628	-0.0130	
	(0.2335)	(0.6250)	(0.7642)	(0.8182)	(0.4640)	(0.7631)	(0.0372)	(0.0960)	(0.7860)	
θ_0	0.0104	0.0339	0.0192	0.0280	0.0420	0.0063	-0.0123	0.0749	0.0259	
	(0.7196)	(0.0684)	(0.3642)	(0.2261)	(0.0020)	(0.7691)	(0.4534)	(0.0123)	(0.1613)	
θ_1	-0.0275	0.0440	-0.0219	-0.0178	-0.0152	-0.0276	-0.0043	-0.0621	-0.0338	
	(0.3588)	(0.0662)	(0.3411)	(0.4074)	(0.3155)	(0.1450)	(0.7519)	(0.0345)	(0.0415)	
$\phi_{0,0}$	0.0189	0.0561	-0.0068	-0.0500	-0.0543	-0.0018	-0.0198	0.0161	-0.0139	
	(0.6022)	(0.0503)	(0.8423)	(0.1568)	(0.0896)	(0.5074)	(0.5788)	(0.6934)	(0.7013)	
$\phi_{1,0}$	-0.0213	-0.0013	-0.0024	-0.0076	0.0029	-0.0018	-0.0022	-0.0027	-0.0056	
	(0.0298)	(0.7648)	(0.6839)	(0.2613)	(0.3442)	(0.7475)	(0.6128)	(0.8116)	(0.3219)	
$\phi_{0,1}$	0.0023	0.0884	-0.0244	-0.0326	0.0026	-0.0288	-0.0079	-0.0793	0.0581	
	(0.9521)	(0.0110)	(0.4215)	(0.3101)	(0.9409)	(0.3851)	(0.7981)	(0.0170)	(0.0878)	
$\phi_{1,1}$	-0.0023	-0.0026	-0.0053	-0.0057	-0.0034	-0.0008	-0.0041	-0.0030	-0.0106	
	(0.8627)	(0.7457)	(0.4843)	(0.4394)	(0.4772)	(0.9065)	(0.3599)	(0.8170)	(0.0685)	
ω	0.0202	0.0422	0.0268	0.0161	0.0224	0.0317	0.0411	0.0249	0.0198	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
β	0.0347	0.0022	0.0134	0.0243	0.0179	0.0124	0.0138	0.0285	0.0252	
	(0.0000)	(0.6819)	(0.0499)	(0.0001)	(0.0003)	(0.0000)	(0.0069)	(0.0059)	(0.0002)	
λ	0.9397	0.9208	0.9237	0.9338	0.9458	0.9281	0.9272	0.9158	0.9391	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
δ	0.0314	0.1221	0.0986	0.0696	0.0603	0.0968	0.0879	0.0773	0.0604	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

The table presents the maximum likelihood estimates from the set of the following equations for the full sample period (20/6/2000-27/4/2016):

$$r_t = \alpha_0 D_{t-1} + \alpha_1(1 - D_{t-1}) + \theta_0 D_{t-1}\sigma_t^2 + \theta_1(1 - D_{t-1})\sigma_t^2 + D_{t-1}\left(\phi_{0,0} + \phi_{1,0}\sigma_t^2\right)r_{t-1} + (1 - D_{t-1})\left(\phi_{0,1} + \phi_{1,1}\sigma_t^2\right)r_{t-1} + \varepsilon_t,$$

$$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2.$$

D_{t-1} is a dummy variable assuming the value of unity if the ETF has posted a discount in period $t-1$, zero otherwise. ETFs appear in the table with the following abbreviations: AU (iShares MSCI Australia ETF), AT (iShares MSCI Austria Capped ETF), BE (iShares MSCI Belgium Capped ETF), BR (iShares MSCI Brazil Capped ETF), CA (iShares MSCI Canada ETF), FR (iShares MSCI France ETF), DE (iShares MSCI Germany ETF), HK (iShares MSCI Hong Kong ETF), IT (iShares MSCI Italy Capped ETF), JP (iShares MSCI Japan ETF), ML (iShares MSCI Malaysia ETF), MX (iShares MSCI Mexico Capped ETF), NL (iShares MSCI Netherlands ETF), SG (iShares MSCI Singapore ETF), SK (iShares MSCI South Korea Capped ETF), SP (iShares MSCI Spain Capped ETF), SW (iShares MSCI Sweden ETF), CH (iShares MSCI Switzerland Capped ETF), TW (iShares MSCI Taiwan ETF). Parentheses include p-values.

Table 4: Maximum likelihood estimates from the Sentana and Wadhwani (1992) model controlling for forecast premiums/discounts.

	AU	AT	BE	BR	CA	FR	DE	HK	IT	JP
α_0	-0.3744	-0.3312	-0.2536	-0.0613	-0.1928	-0.2856	-0.3288	-0.3196	-0.3390	-0.4218
	(0.0000)	(0.0000)	(0.0000)	(0.3823)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
α_1	0.1146	0.2537	0.1205	0.0297	0.2189	0.1580	0.2449	0.2459	0.2631	0.1625
	(0.0042)	(0.0000)	(0.0010)	(0.6605)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0019)
θ_0	-0.2115	-0.0761	-0.1077	0.0015	-0.0758	-0.0874	-0.0537	-0.2215	-0.0883	-0.1276
	(0.0000)	(0.0049)	(0.0000)	(0.9164)	(0.0030)	(0.0003)	(0.0049)	(0.0000)	(0.0003)	(0.0001)
θ_1	0.2429	0.1167	0.1647	0.0050	0.0591	0.249	0.0747	0.2135	0.0790	0.2501
	(0.0000)	(0.0006)	(0.0000)	(0.7415)	(0.0150)	(0.0000)	(0.0006)	(0.0000)	(0.0000)	(0.0000)
$\phi_{0,0}$	-0.0403	-0.0769	-0.0844	0.0373	0.0302	-0.1549	-0.0892	-0.1093	-0.1687	-0.1179
	(0.1669)	(0.0025)	(0.0022)	(0.2715)	(0.2913)	(0.0000)	(0.0018)	(0.0002)	(0.0000)	(0.0001)
$\phi_{1,0}$	0.0010	0.0052	0.0064	-0.0014	0.0069	0.0130	0.0024	-0.0021	0.0083	-0.0030
	(0.8875)	(0.1961)	(0.3121)	(0.6599)	(0.3778)	(0.0622)	(0.7065)	(0.8283)	(0.2249)	(0.7663)
$\phi_{0,1}$	-0.0607	0.0076	-0.0477	0.0540	-0.0321	-0.0371	-0.0472	-0.0793	-0.1049	-0.0650
	(0.0290)	(0.8091)	(0.1381)	(0.0618)	(0.2606)	(0.2410)	(0.1462)	(0.0025)	(0.0007)	(0.0247)
$\phi_{1,1}$	-0.0108	-0.0044	-0.0035	-0.0037	0.0002	-0.0014	-0.0010	-0.0162	0.0051	-0.0178
	(0.1166)	(0.5447)	(0.7039)	(0.1716)	(0.9733)	(0.8567)	(0.8980)	(0.0320)	(0.3988)	(0.1328)
ω	0.0224	0.0298	0.0275	0.0602	0.0122	0.0265	0.2736	0.0170	0.0201	0.0399
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
β	0.0245	0.0167	0.0259	0.0150	0.0157	0.0176	0.0154	0.0247	0.0280	0.0535
	(0.0000)	(0.0019)	(0.0000)	(0.0096)	(0.0059)	(0.0000)	(0.0019)	(0.0000)	(0.0000)	(0.0001)
λ	0.9382	0.9350	0.9186	0.9314	0.9370	0.9228	0.9262	0.9382	0.9279	0.8942
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
δ	0.0483	0.0668	0.0804	0.0827	0.0760	0.0924	0.0896	0.0536	0.0727	0.0476
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	ML	MX	NL	SG	SK	SP	SW	CH	TW	
α_0	0.0008	0.0372	-0.3122	-0.3625	-0.0313	-0.3783	0.3342	-0.2761	0.0332	
	(0.9800)	(0.6775)	(0.0000)	(0.0000)	(0.5246)	(0.0000)	(0.0000)	(0.0000)	(0.4964)	
α_1	-0.0161	-0.0036	0.1702	0.1929	0.0041	0.2549	0.1457	0.1247	0.0077	
	(0.6169)	(0.9736)	(0.0007)	(0.0000)	(0.9390)	(0.0000)	(0.0007)	(0.0002)	(0.8715)	
θ_0	0.0072	-0.0009	-0.0997	-0.1521	0.0067	-0.0735	-0.0883	-0.1684	-0.0041	
	(0.5924)	(0.9654)	(0.0000)	(0.0000)	(0.6023)	(0.0000)	(0.0000)	(0.0030)	(0.8097)	
θ_1	-0.0025	0.0133	0.1391	0.1752	0.0145	0.958	0.1220	0.1790	-0.0015	
	(0.7950)	(0.4547)	(0.0000)	(0.0000)	(0.3996)	(0.0000)	(0.000)	(0.0000)	(0.9287)	
$\phi_{0,0}$	-0.0178	0.0372	-0.0917	-0.1256	-0.0228	-0.1895	0.0977	-0.0965	-0.0007	
	(0.5970)	(0.2100)	(0.0007)	(0.0000)	(0.3546)	(0.0000)	(0.0001)	(0.0029)	(0.9839)	
$\phi_{1,0}$	-0.0241	-0.0036	0.0017	-0.0040	-0.0025	0.0161	0.0027	-0.0045	-0.0097	
	(0.0162)	(0.4762)	(0.7859)	(0.6163)	(0.3808)	(0.0098)	(0.6007)	(0.7131)	(0.0677)	
$\phi_{0,1}$	-0.0113	0.0558	-0.0280	-0.0872	-0.0175	-0.0383	-0.0167	-0.0458	0.0093	
	(0.6849)	(0.0697)	(3738)	(0.0023)	(0.6010)	(0.2143)	(0.5842)	(0.1777)	(0.7755)	
$\phi_{1,1}$	-0.0016	-0.0058	-0.0034	-0.0156	-0.0039	-0.0007	-0.0066	-0.0091	-0.0110	
	(0.5990)	(0.2695)	(0.6900)	(0.0482)	(0.4439)	(0.9027)	(0.2282)	(0.5459)	(0.0508)	
ω	0.0063	0.0534	0.0225	0.0092	0.0260	0.0216	0.0307	0.0198	0.0209	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
β	0.0234	0.0024	0.0231	0.0310	0.0216	0.0116	0.0060	0.0345	0.0227	
	(0.0000)	(0.1538)	(0.0002)	(0.0001)	(0.0013)	(0.0000)	(0.3400)	(0.0059)	(0.0002)	
λ	0.9611	0.9088	0.9212	0.9400	0.9401	0.9356	0.9384	0.9218	0.9382	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
δ	0.0351	0.1456	0.0878	0.0513	0.0612	0.0894	0.0859	0.0568	0.0653	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

The table presents the maximum likelihood estimates from the set of the following equations for the full sample period (20/6/2000- 27/4/2016):

$$r_t = \alpha_0 D_t + \alpha_1(1-D_t) + \theta_0 D_t \sigma_t^2 + \theta_1(1-D_t)\sigma_t^2 + D_t\left(\phi_{0,0} + \phi_{1,0}\sigma_t^2\right)r_{t-1} + (1-D_t)\left(\phi_{0,1} + \phi_{1,1}\sigma_t^2\right)r_{t-1} + \varepsilon_t,$$

$$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2.$$

D_t is a dummy variable assuming the value of unity if a discount was forecast for the ETF for day t, zero otherwise. ETFs appear in the table with the following abbreviations: AU (iShares MSCI Australia ETF), AT (iShares MSCI Austria Capped ETF), BE (iShares MSCI Belgium Capped ETF), BR (iShares MSCI Brazil Capped ETF), CA (iShares MSCI Canada ETF), FR (iShares MSCI France ETF), DE (iShares MSCI Germany ETF), HK (iShares MSCI Hong Kong ETF), IT (iShares MSCI Italy Capped ETF), JP (iShares MSCI Japan ETF), ML (iShares MSCI Malaysia ETF), MX (iShares MSCI Mexico Capped ETF), NL (iShares MSCI Netherlands ETF), SG (iShares MSCI Singapore ETF), SK (iShares MSCI South Korea Capped ETF), SP (iShares MSCI Spain Capped ETF), SW (iShares MSCI Sweden ETF), CH (iShares MSCI Switzerland Capped ETF), TW (iShares MSCI Taiwan ETF). Parentheses include p-values.

Table 5: Maximum likelihood estimates from the original Sentana and Wadhwani (1992) model pre crisis' outbreak.

	AU	AT	BE	BR	CA	FR	DE	HK	IT	JP
α	0.0387	0.1940	0.0207	0.0563	0.1365	0.0257	0.1070	0.0919	0.0390	-0.0023
	(0.5844)	(0.0326)	(0.6449)	(0.6092)	(0.0431)	(0.5632)	(0.0354)	(0.1424)	(0.4716)	(0.9742)
θ	0.0189	-0.0571	0.0242	0.0102	-0.0392	0.0212	-0.0171	-0.0190	0.0091	0.0146
	(0.6437)	(0.3030)	(0.3677)	(0.6368)	(0.4502)	(0.4708)	(0.5482)	(0.5353)	(0.8223)	(0.7401)
ϕ_0	0.0122	-0.0311	-0.1004	0.0893	0.0459	-0.0829	-0.0951	-0.0637	-0.1132	0.0262
	(0.8265)	(0.8167)	(0.0040)	(0.0774)	(0.4316)	(0.0479)	(0.0174)	(0.2303)	(0.0138)	(0.6709)
ϕ_1	-0.0318	-0.0258	0.0058	-0.0108	-0.0422	-0.0001	0.0034	-0.0244	-0.0049	-0.0413
	(0.1094)	(0.3251)	(0.5903)	(0.1162)	(0.1884)	(0.9927)	(0.7703)	(0.1602)	(0.8287)	(0.1740)
ω	0.0470	0.0760	0.0545	0.2273	0.0504	0.0237	0.0291	0.0190	0.0319	0.0209
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0041)	(0.0000)	(0.0050)
β	0.0085	0.0136	0.0019	-0.0009	0.0257	-0.0009	0.0205	0.0302	0.0131	0.0462
	(0.5653)	(0.0093)	(0.1248)	(0.9182)	(0.0708)	(0.9250)	(0.0040)	(0.0003)	(0.1884)	(0.0001)
λ	0.9297	0.9328	0.8906	0.8954	0.8983	0.9439	0.9287	0.9468	0.9232	0.9345
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
δ	0.0609	0.0700	0.1101	0.1173	0.0746	0.0775	0.0660	0.0285	0.0771	0.0161
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0309)	(0.0000)	(0.0000)
	ML	MX	NL	SG	SK	SP	SW	CH	TW	
α	0.0104	0.0673	0.0319	0.0009	0.1004	0.0822	0.0237	0.0727	0.0598	
	(0.8609)	(0.3192)	(0.4637)	(0.9889)	(0.3105)	(0.1350)	(0.6837)	(0.1322)	(0.3418)	
θ	0.0126	-0.0001	0.0045	0.0275	-0.0063	-0.0008	0.0151	-0.0127	-0.0090	
	(0.6931)	(0.9980)	(0.8713)	(0.3851)	(0.8062)	(0.9822)	(0.5173)	(0.7241)	(0.5337)	
ϕ_0	-0.0343	0.0542	0.0136	0.0206	-0.0267	-0.0829	-0.0372	-0.1329	-0.0410	
	(0.3994)	(0.2624)	(0.2471)	(0.7167)	(0.6626)	(0.5148)	(0.3673)	(0.0008)	(0.2670)	
ϕ_1	-0.0268	-0.0164	-0.0068	-0.0524	-0.0070	-0.0289	-0.0251	0.0018	-0.0072	
	(0.0371)	(0.2669)	(0.6059)	(0.0040)	(0.5705)	(0.6028)	(0.0093)	(0.9090)	(0.1126)	
ω	0.0080	0.1101	0.0229	0.0335	0.0583	0.0273	0.0355	0.0244	0.0398	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
β	0.0320	-0.0209	0.0012	0.0182	0.0260	0.0048	-0.0005	0.0241	0.0365	
	(0.0000)	(0.0649)	(0.8905)	(0.0979)	(0.0084)	(0.2720)	(0.9643)	(0.0595)	(0.0002)	
λ	0.9691	0.8907	0.9319	0.9379	0.9369	0.9383	0.9452	0.9271	0.9324	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
δ	-0.0076	0.1749	0.0876	0.0558	0.0458	0.0759	0.0780	0.0594	0.0494	
	(0.0623)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0011)	(0.0000)	

The table presents the maximum likelihood estimates from the set of the following equations pre crisis' outbreak (20/6/2000- 31/8/2008):

$$r_t = \alpha + \theta\sigma_t^2 + (\phi_0 + \phi_1\sigma_t^2)r_{t-1} + \varepsilon_t,$$

$$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2.$$

ETFs appear in the table with the following abbreviations: AU (iShares MSCI Australia ETF), AT (iShares MSCI Austria Capped ETF), BE (iShares MSCI Belgium Capped ETF), BR (iShares MSCI Brazil Capped ETF), CA (iShares MSCI Canada ETF), FR (iShares MSCI France ETF), DE (iShares MSCI Germany ETF), HK (iShares MSCI Hong Kong ETF), IT (iShares MSCI Italy Capped ETF), JP (iShares MSCI Japan ETF), ML (iShares MSCI Malaysia ETF), MX (iShares MSCI Mexico Capped ETF), NL (iShares MSCI Netherlands ETF), SG (iShares MSCI Singapore ETF), SK (iShares MSCI South Korea Capped ETF), SP (iShares MSCI Spain Capped ETF), SW (iShares MSCI Sweden ETF), CH (iShares MSCI Switzerland Capped ETF), TW (iShares MSCI Taiwan ETF). Parentheses include p-values.

Table 6: Maximum likelihood estimates from the original Sentana and Wadhwani (1992) model post crisis' outbreak.

	AU	AT	BE	BR	CA	FR	DE	HK	IT	JP
α	-0.0302	-0.0373	0.0127	-0.0641	0.0058	-0.0357	-0.0235	0.0082	-0.0973	-0.0357
	(0.4500)	(0.4113)	(0.7252)	(0.2034)	(0.8396)	(0.4040)	(0.5611)	(0.8096)	(0.1214)	(0.3541)
θ	0.0007	0.0006	-0.0042	-0.0006	-0.0041	0.0076	0.0069	0.0047	0.0141	0.0232
	(0.9610)	(0.9642)	(0.8044)	(0.9571)	(0.8077)	(0.6010)	(0.6161)	(0.7780)	(0.3693)	(0.3232)
ϕ_0	0.0082	0.0285	-0.0301	0.0388	0.0252	-0.0519	-0.0129	0.0398	-0.0651	-0.0506
	(0.7692)	(0.2999)	(0.2539)	(0.1659)	(0.3597)	(0.0891)	(0.6487)	(0.1391)	(0.0690)	(0.0897)
ϕ_1	-0.0059	-0.0027	-0.0004	-0.0016	-0.0016	-0.0017	-0.0041	-0.0110	-0.0008	-0.0101
	(0.0822)	(0.3755)	(0.9163)	(0.4544)	(0.7483)	(0.6979)	(0.3890)	(0.0092)	(0.8646)	(0.1332)
ω	0.0273	0.0344	0.0247	0.0343	0.0079	0.0453	0.0416	0.0378	0.1083	0.0842
	(0.0000)	(0.0000)	(0.0000)	(0.0003)	(0.0022)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
β	0.0206	0.0275	0.0244	0.0114	0.0028	0.0237	0.0104	0.0263	0.0399	0.0324
	(0.0338)	(0.0010)	(0.0065)	(0.1449)	(0.7569)	(0.0074)	(0.2155)	(0.0003)	(0.0000)	(0.0003)
λ	0.9235	0.9250	0.9139	0.9352	0.9419	0.9019	0.9179	0.9004	0.8886	0.8449
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
δ	0.0939	0.0736	0.1057	0.0946	0.0990	0.1217	0.1128	0.1048	0.0918	0.1420
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0309)	(0.0000)	(0.0000)

	ML	MX	NL	SG	SK	SP	SW	CH	TW
α	-0.0003	-0.0374	0.0032	-0.0252	-0.0456	-0.0955	-0.0522	0.0098	0.0432
	(0.9918)	(0.2835)	(0.9348)	(0.3704)	(0.2179)	(0.1018)	(0.2311)	(0.7603)	(0.4636)
θ	0.0026	0.0080	-0.0003	0.0010	0.0085	0.0130	0.0121	0.0046	0.0326
	(0.9086)	(0.5558)	(0.9855)	(0.9484)	(0.4426)	(0.3886)	(0.3196)	(0.8299)	(0.4045)
ϕ_0	-0.0277	0.0521	-0.0264	-0.0112	-0.0019	-0.0281	-0.0311	-0.0364	0.0735
	(0.4243)	(0.0667)	(0.3291)	(0.6692)	(0.9472)	(0.3869)	(0.2803)	(0.2052)	(0.0871)
ϕ_1	-0.0010	-0.0018	-0.0047	-0.0069	-0.0027	-0.0019	-0.0032	-0.0088	-0.0336
	(0.9245)	(0.6501)	(0.3050)	(0.1304)	(0.2917)	(0.6400)	(0.2955)	(0.2177)	(0.1054)
ω	0.0224	0.0271	0.0324	0.0095	0.0219	0.0842	0.0459	0.0245	0.0392
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
β	0.00144	-0.0125	0.0296	0.0095	0.0089	0.0306	-0.0357	0.0323	-0.0133
	(0.0963)	(0.0649)	(0.0048)	(0.1783)	(0.3041)	(0.0002)	(0.0034)	(0.0007)	(0.0550)
λ	0.9285	0.9313	0.9048	0.9407	0.9399	0.8961	0.9041	0.9075	0.9349
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
δ	0.0927	0.1404	0.1089	0.0925	0.0860	0.1098	0.0966	0.0915	0.1047
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0011)	(0.0000)

The table presents the maximum likelihood estimates from the set of the following equations post crisis' outbreak (1/9/2008 – 27/4/2016):

$r_t = \alpha + \theta\sigma_t^2 + (\phi_0 + \phi_1\sigma_t^2)r_{t-1} + \varepsilon_t,$

$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2.$

ETFs appear in the table with the following abbreviations: AU (iShares MSCI Australia ETF), AT (iShares MSCI Austria Capped ETF), BE (iShares MSCI Belgium Capped ETF), BR (iShares MSCI Brazil Capped ETF), CA (iShares MSCI Canada ETF), FR (iShares MSCI France ETF), DE (iShares MSCI Germany ETF), HK (iShares MSCI Hong Kong ETF), IT (iShares MSCI Italy Capped ETF), JP (iShares MSCI Japan ETF), ML (iShares MSCI Malaysia ETF), MX (iShares MSCI Mexico Capped ETF), NL (iShares MSCI Netherlands ETF), SG (iShares MSCI Singapore ETF), SK (iShares MSCI South Korea Capped ETF), SP (iShares MSCI Spain Capped ETF), SW (iShares MSCI Sweden ETF), CH (iShares MSCI Switzerland Capped ETF), TW (iShares MSCI Taiwan ETF). Parentheses include p-values.

Table 7: Maximum likelihood estimates for the feedback coefficients of the extended Sentana and Wadhwani (1992) model accounting for actual (lagged) and forecast premiums/discounts.

	Pre crisis' outbreak				Post crisis' outbreak			
	$\phi_{1,0}$		$\phi_{1,1}$		$\phi_{1,0}$		$\phi_{1,1}$	
	Actual discount	Forecast discount	Actual premium	Forecast premium	Actual discount	Forecast discount	Actual premium	Forecast premium
iShares MSCI Australia ETF	-0.0173	0.0732	-0.0375	-0.0095	-0.0099	0.0007	-0.0079	-0.0104
	(0.6247)	(0.0913)	(0.3039)	(0.7747)	(0.0763)	(0.9150)	(0.1161)	(0.1734)
iShares MSCI Austria Capped ETF	0.0322	-0.0164	-0.0884	0.0113	-0.0019	0.0032	-0.0052	-0.0062
	(0.3661)	(0.7002)	(0.1802)	(0.7600)	(0.5985)	(0.4397)	(0.5391)	(0.4221)
iShares MSCI Belgium Capped ETF	0.0320	0.0084	0.0038	0.0027	0.0038	0.0066	-0.0005	-0.0126
	(0.0786)	(0.5302)	(0.8477)	(0.9004)	(0.4730)	(0.4152)	(0.9565)	(0.2760)
iShares MSCI Brazil Capped ETF	-0.0099	-0.0014	0.0008	-0.0186	-0.0019	-0.0003	-0.0025	-0.0031
	(0.2806)	(0.8430)	(0.9534)	(0.0761)	(0.5627)	(0.9348)	(0.4306)	(0.2904)
iShares MSCI Canada ETF	-0.0441	0.0406	-0.0490	-0.0257	0.0025	0.0028	-0.0066	0.0017
	(0.4292)	(0.4399)	(0.3146)	(0.5091)	(0.7683)	(0.7556)	(0.3458)	(0.8175)
iShares MSCI France ETF	-0.0040	0.0365	-0.0079	-0.0204	0.0022	0.0087	-0.0086	-0.0151
	(0.8468)	(0.0843)	(0.7337)	(0.4350)	(0.7557)	(0.2853)	(0.2699)	(0.1333)
iShares MSCI Germany ETF	-0.0110	0.0142	0.01137	0.0078	0.0031	0.0011	-0.0097	-0.0051
	(0.5305)	(0.3944)	(0.5509)	(0.6203)	(0.6586)	(0.8753)	(0.1857)	(0.5943)
iShares MSCI Hong Kong ETF	-0.0412	0.0011	-0.0199	0.0089	-0.0070	-0.0045	-0.0117	-0.0177
	(0.1501)	(0.9715)	(0.4672)	(0.7547)	(0.3783)	(0.6533)	(0.0611)	(0.0285)
iShares MSCI Italy Capped ETF	-0.0657	0.0500	0.0512	0.0041	0.0064	0.0093	-0.0052	0.0010
	(0.1055)	(0.1603)	(0.1625)	(0.9109)	(0.3689)	(0.2544)	(0.5188)	(0.8738)
iShares MSCI Japan ETF	0.0064	0.0093	-0.0052	0.0010	-0.0109	-0.0050	-0.0044	-0.0103
	(0.3689)	(0.2544)	(0.5188)	(0.8738)	(0.2634)	(0.5839)	(0.7966)	(0.2755)
iShares MSCI Malaysia ETF	0.0140	-0.0007	-0.0007	-0.0338	-0.0313	-0.0284	-0.0012	-0.0010
	(0.4918)	(0.9649)	(0.9868)	(0.3025)	(0.0476)	(0.0807)	(0.9245)	(0.9401)
iShares MSCI Mexico Capped ETF	-0.0155	-0.0168	-0.0166	-0.0246	0.0007	0.0016	-0.0049	-0.0045
	(0.4566)	(0.4325)	(0.5048)	(0.3663)	(0.8910)	(0.7806)	(0.5819)	(0.4677)
iShares MSCI Netherlands ETF	-0.0150	-0.0085	-0.0026	0.0048	-0.0022	0.0028	-0.0082	-0.0275
	(0.4641)	(0.6645)	(0.8848)	(0.8104)	(0.7482)	(0.7798)	(0.3536)	(0.4279)
iShares MSCI Singapore ETF	-0.0922	-0.0507	-0.0306	-0.0695	-0.0055	-0.0047	-0.0050	-0.0143
	(0.0062)	(0.1365)	(0.2732)	(0.0419)	(0.4777)	(0.5735)	(0.5283)	(0.1070)
iShares MSCI South Korea Capped ETF	-0.0001	-0.0046	-0.0040	-0.0205	-0.0194	-0.0022	-0.0536	-0.0029
	(0.9945)	(0.8027)	(0.7552)	(0.2719)	(0.3608)	(0.4798)	(0.0532)	(0.5559)
iShares MSCI Spain Capped ETF	-0.0414	0.0081	-0.0016	-0.0338	-0.0036	0.0102	-0.0091	-0.0120
	(0.2734)	(0.8141)	(0.9593)	(0.2021)	(0.6066)	(0.1725)	(0.2374)	(0.1815)
iShares MSCI Sweden ETF	-0.0242	-0.0300	-0.0231	-0.0227	-0.0009	0.0046	-0.0021	-0.0065
	(0.1241)	(0.1335)	(0.0918)	(0.1060)	(0.8369)	(0.3723)	(0.6628)	(0.2768)
iShares MSCI Switzerland Capped ETF	0.0085	-0.0216	0.0283	-0.0062	0.0006	0.0023	-0.0076	-0.0230
	(0.7133)	(0.3921)	(0.3105)	(0.8295)	(0.9626)	(0.8669)	(0.5681)	(0.1639)
iShares MSCI Taiwan ETF	-0.0106	-0.0171	-0.0084	-0.0038	-0.0039	-0.0064	-0.0144	-0.0119
	(0.4263)	(0.2220)	(0.4331)	(0.7465)	(0.5629)	(0.2826)	(0.0569)	(0.0642)

The table presents the maximum likelihood estimates for the feedback coefficients when feedback trading is conditioned upon actual lagged/forecast discounts ($\phi_{1,0}$) and premiums ($\phi_{1,1}$) based on estimations from the following set of equations before (20/6/2000- 31/8/2008) and after the crisis' outbreak (1/9/2008 – 27/4/2016):

Actual (lagged) premiums/discounts:

$$r_t = \alpha_0 D_{t-1} + \alpha_1(1 - D_{t-1}) + \theta_0 D_{t-1}\sigma_t^2 + \theta_1(1 - D_{t-1})\sigma_t^2 + D_{t-1}(\phi_{0,0} + \phi_{1,0}\sigma_t^2)r_{t-1} + (1 - D_{t-1})(\phi_{0,1} + \phi_{1,1}\sigma_t^2)r_{t-1} + \varepsilon_t,$$

$$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2.$$

Forecast premiums/discounts:

$$r_t = \alpha_0 D_t + \alpha_1(1 - D_t) + \theta_0 D_t\sigma_t^2 + \theta_1(1 - D_t)\sigma_t^2 + D_t(\phi_{0,0} + \phi_{1,0}\sigma_t^2)r_{t-1} + (1 - D_t)(\phi_{0,1} + \phi_{1,1}\sigma_t^2)r_{t-1} + \varepsilon_t,$$

$$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2.$$

Parentheses include p-values.

Table 8: Maximum likelihood estimates for the feedback coefficients of the extended Sentana and Wadhwani (1992) model accounting for successful premiums/discounts forecasts.

	Full period		Pre crisis' outbreak		Post crisis' outbreak	
	$\phi_{1,0}$	$\phi_{1,1}$	$\phi_{1,0}$	$\phi_{1,1}$	$\phi_{1,0}$	$\phi_{1,1}$
iShares MSCI Australia ETF	0.0037	-0.0076	0.0320	-0.0202	0.0008	-0.0071
	(0.5266)	(0.1101)	(0.3432)	(0.5102)	(0.8939)	(0.1294)
iShares MSCI Austria Capped ETF	-0.0002	-0.0034	-0.0793	0.1293	0.0001	-0.0059
	(0.9575)	(0.5496)	(0.0315)	(0.0139)	(0.9857)	(0.3252)
iShares MSCI Belgium Capped ETF	0.0099	-0.0060	0.0152	0.0103	0.0071	-0.0092
	(0.0929)	(0.4033)	(0.3352)	(0.5828)	(0.3579)	(0.2495)
iShares MSCI Brazil Capped ETF	-0.0019	-0.0040	-0.0073	-0.0141	-0.0009	-0.0023
	(0.6275)	(0.1338)	(0.4052)	(0.1825)	(0.8259)	(0.4115)
iShares MSCI Canada ETF	-0.0027	0.0005	-0.0133	-0.0247	0.0021	-0.0001
	(0.7254)	(0.9345)	(0.7926)	(0.5337)	(0.7838)	(0.9843)
iShares MSCI France ETF	0.0091	-0.0032	0.0005	0.0040	0.0093	-0.0047
	(0.2978)	(0.5627)	(0.9794)	(0.8672)	(0.3539)	(0.4131)
iShares MSCI Germany ETF	0.0043	-0.0035	-0.0011	0.0094	0.0057	-0.0064
	(0.5812)	(0.5542)	(0.9461)	(0.6171)	(0.5129)	(0.2966)
iShares MSCI Hong Kong ETF	-0.0084	-0.0104	-0.0153	-0.0015	-0.0092	-0.0114
	(0.1725)	(0.1123)	(0.5503)	(0.9583)	(0.1898)	(0.0922)
iShares MSCI Italy Capped ETF	-0.0013	0.0062	-0.0104	0.0128	-0.0049	0.0052
	(0.8517)	(0.2337)	(0.7887)	(0.6646)	(0.5184)	(0.3735)
iShares MSCI Japan ETF	-0.0134	-0.0041	-0.0470	0.0073	0.0164	-0.0004
	(0.2498)	(0.6769)	(0.2866)	(0.8641)	(0.1774)	(0.9962)
iShares MSCI Malaysia ETF	-0.0192	-0.0374	0.0017	-0.0463	-0.0023	-0.0409
	(0.1536)	(0.0379)	(0.9399)	(0.1134)	(0.8653)	(0.0938)
iShares MSCI Mexico Capped ETF	-0.0018	-0.0062	-0.0169	-0.0120	0.0034	-0.0052
	(0.7313)	(0.2380)	(0.3844)	(0.5533)	(0.6044)	(0.3568)
iShares MSCI Netherlands ETF	-0.0002	-0.0047	-0.0040	-0.0040	-0.0021	-0.0050
	(0.9743)	(0.4531)	(0.8588)	(0.8253)	(0.7773)	(0.4610)
iShares MSCI Singapore ETF	-0.0091	-0.0048	-0.0642	-0.0650	-0.0066	-0.0051
	(0.1848)	(0.4626)	(0.0133)	(0.0707)	(0.3871)	(0.4514)
iShares MSCI South Korea Capped ETF	-0.0017	-0.0036	-0.0072	-0.0039	-0.0005	-0.0046
	(0.5956)	(0.3959)	(0.6479)	(0.8397)	(0.8704)	(0.3011)
iShares MSCI Spain Capped ETF	0.0013	0.0014	-0.0344	-0.0139	0.0005	0.0014
	(0.8349)	(0.7882)	(0.2290)	(0.6832)	(0.9445)	(0.7928)
iShares MSCI Sweden ETF	-0.0022	-0.0074	-0.0108	-0.0218	0.0016	-0.0069
	(0.8787)	(0.0625)	(0.5012)	(0.0936)	(0.7797)	(0.1009)
iShares MSCI Switzerland Capped ETF	0.0074	-0.0512	-0.0041	0.0316	0.0094	-0.0233
	(0.4897)	(0.1467)	(0.8294)	(0.2489)	(0.4728)	(0.0207)
iShares MSCI Taiwan ETF	-0.0133	-0.0075	-0.0094	-0.0057	-0.0199	-0.0489
	(0.0334)	(0.1491)	(0.1884)	(0.3655)	(0.4563)	(0.1218)

The table presents the maximum likelihood estimates for the feedback coefficients for successful ($\phi_{1,0}$) and unsuccessful ($\phi_{1,1}$) premium/discount predictions from the set of the following equations for the full sample period (20/6/2000- 27/4/2016), before (20/6/2000- 31/8/2008) and after the crisis' outbreak (1/9/2008 – 27/4/2016):

$$r_t = \alpha_0 D_t + \alpha_1(1 - D_t) + \theta_0 D_t \sigma_t^2 + \theta_1(1 - D_t)\sigma_t^2 + D_t(\phi_{0,0} + \phi_{1,0}\sigma_t^2)r_{t-1} + (1 - D_t)(\phi_{0,1} + \phi_{1,1}\sigma_t^2)r_{t-1} + \varepsilon_t,$$

$$\sigma_t^2 = \omega + \beta\varepsilon_{t-1}^2 + \lambda\sigma_{t-1}^2 + \delta I_{t-1}\varepsilon_{t-1}^2.$$

D_t is a dummy variable assuming the value of unity if the predicted sign of the ETF's percentage price deviation from its NAV for day t equals the actual one, zero otherwise. Parentheses include p-values.