

Psychological Price Barriers in Frontier Equities

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Abstract

Psychological barriers are shown to be a feature in frontier market equity pricing. Using MSCI Frontier 100 index constituents; prices, upon breaching an upward or downward psychologically important price point, generally follow predictable patterns in the days after such a breach. It is demonstrated that certain characteristics of frontier markets drive the presence of this relationship. There are regional effects, and also cultural influences as measured by country individualism scores. Liquidity also appears to mediate the presence of psychological barriers. This constitutes a first study of behavioral influences in these fast-growing markets that are being increasingly recognised as an asset class with strong diversification benefits for investors previously restricted to developed and emerging equity markets.

Keywords: frontier markets, psychological barriers, individualism

JEL Codes: G15

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1. Introduction

Frontier markets, equity markets that are not yet developed enough to be classified as 'emerging' but have some investable qualities, are only starting to be studied. The little we do know about them is that they offer very low correlations (and thus diversification benefits) with developed and even emerging markets, that they are expensive and difficult to invest in, and they are relatively new markets based in fast-growing under-developed countries that offer strong future economic growth potential.

We offer a first behavioral investigation of these markets using investor psychology principles adjusted for the cultural, geographic, and liquidity factors that are likely to be features of these markets. Specifically, we examine trading around psychologically important price points for a selection of the most liquid equities from these markets.

Our investigation is motivated by a number of factors. The first being the absence of prior behavioral investigation in these markets, thus this investigation offers the potential for greater understanding of the drivers of pricing in these markets. Providing some impetus for the investigation is a prior study which finds momentum effects in frontier markets (De Groot et al., 2012). Although momentum is not necessarily behavioral, as it is at least partially explainable by liquidity risk (Asness et al., 2013). A behavioral investigation is important as there are a lot of pull factors towards these markets for investors, but we know very little about investor behavior and the pricing dynamics that determine price movements of frontier markets.

A second motivation is that *a priori* we would expect that under-developed

and newer markets, such as these, would have relatively more less-experienced investors who have been shown to be more prone to psychologically biased investment decision making (Da Costa et al., 2013, Feng and Seasholes, 2005). A third motivation is that the cultural diversity of frontier markets, and their cultural difference from most developed markets, allows us to investigate whether cultural influences and psychological factors interact in investor decision making and equity pricing. Culture and psychology are known to interact in general decision making (Nisbett et al., 2001), and a limited body of research suggests this is also a feature of international financial markets (Arkes et al., 2010, Chui et al., 2010, Ji et al., 2008). Understanding more about how culture and psychological influences interact can help us to determine the international validity of investor psychology theories that currently largely concentrate on pricing patterns in developed Western Hemisphere countries. Last but not least, frontier markets represent huge opportunities and investment potential. According to (FTSERussell, 2014) there are 247 nations in the world, with only 150 of them have stock exchanges. Only 26 countries are currently classified as developed markets, and only 22 further as emerging. With only roughly 30 countries currently considered as frontier markets, at least twice as many have a potential to become one.

The term 'frontier markets' dates back to 1992 when the *International Finance Corporation* coined the term to describe equity markets that are not yet sufficiently developed to be described as emerging markets, but which have shown some progress in development (Marshall et al., 2015). In 2007 both Standard & Poor's and MSCI launched indexes covering a selection of frontier markets leading to an increased popularity, and a number of

exchange-traded funds (ETF) now track frontier market performance. However, a precise definition of what these markets comprise is still a matter of debate with, for example, the MSCI frontier market universe consisting of 24 countries, while Speidell and Krohne (2007) identify 57 potential frontier market countries.

Frontier market countries tend to be poor but are also among the fastest growing economies in the world, they have young populations to contribute to future economic growth, and have small stock markets as a proportion of the size of their economies suggesting potential for their stock markets to grow (Speidell and Krohne, 2007). Besides, frontier market countries exhibit very low levels of public debt relative to GDP, are rich with natural resources and experience rapid urbanization and technological advances, coupled with low labour costs (FTSERussell, 2014). Apart from the economic potential, another key attraction of these markets is the diversification benefits for investors currently invested in developed and emerging market equities. Berger et al. (2011) show a very low level of integration between 20 frontier markets and a global market factor, in contrast to developed and emerging markets which are highly integrated, especially in recent years. They suggest including frontier equities in a portfolio of developed and emerging equities (all equities equally weighted) can improve the investor's Sharpe ratio from 0.20 to 0.36. Other research shows similar diversification benefits are available for investors who choose to invest through easily-accessible US, global, and frontier market ETFs; and these have thus shown strong growth in popularity as an investment medium (Berger et al., 2013). The two Berger et al studies though do not take account of transaction costs for trading in these markets,

and these are substantial at around 2% per round-trip transaction, but not much more than average emerging market transaction costs (Marshall et al., 2015). Marshall et al. (2013) determine that the high transaction costs are reflective of liquidity constraints in these markets.

Conscious of these liquidity, transaction cost, and accessibility issues, our study focuses on the MSCI Frontier Markets 100 index of the most liquid equities from frontier markets. After a range of further liquidity filters of these constituents our starting sample consists of 77 equities spread across 15 countries, using daily price data from 1st January 2008 to 30th June 2014. This data selection approach is driven in part by an acknowledgment that these frontier equities are the most practical investment set due to accessibility and reasonable liquidity, but also because if psychologically biased investment patterns are observed in even the most internationally invested frontier equities, then the findings should be generalisable to the remainder of frontier equities that presumably have a lower base of informed international investors.

We test for the presence of psychologically important price points in daily pricing of the selected equities, as a means of gaining greater understanding of investor behavior in these markets. This research area dates back to the 1960s when Osborne (1962) and Niederhoffer (1965) observed that clustering occurs in the pricing of equities around certain price points, most commonly when prices ended in 'round' numbers such as 5 and 0. Subsequent research has suggested that investors find round numbers such as these preferable for a range of reasons. Investors may default to setting buy and sell levels at round numbers leading to increased price clustering around these levels,

or may just generally find it more convenient to trade at round numbers (Sonnemans, 2006). Mitchell (2001) suggests that the clustering effect is also driven by a cultural and psychological preference for round numbers, with round numbers being viewed as more noteworthy than other numbers and thus leading to greater investor attention on these price points. A number of studies confirm that clustering is a feature of equity pricing (Bhattacharya et al., 2012, Ikenberry and Weston, 2008), and is also a feature in other financial markets such as oil (Bharati et al., 2012), foreign exchange (Mitchell and Izan, 2006), and credit default swaps (Meng et al., 2013).

Related to the price clustering literature is research on psychological barriers. Donaldson and Kim (1993) drew on an investor sentiment argument to introduce the idea of psychological barriers in pricing. Their study posited that there exist natural resistance and support levels in the Dow Jones Industrial Average around whole 100s numbers (e.g. round price levels like 2,500, 2,600, 2,700) within which normal trading occurs, but that when prices 'broke through' these barrier points there were predictable trend continuation patterns to subsequent pricing. They argue that this behavior is driven by changes to investor sentiment when pricing breaks out of its regular range. Further studies generally confirm the presence of psychological barriers in equity pricing (Aragon and Dieckmann, 2011, Cyree et al., 1999, Woodhouse et al., 2016), however Dorfleitner and Klein (2009) cannot confirm the presence of psychological barriers in a selection of European equity indices.

Li and Yu (2012) recently extended this research by showing that equity prices being close to their 52-week highs is predictive of positive future returns. This matches a general pattern of findings in equity psychological

barriers research, that prices breaking out of their barrier range - whether by rising through a barrier or falling through one - is predictive of prices continuing in the same direction in the subsequent days. Other financial markets, where there is a greater likelihood of professional investors driving pricing, do not necessarily match this sentiment trading pattern. Dowling et al. (2016) find that oil futures breaking through a round \$10 price point is predictive of prices retrenching back below the price point in the subsequent days, and Cummins et al. (2015) find significant but mixed barrier pricing patterns across a range of non-ferrous metals. Aggarwal and Lucey (2007), in an investigation of psychological barriers in gold futures, finds no return effects after breaching a barrier but do observe a spike in volatility.

Our study follows an adapted methodology from Cummins et al. (2015) and Aggarwal and Lucey (2007) to identify possible psychological barriers and their impact on the pricing of our sample of frontier equities. The primary technique is to test for anomalous price behavior in the 1-5 and 10 days before and after a barrier breach for each equity, with our main focus being on behavior in the days after a barrier was breached. We separately investigate the impact of whether a barrier was breached through falling or rising prices. Psychological barriers are determined based on the price range a stock trades in over the sample. For example, for a stock that trades between 5 and 350 currency units over the time period, we test 1, 10, and 100 round price levels as potential psychological barriers, as all of these levels were potentially important to investors over the time studied. Both returns and volatility predictability around barrier levels are investigated, with the latter implemented through GARCH modeling.

As we are testing a large number of stocks across a range of time windows and price barrier points there is a risk that some of our findings will appear significant purely by chance alone. There are 17,520 individual coefficient tests in this study, and even assuming that for every test the null was true, we should still find that about 876 of the p-values appear significant at the 5% level. We adopt a Generalised Bonferroni-correction for multiple hypothesis testing to control for this potential for inadvertent data mining. The details on the approach are in the following section, but the main impact of the correction is straightforward; we use approximately 0.5% as opposed to 5% as the p-value cut-off for significant results.

These results form the main body of our tests. However, there are particular features of these frontier markets that should also determine the presence and influence of psychological barriers in the pricing of such equities. One issue is that there are a wide range of countries and regions from which the equities are selected. This suggests there might be country-specific and regional effects, perhaps driven by institutional differences or cultural influences. There might also be differing levels of pricing efficiency among the equities. The following discussion details how and why we account for these potential features to build up a richer understanding of psychological pricing patterns in frontier equities.

A noteworthy feature of frontier markets, although not commonly noted, is that the individual frontier markets themselves are very different. In the MSCI Frontier Market index, eight countries are European, five each are African and Middle Eastern, four are Asian, and one is from the Americas. It was discussed above that Berger et al (2011) find low integration between

frontier markets and global pricing factors, however they also find, but don't comment on, low correlations between individual frontier countries and the overall frontier market index. Chen et al. (2014) examine causality across the frontier markets by region, and test whether the largest economies in a region, plus the US, Granger-cause local frontier markets. In most cases there is a strong role for the US as the *de facto* global market, but also in the Middle East there is an influence for Saudi Arabia, while in the Americas there is a role for Brazil; and China, India, Japan in Asian frontier markets. Other research also suggests a particularly local facet to pricing in a selection of these markets (Benic and Franic, 2008, Bley and Saad, 2012, Cheng et al., 2010). This suggests a regional aspect to these markets that would not be captured in indiscriminate overall frontier markets testing.

We account for these regional and country differences in a number of ways. A regional breakdown of our sample shows that Africa, Asia, and the Middle East comprise 90 percent of firms, so given the regional findings of Chen et al. (2014) we conduct a first stage analysis of comparing the findings between these three regions, without any prior expectation as to what might emerge. We also summarise findings on a country-by-country level.

Our second level of analysis builds on the known differences across cultures by applying the individualism measure of Hofstede (Hofstede, 1984). Individualism is a measure of the extent to which there is a focus on the individual in society (as opposed to collectivism where there is more of a group focus). Markus and Kitayama (1991) argue from a theoretical perspective that much of cognitive psychology is primarily applicable to the Western cultural framework of the 'independent self', where there exists a

strongly introspective, individualistic, nature to personalities. This allows cognitive biases to feature more in the influence of psychology on the individual, particularly overconfidence. This is contrasted with more collectivist cultures which can be best characterized by the 'interdependent self' in which a group-focused culture plays an important role in mediating the influence of individualistic psychological traits and biases.

Given that investors allowing psychological barriers to influence their trading is a cognitive bias we investigate whether the presence of psychological barriers in pricing is related to the individualism rating of the country in which an equity is listed. Some prior studies support this cultural investor psychology interpretation. Chui et al. (2010) find that individualism mediates whether momentum trading patterns are a feature of a country's equity pricing, and find low momentum trading in low individualism countries. Western investors have also been shown to be more willing to follow price trends than Asian investors in experimental studies (Ji et al., 2008, Arkes et al., 2010). However no studies apply this relationship to psychological barriers, or extend the testing out to the range of regions covered in our frontier markets dataset.

A final analysis we run to take advantage of the features of frontier equities is to test whether investor sophistication is a driver of the presence of psychological barrier trading in these stocks. As frontier markets tend to be newer markets in less-developed countries it is reasonable to assume that investors will be less-experienced than those in developed markets. This should vary by country, and even company. To test whether this is a driver of psychological barrier influence we estimate the level of investor sophistica-

tion using bid-ask spreads of each equity. This is partially due to the absence of a better direct measure, but also as investor uncertainty is known to be a driver of spreads (Rühl and Stein, 2015, Venkatesh and Chiang, 1986) and less-experienced traders should face greater uncertainty in their investment decision making.

Our paper thus contributes in a number of ways. We provide a first behavioral investigation of frontier market equities. We also examine whether institutional, cultural, and experience factors play a role in the presence of behavioral influences in pricing. This provides a path to future research in these markets, and also suggests more generally how behavioral and cultural effects can interact to influence trader decision making. The next section details the data and methodological approach, this is followed by the results and analysis, and finally concluding comments are provided.

2. Data and Empirical Approach

We use MSCI Frontier Markets 100 index (hereafter Frontier100) constituents to capture a viable sample of frontier market equities. This index consists of between 85 and 115 stocks in markets classed as being at the frontier level of development, with the constituents selected based on investability. Constituents must be investable in general (have a minimum free float, and minimum annual turnover), and investable for foreign investors.

As the Frontier100 index was only launched on 11th April 2012, this presents a data availability issue, although the broader MSCI Frontier Markets index, from which the Frontier100 was developed, has been tested as far

back as 2002 in recent research (Marshall et al., 2015). Our data approach is to take all Frontier100 constituents as at 28th May 2014 and based on a data inspection we test over a period from 1st January 2008 to 30th June 2014 using daily prices. In May 2014 Qatar and the United Arab Emirates were reclassified from frontier markets to emerging markets, however we keep firms from these countries in the dataset as they were only removed at the end of the period, and it enables us to test if there are differences between the presence of psychological barriers for equities from these (ex-ante more developed) markets compared to the other frontier markets.

We start with 105 companies, but make a number of adjustments based on liquidity and trading patterns that mean our final sample is 77 firms. We exclude stocks that trade below 1 unit of local currency for at least 50 percent of the time (this follows standard practice to remove stocks below \$1 in US equity studies due to illiquidity concerns e.g. Cooper et al. (2004)), stocks where no observations exist for over 50 percent of the time, and stocks where zero returns (i.e. no price changes) were observed for over 50 percent of the time. That 28 of the most investable stocks in frontier markets fail these minimal liquidity and trading tests, indicates some of the problems with working with equities from pre-emerging markets. Table 1 provides descriptive statistics for the dataset.

Table 1: Descriptive Statistics

Country	Number	Mean	StdDev	Skewness	Kurtosis
Argentina	3	79.57	28.52	1.80	7.13
Croatia	1	13511	11037	2.97	10.29
Jordan	6	7.23	3.57	2.03	7.43
Kenya	1	5.01	2.90	1.05	4.23
Kuwait	3	1.33	0.55	1.74	5.67
Mauritius	1	64.57	34.26	-1.11	2.59
Morocco	4	447.33	671.91	1.88	6.47
Nigeria	7	51.26	20.91	1.36	4.80
Oman	2	1.50	0.41	1.13	4.21
Pakistan	12	145.21	65.27	1.30	5.39
Qatar	14	69.25	19.98	1.20	5.73
Romania	2	6.39	2.25	0.87	3.87
Sri Lanka	2	169.41	64.25	0.38	2.46
UAE	7	4.64	2.35	1.49	4.73
Vietnam	12	47376	23698	1.54	6.14
Total	77				

Notes: Table 1 provides the summary descriptive statistics for the frontier markets price data by country. The reported statistics are averaged across the equities recorded for each country, and use prices unadjusted for stock splits. Reported figures are based on prices, not returns.

The core testing approach is adapted from Cummins et al. (2015), with the testing being of pricing conditional on key price points being passed through. We set the psychologically important price barriers based on standard practice in the prior literature as being relative to the normal price range of each equity over the time period. To expand on the example given in the introduction of a stock that trades between 5 and 350 currency units over the time period, for this stock we would test all 1, 10, and 100 round price levels for this stock as potential psychological barriers, as each of these price levels were potentially important to investors at some point over the time studied. In practice, for this example, this means testing each time the

stock passes through a whole 1 currency unit amount (5 up to 350 in round dollar amounts), or a whole 10 currency units (10 up to 350 in round 10 amounts) or 100 currency unit (100, 200, 300) amounts. Across the sample we test barriers ranging from 1 currency unit up to 100,000 currency units, as pricing conventions for stocks and currency values vary significantly across the countries (as can be seen for country mean prices in Table 1).

Our first tests are OLS regressions with dummy variables representing days around which prices break through a barrier level. We distinguish two aspects related to these days. First, whether a barrier is breached through prices falling or whether the breach is caused by prices rising. Second, we examine separately the days before and after a barrier breach. This leads to the creation of four dummy variables.

- BDB: Assigns a dummy variable value of 1 to the n days before a breach of a barrier through falling prices
- BUB: Assigns a dummy variable value of 1 to the n days before a breach of a barrier through rising prices
- ADB: Assigns a dummy variable value of 1 to the n days after a breach of a barrier through falling prices
- AUB: Assigns a dummy variable value of 1 to the n days after a breach of a barrier through rising prices

In each case n days is tested separately as 1, 2, 3, 4, 5, 10 days to allow us to identify the duration of price impact, if any. Based on prior research we expect most of the price impact to be confined to the days immediately after

a breach rather than the longer time windows. We are also most interested in the ADB and AUB dummy variables, as these represent the predictable part of the price impact, due to occurring in the days after an easily observable price point has been passed. The regression model is as follows:

$$R_t = \beta_0 + \beta_1 R_{t-1} + \beta_2 BDB_t^n + \beta_3 BUB_t^n + \beta_4 ADB_t^n + \beta_5 AUB_t^n + \varepsilon_t \quad (1)$$

A second set of tests implements a GARCH(1,1) model with the same variables, but included in both the mean and the variance equation. This allows us to investigate if there are volatility impacts around barrier levels (Aggarwal and Lucey, 2007). The return equation is similarly specified as in Equation (1) and the variance equation takes the form:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \beta_2 BDB_t^n + \beta_3 BUB_t^n + \beta_4 ADB_t^n + \beta_5 AUB_t^n \quad (2)$$

The initial returns testing involves a total of 7,464 coefficient tests, when we count across all the equities, time windows, individual coefficients, barrier regions. The GARCH volatility tests add another 10,056 coefficient tests, for a total of 17,520 tests. This suggests an obvious potential for chance to potentially drive any significant results, as even if all null hypotheses were true, with this number of coefficient tests a number of coefficients would still appear to be significant purely due to chance (at the five percent level approximately 876 coefficients would appear significant just through chance). We control for this possibility with a multiple hypothesis testing (MHT) framework and only report results that are robust to this adjustment.

Our MHT framework comes from Romano et al. (2010), and as applied in Cummins et al. (2015) and Dowling et al. (2016) for psychological barriers.

More broadly in financial research a variant of this approach has been recently applied in Harvey et al. (2016) to demonstrate that a large proportion of proposed asset pricing models are probably unreliable. In this paper we apply a Generalised Bonferroni approach to adjust to a reliable significance level whereby a hypothesis is only deemed rejected if:

$$\hat{p}_{(i)} \leq \alpha_{(i)} \equiv k \cdot \alpha / s \quad (3)$$

To explain this condition; s is the total number of coefficient tests, 17,520 in our case; k is the number of false discoveries that are to be controlled for; and α is the significance level. Following prior studies we set k at five percent and $\alpha = 10\%$. This means our Generalised Bonferroni cut-off point is a conservative 0.5% as opposed to the traditional p-value range of 1%, 5%, 10%. We only report results as significant if they meet this enhanced significance threshold.

A final stage in the empirical approach is that we present four sets of aggregate comparisons for the equities in the dataset, in order to determine if certain differentiating characteristics of the regions, countries, and individual equities might be driving our findings. These characteristics are summarised in Table 2. We look at the presence of psychological barriers for countries individually as there might be country-specific drivers, we also compare the three regions of Africa, Asia, and the Middle East which account for 71 of the 77 equities in the dataset. We create two groups of countries based on high and low individualism scores (Hofstede, 1984) to test for cultural determinants of barrier presence. Finally, we divide companies into high and low bid-ask spread groups based on the average bid-ask spread for their

country in order to test the impact of investor sophistication on the presence of psychological barriers (this also allows us to test for liquidity impacts on the presence of barrier effects, which our results suggest are actually a more important feature captured by the bid-ask spread). Related to this, we compare the results for Qatar and UAE to the other countries, as both of these countries were reassigned as emerging countries at the end of the sample period, in part because of better liquidity and market efficiency. Our comparisons are carried out for both returns and volatility, and the approach is necessarily quite simple; we report and compare the percentage of eligible companies in each group which show significant coefficients for the presence of psychological barriers.

Table 2: Geographic, Cultural, and Liquidity Characteristics

Country	Number	Region	Individualism	Bid-Ask %
Argentina	3	Americas	46	0.85
Croatia	1	Europe	33	1.71
Jordan	6	Middle East	38	1.07
Kenya	1	Africa	27	1.00
Kuwait	3	Middle East	38	1.59
Mauritius	1	Africa	27	1.08
Morocco	4	Africa	46	0.81
Nigeria	7	Africa	20	1.17
Oman	2	Middle East	38	1.15
Pakistan	12	Asia	14	0.23
Qatar	14	Middle East	38	0.45
Romania	2	Europe	30	0.61
Sri Lanka	2	Asia	35	1.76
UAE	7	Middle East	38	1.01
Vietnam	12	Asia	20	0.86

Notes: Table 2 summarises the country characteristics used to compare across equities. Reported are the number of equities per country, their region, Hofstede Individualism score for these countries, and bid-ask spread. Bid-Ask is the average relative bid-ask spread $(Ask - Bid)/Bid$ in percentage terms.

3. Findings and Analysis

The tests show that psychological barriers are a significant feature of frontier market equity pricing. Given the amount of tests; as mentioned in the previous section there are 17,520 coefficients tested when we count across all equities, types of tests, barrier definitions, and time windows, a condensed approach is adopted to coherently present the findings. For the raw tests of the price returns impact of psychological barriers, only results that meet the robust Generalised Bonferroni p-value criteria of 0.5% are presented. This forms the basis for the initial discussion in this section. We then move on to analysis of the aggregated comparative results for both returns and volatility tests. This allows us to focus on how differences across region, country, cultural groups, and liquidity influence the presence of barriers; and thus gain greater insight into the nature of psychological influence on pricing in frontier markets.

Tables 5-12 contain the findings for individual companies, barrier levels, and time periods before and after a barrier breach. All results reported in these tables have a minimum significance level of 0.5% which is the Generalised Bonferroni corrected significance level¹. Tables 5-8 contain the tests of most interest as they refer to the tests of behavior after a price barrier has been breached either through prices rising (AUB; Tables 5,6) or falling (ADB; Tables 7,8). Of lesser interest, but included for the sake of completeness, are Tables 9-12 tracking price direction before a barrier is breached. These latter tables generally show that prices tend to be rising for up to two weeks before

¹Full results for all tests are available upon request from the authors

a barrier is breached by rising through a barrier (BUB; Tables 9,10), and prices tend to be falling steadily before a price is breached through falling through a price barrier (BDB; Tables 11,12). This suggests that momentum pushes prices through a barrier level.

Turning to the main results in Tables 5-8 for returns in the days after passing through a barrier, we see that 34 of the 77 companies (44%) display some sort of predictability in the days after rising through a psychological price barrier (Tables 5,6), and the same proportion show predictability after falling through a barrier (Tables 7,8). 24 of the 34 companies appear on both the AUB and ADB tables, so a company that shows return predictability after an upward breach is also likely to show predictability after a downward breach.

The direction of prices following a breach of a barrier suggests a momentum effect, similar to that observed for developed equity market studies (see Donaldson and Kim, 1993). For the 129 significant coefficients across Tables 5 and 6 covering AUB, 68% are positive, indicating that prices tend to predictably continue to rise after rising through a barrier. The effect is more pronounced for the ADB coefficients in Tables 7 and 8, with 87% of coefficients being negative for returns in the days following a downward breach. There is a strong internal consistency to the results at the individual company level; where there are two or more significant coefficients across the time periods for a company (Days 1-5, 10 before and after a breach), in only one case across all the tables is there a change of coefficient signs across the time periods.

Developed market studies of psychological barriers tend to show an immediate price impact of crossing a barrier (Li and Yu, 2012), and we expected a similar finding for our frontier equities. However there is a reasonably even number of significant coefficients across all the time periods investigated, for example across the AUB and ADB tables there are 44 significant coefficients on the first day after a breach, and tracking the impact for two weeks after a breach shows 43 significant coefficients. This suggests a slower level of investor reaction than is seen in developed market studies, and might reflect lack of investor sophistication. There is also some indication of country level differences. All Vietnamese coefficients are positive after an AUB event and all are negative after an ADB event, suggesting strong momentum effects. The Qatar findings also suggest momentum effects. Other countries such as Croatia and Pakistan have more mixed findings with some evidence of price retrenchment. Other countries again, like Nigeria and UAE, show very low presence in the tables despite representing 14 companies in the dataset.

We proceed now to develop an understanding of some of the potential drivers of these differences between countries. Table 3 presents the summary results across country, region, cultural group, and liquidity. The percentages in the table are the number of companies with (any) significant coefficients for the barrier measures (AUB, ADB, BUB, BDB) as a percentage of the total number of companies in that category. For example, reading the first line of the results; Argentina has 33% for ADB as one of the three companies from Argentina has significant coefficients for the days after prices fall through a barrier, while the other two do not. As with the prior discussion, we will confine our discussion to the AUB and ADB findings as these speak to

predictability of prices.

Taking the six largest countries by number of companies in the dataset; Jordan, Nigeria, Pakistan, Qatar, UAE, Vietnam, we see differences across these countries for AUB and ADB. All countries have some level of predictability following crossing a psychological price barrier, but it is not uniform. Nigeria and UAE have no predictability for AUB, showing an absence of price effect from rising through a price barrier, and just 21% of equities from these countries show price effects from falling through a price barrier. On the opposite extreme Pakistan and Qatar, which represent a third of the companies in the dataset show very high presence of barrier effects, with a combined 69% having predictability for AUB and 61% for ADB. Jordan and Vietnam rest in the middle between these two extremes. Thus, clearly treating frontier markets as a unified investment set for analysis runs the risk of overlooking the differences that exist between these markets.

When we examine effects by region, we see that Asia has the highest level of momentum following a barrier breach. The effect is present for 50% of equities across AUB and ADB. The Middle East also shows a high barriers effect, while Africa rests quite far behind Asia and the Middle East. Comparing Qatar and UAE who were reclassified as emerging markets at the end of the sample period with companies from all other countries does not highlight any differences.

The two most interesting findings are at the end of Table 3 regarding cultural differences as measured by the Hofstede (1984) individualism factor, and investor sophistication and liquidity as measured by the bid-ask spread.

Table 3: Summary Results: Conditional Returns Effects

	Total # Stocks	AUB	ADB	BUB	BDB
Country					
Argentina	3	100%	33%	33%	33%
Croatia	1	100%	100%	100%	100%
Jordan	6	33%	50%	50%	50%
Kenya	1	0%	0%	0%	0%
Kuwait	3	67%	67%	33%	67%
Mauritius	1	100%	100%	100%	100%
Morocco	4	75%	50%	50%	50%
Nigeria	7	0%	14%	86%	71%
Oman	2	0%	0%	50%	0%
Pakistan	12	83%	58%	33%	50%
Qatar	14	57%	64%	43%	29%
Romania	2	0%	0%	0%	50%
Sri Lanka	2	100%	0%	50%	0%
United Arab Emirates	7	0%	29%	14%	14%
Vietnam	12	17%	42%	42%	50%
Region					
Africa	13	31%	31%	69%	62%
Asia	26	54%	46%	38%	46%
Middle East	32	38%	50%	38%	31%
Emerging					
Qatar/UAE	21	38%	52%	33%	24%
Remaining Countries	56	46%	41%	46%	50%
Individualism					
Low Individualism	36	39%	42%	47%	56%
High Individualism	41	49%	46%	39%	32%
Bid-Ask Spread					
Low Bid-Ask	48	54%	50%	38%	42%
High Bid-Ask	29	28%	34%	52%	45%

Notes: Table 3 summarises conditional return effects for the four barrier variables; AUB, ADB, BUB, BDB, according to various groupings formed based on country, region, cultural, and liquidity measures (see Table 2). Percentages are calculated as the number of companies within a group that show significant coefficients for a barrier variable as a proportion of total companies in that group.

As noted in the introduction, Chui et al. (2010) find that individualism mediates whether momentum trading patterns are a feature of a country's equity pricing, and find low momentum trading in low individualism countries. A rationale put forward for this relationship is that high individualism promotes overconfidence which in turn leads to trend following as investors are more likely to attribute putative trends to their own skill in spotting these trends rather than random pricing noise. When we divide our dataset approximately in two according to the national individualism score of the country of origin of companies, we are able to observe the same pattern as Chui et al. (2010) found for momentum in the presence of psychological patterns in pricing. For equities based in low individualism countries 40.5% displayed predictability after crossing a barrier level, while for high individualism countries this effect is 7% higher at 47.5%.

The bid-ask spread findings divide companies into two groups based on the average bid-ask spread for the country of origin (see Table 2). We find the predictability of returns following psychological barriers is much lower for companies with high bid-ask spreads, with an average of 31% of companies in such circumstances showing AUB and ADB predictability, while 52% of companies with low-bid ask spreads have significant AUB and ADB coefficients. We included the bid-ask spread measure due to investor uncertainty being a (partial) driver of spreads (Rühl and Stein, 2015, Venkatesh and Chiang, 1986) and the less-experienced traders who we assumed would be a presence in these markets should face greater levels of uncertainty in their decision making. It was expected therefore that this measure would capture variations in presence of barriers as a result of investor sophistication which

should be a feature of frontier markets. Given the findings are contrary to this, we suspect the bid-ask spread measure is instead highlighting liquidity differences. A high bid-ask spread is likely to act as a deterrent to frequent trading, such as trading around price levels, due to the cost of trading. These markets might also have high bid-ask spreads as a result of low volume of trading in general (Narayan et al., 2015), meaning an absence of traders who might be following such price trends.

The final tests in the paper are summarised in Table 4 and comprise the GARCH(1,1) volatility tests. As noted in Section 2, Aggarwal and Lucey (2007) apply GARCH modelling to show heightened volatility following psychological barrier breaches in gold markets. This has not previously been applied in equity markets. Our range of countries, regions, cultures, and costs of trading allow us to not only test for volatility effects, but also to determine if there are any determinants of when such volatility effects are present. The findings are rather straightforward to summarise: heightened volatility is a nearly universal feature of crossing a psychologically significant price barrier. Even though returns might generally continue in a positive direction after rising through a barrier and in a negative direction after falling through a barrier, those returns are met with heightened volatility, thus effectively reducing any putative increase in the returns numerator of the Sharpe ratio by simultaneously increasing the volatility denominator. This volatility effect is also present for equities that see no predictability of returns following passing through a barrier. There are also no apparent regional, country, cultural, or liquidity differences in the presence of such volatility increases.

Table 4: Summary Results: Conditional Volatility Effects

	Total # Stocks	AUB	ADB	BUB	BDB
Country					
Argentina	3	100%	100%	100%	100%
Croatia	1	100%	100%	100%	100%
Jordan	6	83%	100%	83%	67%
Kenya	1	0%	0%	0%	0%
Kuwait	3	33%	67%	0%	100%
Mauritius	1	100%	100%	100%	100%
Morocco	4	100%	100%	100%	100%
Nigeria	7	100%	100%	100%	100%
Oman	2	100%	50%	50%	50%
Pakistan	12	100%	100%	100%	100%
Qatar	14	93%	93%	93%	93%
Romania	2	100%	100%	100%	100%
Sri Lanka	2	100%	100%	100%	100%
United Arab Emirates	7	86%	100%	71%	86%
Vietnam	12	75%	58%	67%	58%
Region					
Africa	13	92%	92%	92%	92%
Asia	26	88%	81%	85%	81%
Middle East	32	84%	91%	75%	84%
Emerging					
Qatar/UAE	21	90%	95%	86%	90%
Remaining Countries	56	88%	86%	82%	84%
Individualism					
Low Individualism	36	89%	83%	86%	83%
High Individualism	41	88%	93%	80%	88%
Bid-Ask Spread					
Low Bid-Ask	48	90%	85%	88%	85%
High Bid-Ask	29	86%	93%	76%	86%

Notes: Table 4 summarises conditional volatility effects for the four barrier variables; AUB, ADB, BUB, BDB, according to various groupings formed based on country, region, cultural, and liquidity measures (see Table 2). Volatility is modelled using a GARCH (1,1) specification. Percentages are calculated as the number of companies within a group that show significant coefficients for a barrier variable as a proportion of total companies in that group.

4. Conclusions

Frontier markets have been proposed as a cure to anaemic portfolio returns. They offer low correlations with developed and emerging markets, the countries themselves have fast growing economies (albeit from a very low base), and the demographic characteristics suggest strong future economic growth potential. To further the understanding of these markets and their investibility we conduct a first behavioral investigation through testing for the presence of psychological pricing barriers. We also acknowledge that these markets, though grouped together under the umbrella term 'frontier' have underlying characteristics that make them as different from each other as they are collectively to emerging and developed markets.

Our overall finding is that psychological barriers matter in these markets. Using a robust Generalised Bonferroni adjustment to p-values to avoid inadvertent data mining, we show that a large number of equities in the benchmark MSCI Frontier 100 index have predictable pricing patterns after passing through a psychologically important price point. Generally, prices continue to rise following rising through a barrier level, and continue to fall after falling through a barrier level. This is generally in line with psychological barriers studies in developed markets. Where they differ though is that while in developed markets the price impact tends to be immediate and quickly disappear, for our frontier equities the price effect shows no signs of fading for up to two weeks afterwards. Using a GARCH(1,1) model, we also find that volatility is heightened following passing through a barrier, something which has only previously been tested for psychological barriers in gold

pricing.

Of most interest in our findings, we suggest, is when we summarise the findings across groups based on countries, regions, culture, and liquidity. We show there are strong differences between countries and regions, suggesting that there are dangers to treating these equities as similar despite them being grouped together in the same index. Two novel findings are that, in common with prior findings regarding momentum trading, psychological barriers are most present for equities in countries that have high cultural measures of individualism. Individualism is linked to trend following behavior through its association with overconfidence, with high individualism leading to higher overconfidence. Of interest to the wider body of research on psychological barriers is that we can now propose that individualism is also associated with the presence of psychological barriers. Finally we find that high bid-ask spreads act as a deterrent to the presence of psychological barriers, perhaps due to the high cost associated with trend following trading in markets with high spreads.

In recent years research has extended the investigation of psychological barriers away from equity markets to markets such as oil and metals that are primarily professionally traded (Cummins et al., 2015, Dowling et al., 2016). This was motivated by research increasingly showing that professional traders are susceptible to many of the same biases as ordinary traders, but just to a lesser extent. Our study pulls in the opposite direction, away from the developed markets that predominate research on this phenomenon, towards markets that are just opening to business. This has allowed us to identify some new drivers behind the presence of psychological barriers in equity pric-

ing, and also to gain a preliminary understanding of the behavior of investors in these new markets. There is though much to be done on further developing this behavioral understanding. What is clear is that frontier market investors are not immune to behavioral biases, and nor were they expected to be, and that when we talk about frontier markets we are really referring to a loose grouping of equities based in different regions, different cultures, and facing different institutional influences on trading. These factors all influence investor behavior and pricing dynamics.

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Table 5: AUB Price Barriers: Conditional Returns Effects

Company Name	Country	Barrier	AUB1	AUB2	AUB3	AUB4	AUB5	AUB10
GRUPO FINO.GALICIA 'B'	Argentina	10						-0.020
PETROBRAS ON (BUE)	Argentina	100					0.030	
YPF 'D'	Argentina	1	0.005					0.016
INGRA ZAGREB	Croatia	10	-0.050	-0.037	-0.033			
INGRA ZAGREB	Croatia	100	-0.190	-0.099	-0.131	-0.164	-0.232	-0.207
INGRA ZAGREB	Croatia	1000	-0.133	-0.094	-0.088	-0.094	-0.110	
JORDAN PETROLEUM REF.	Jordan	10	0.032	0.024				0.018
JORDAN PHOSPHATE MINES	Jordan	10	0.011					
KUWAIT FINCE HOUSE	Kuwait	1			0.014			
TIOL BANK OF KUWAIT	Kuwait	1						-0.012
STATE BANK OF MAURITIUS	Mauritius	100						-0.255
ATTIJARIWafa BANK	Morocco	100				0.027	0.036	
BANQUE CENTE.POPULAIRE	Morocco	100	-0.020	-0.016	-0.017	-0.015	-0.015	-0.015
DOUJA PROM ADDOHA	Morocco	10	-0.016					
ENGRO	Pakistan	1						0.016
FAUJI FERTILIZER	Pakistan	100	-0.048	-0.026	-0.017	-0.014	-0.015	-0.017
HABIB BANK	Pakistan	100			-0.010			
JAHANGIR SIDDIQUI & CO.	Pakistan	1	0.010					
JAHANGIR SIDDIQUI & CO.	Pakistan	10				0.015		
LUCKY CEMENT	Pakistan	1						0.013
MCB BANK	Pakistan	1						0.015
OIL & GAS DEVELOPMENT	Pakistan	1						0.008
PAKISTAN OILFIELDS	Pakistan	1						0.014
PAKISTAN PETROLEUM	Pakistan	1						0.015
T.BANK OF PAKISTAN	Pakistan	10	0.009	0.007	0.007	0.007	0.005	
T.BANK OF PAKISTAN	Pakistan	100						-0.027

Notes: Tables 5-12 report the significant OLS regression tests

$$R_t = \beta_0 + \beta_1 R_{t-1} + \beta_2 BDB_t^n + \beta_3 BUB_t^n + \beta_4 ADB_t^n + \beta_5 AUB_t^n + \varepsilon_t$$

across all barrier levels (relative to equity price, as described in Section 2) and for the time periods of 1-5 and 10 days before and after a barrier breach. BUB and AUB are before and after an upward breach of a price barrier, respectively. BDB and ADB are before and after a downward breach of a price barrier. All coefficients have p-values at least at the Generalised Bonferroni level of 0.005 as detailed in Section 2.

Table 6: AUB Price Barriers: Conditional Returns Effects (contd.)

Company Name	Country	Barrier	AUB1	AUB2	AUB3	AUB4	AUB5	AUB10
AL KHALIJ COML.BANK	Qatar	10						-0.015
COMMERCIAL BK.OF QATAR	Qatar	100			-0.035	-0.024	-0.025	-0.022
DOHA BANK	Qatar	1		0.004				
INDUSTRIES QATAR	Qatar	1		0.004	0.004	0.004		
QATAR INSURANCE	Qatar	1	0.010					
QATAR INSURANCE	Qatar	10	0.014	0.008	0.008			
QATAR INSURANCE	Qatar	100		0.045	0.043			
QATAR INTL.ISLAMIC BANK	Qatar	1	0.010	0.008	0.006			
QATAR INTL.ISLAMIC BANK	Qatar	10	0.029	0.019	0.013		0.009	0.012
QATAR INTL.ISLAMIC BANK	Qatar	100		-0.082	-0.084	-0.081	-0.079	-0.051
QATAR ISLAMIC BANK	Qatar	1	0.010	0.008	0.006	0.004		
QATAR ISLAMIC BANK	Qatar	10	0.012	0.008	0.007			
QATAR ISLAMIC BANK	Qatar	100	0.058					
QATAR TIOL BANK	Qatar	1	0.006					
COMMERCIAL BK.OF CEYLON	Sri Lanka	1		0.004	0.004			
COMMERCIAL BK.OF CEYLON	Sri Lanka	10		0.005				
COMMERCIAL BK.OF CEYLON	Sri Lanka	100						0.008
JOHN KEELLS HOLDINGS	Sri Lanka	1		0.004	0.004	0.005	0.005	
JOHN KEELLS HOLDINGS	Sri Lanka	10			0.003	0.003	0.004	0.003
BAO VIET SECURITIES	Vietnam	10000				0.011	0.009	
FPT	Vietnam	1	0.009	0.007	0.007	0.009	0.011	
FPT	Vietnam	10	0.009	0.007	0.007	0.009	0.011	
FPT	Vietnam	100	0.009	0.007	0.007	0.009	0.011	
FPT	Vietnam	1000	0.011	0.007	0.006	0.006	0.006	
FPT	Vietnam	10000	0.017	0.014	0.009	0.008	0.008	
FPT	Vietnam	100000						0.025

Table 7: ADB Price Barriers: Conditional Returns Effects

Company Name	Country	Barrier	ADB1	ADB2	ADB3	ADB4	ADB5	ADB10
PETROBRAS ON (BUE)	Argentina	100	-0.073	-0.064	-0.053	-0.042		
INGRA ZAGREB	Croatia	100	-0.120				0.077	-0.199
INGRA ZAGREB	Croatia	1000						
JORDAN ELECTRIC POWER	Jordan	1						0.005
JORDAN PETROLEUM REF.	Jordan	10						-0.016
JORDAN PHOSPHATE MINES	Jordan	10	-0.015	-0.016	-0.011	-0.010	-0.012	
KUWAIT FINCE HOUSE	Kuwait	1						0.007
TIOL BANK OF KUWAIT	Kuwait	1						0.014
STATE BANK OF MAURITIUS	Mauritius	100						0.162
ATLJARIWAPA BANK	Morocco	100	-0.029	-0.027	-0.029	-0.024	-0.032	
BANQUE CENTE.POPULAIRE	Morocco	1					0.048	
BANQUE CENTE.POPULAIRE	Morocco	10					0.013	
GUINNESS NIGERIA	Nigeria	10	-0.004					
GUINNESS NIGERIA	Nigeria	100			-0.012	-0.014		
ENGRO	Pakistan	10	-0.005					
HABIB BANK	Pakistan	100	0.016					
JAHANGIR SIDDIQUI & CO.	Pakistan	10		-0.014				
JAHANGIR SIDDIQUI & CO.	Pakistan	100		-0.026				
MCB BANK	Pakistan	100	-0.009	-0.007	-0.007	-0.007		
PAKISTAN OILFIELDS	Pakistan	10	0.005					
PAKISTAN PETROLEUM	Pakistan	1						-0.014
T.BANK OF PAKISTAN	Pakistan	100		-0.028	-0.016			

Company Name	Country	Barrier	ADB1	ADB2	ADB3	ADB4	ADB5	ADB10
BARWA REAL ESTATE	Qatar	1	-0.006	-0.004	-0.004			
BARWA REAL ESTATE	Qatar	10		-0.010	-0.007	-0.006		
COMMERCIAL BK.OF QATAR	Qatar	100	-0.073	-0.027	-0.020			
DOHA BANK	Qatar	100					-0.036	
INDUSTRIES QATAR	Qatar	100	-0.034	-0.023	-0.023	-0.019	-0.012	-0.010
QATAR GS.TRAN.KILAT	Qatar	1		-0.004				
QATAR INSURANCE	Qatar	10			-0.011	-0.011	-0.008	
QATAR INSURANCE	Qatar	100	-0.053	-0.044	-0.031			
QATAR INTL.ISLAMIC BANK	Qatar	1		-0.007	-0.007			
QATAR INTL.ISLAMIC BANK	Qatar	10						-0.010
QATAR INTL.ISLAMIC BANK	Qatar	100	0.191	0.149	0.113	0.094	0.084	0.050
QATAR ISLAMIC BANK	Qatar	1	-0.006	-0.006	-0.005	-0.004		
QATAR ISLAMIC BANK	Qatar	10		-0.008	-0.008	-0.006	-0.008	-0.006
QATAR ISLAMIC BANK	Qatar	100	0.047	0.029				
QATAR VIGATION	Qatar	100	-0.036					
DUBAI FINCIAL MARKET	United Arab Emirates	1	-0.020		-0.011	-0.012	-0.012	-0.008
DUBAI ISLAMIC BANK	United Arab Emirates	1		-0.008	-0.009			
DUBAI ISLAMIC BANK	United Arab Emirates	10	0.061					
BAO VIET SECURITIES	Vietnam	1				-0.011	-0.013	-0.021
BAO VIET SECURITIES	Vietnam	10				-0.011	-0.013	-0.021
BAO VIET SECURITIES	Vietnam	100				-0.011	-0.013	-0.021
BAO VIET SECURITIES	Vietnam	1000		-0.008	-0.007	-0.008	-0.006	
BAO VIET SECURITIES	Vietnam	10000				-0.011	-0.009	-0.008
BAO VIET SECURITIES	Vietnam	100000	-0.065	-0.053				
FPT	Vietnam	1	-0.006	-0.006				
FPT	Vietnam	10	-0.006	-0.006				
FPT	Vietnam	100	-0.006	-0.006				
FPT	Vietnam	1000	-0.011	-0.008	-0.006	-0.005		
FPT	Vietnam	10000		-0.010				
FPT	Vietnam	100000		-0.032	-0.035	-0.027		
KINHBAC CTDEV.SHAREHLDG.	Vietnam	1	-0.011					
KINHBAC CTDEV.SHAREHLDG.	Vietnam	10	-0.011					
KINHBAC CTDEV.SHAREHLDG.	Vietnam	100	-0.011					
KINHBAC CTDEV.SHAREHLDG.	Vietnam	1000	-0.011	-0.008	-0.006	-0.008		
KINHBAC CTDEV.SHAREHLDG.	Vietnam	1000	-0.008	-0.006				
KINHBAC CTDEV.SHAREHLDG.	Vietnam	10000	-0.013	-0.012	-0.008			
PETROVIETM DRILLING	Vietnam	100000						-0.013
PETROVIETM FCM.	Vietnam	10000		-0.008		-0.007		

Table 9: BUB Price Barriers: Conditional Returns Effects

Company Name	Country	Barrier	BUB1	BUB2	BUB3	BUB4	BUB5	BUB10
PETROBRAS ON (BUE)	Argentina	100			0.048	0.043		
INGRA ZAGREB	Croatia	100	0.133		0.064		0.089	0.227
INGRA ZAGREB	Croatia	1000						0.105
ALIA-THE RYLJDNNAIRL.	Jordan	1	0.021					
JORDAN PETROLEUM REF.	Jordan	1	0.009	0.009	0.008	0.006		
JORDAN PETROLEUM REF.	Jordan	10			0.021	0.019	0.017	
JORDAN PHOSPHATE MINES	Jordan	1	0.010	0.008	0.006	0.005	0.004	
JORDAN PHOSPHATE MINES	Jordan	10	0.018	0.015	0.016	0.018	0.015	0.008
TIOL BANK OF KUWAIT	Kuwait	1						-0.016
STATE BANK OF MAURITIUS	Mauritius	100						-0.070
ATTIJARIWafa BANK	Morocco	100	-0.066	-0.033	-0.028	-0.028		
ITISSALAT AL MAGHRIB (MAROC TELECOM)	Morocco	10	0.004					
ACCESS BANK NIGERIA	Nigeria	1	0.007	0.007				
FBN HOLDINGS	Nigeria	1	0.010	0.005				
GUARANTY TRUST BANK	Nigeria	1	0.005					
GUINNESS NIGERIA	Nigeria	10	0.005	0.004	0.004			
GUINNESS NIGERIA	Nigeria	100					0.012	
UNITED BANK FOR AFRICA	Nigeria	1	0.008	0.007				
ZENITH INTERTIOL BK.	Nigeria	1	0.009	0.006				
OMAN TELECOMMUNICATIONS	Oman	1						-0.016
ENGRO	Pakistan	10	0.008	0.006		0.004		
MCB BANK	Pakistan	10	0.005					
MCB BANK	Pakistan	100	0.012		0.009	0.006	0.007	
T.BANK OF PAKISTAN	Pakistan	10	0.012	0.009	0.008	0.006		
UNITED BANK	Pakistan	10	0.008	0.005				

Table 10: BUB Price Barriers: Conditional Returns Effects (contd.)

Company Name	Country	Barrier	BUB1	BUB2	BUB3	BUB4	BUB5	BUB10
BARWA REAL ESTATE	Qatar	10	0.010		0.006	0.008	0.006	
INDUSTRIES QATAR	Qatar	100		0.019		0.015		
QATAR GS.TRAN.KILAT	Qatar	10		0.010				
QATAR INSURANCE	Qatar	10	-0.013					
QATAR INTL.ISLAMIC BANK	Qatar	10	-0.029	-0.015	-0.012			
QATAR ISLAMIC BANK	Qatar	10	-0.009					
QATAR ISLAMIC BANK	Qatar	100	-0.209	-0.100	-0.080	-0.065	-0.058	-0.026
JOHN KEELLS HOLDINGS	Sri Lanka	10	0.005					
DUBAI ISLAMIC BANK	United Arab Emirates	10		-0.065				-0.044
BAO VIET SECURITIES	Vietnam	1000	0.010	0.006	0.005	0.006		
BAO VIET SECURITIES	Vietnam	10000		0.012	0.008	0.009	0.009	
BAO VIET SECURITIES	Vietnam	100000	0.110					
FPT	Vietnam	100000		0.047	0.048	0.050	0.051	0.029
PETROVIETM FCM.	Vietnam	1000	0.004					
PETROVIETM FCM.	Vietnam	10000	0.010			0.006	0.005	0.004
PHA LAI THERMAL PWR.	Vietnam	1000	0.008	0.004				
SONDA URBAN &.INZ.INVDL.	Vietnam	1000	0.007					
SONDA URBAN &.INZ.INVDL.	Vietnam	10000	0.013	0.009	0.007	0.009		

Table 11: BDB Price Barriers: Conditional Returns Effects

Company Name	Country	Barrier	BDB1	BDB2	BDB3	BDB4	BDB5	BDB10
PETROBRAS ON (BUE)	Argentina	100	-0.179	-0.076	-0.062	-0.057	-0.042	
INGRA ZAGREB	Croatia	100	0.137					
INGRA ZAGREB	Croatia	1000						0.128
ALIA-THE RYLJDNNAIRL.	Jordan	1		0.012	0.009			
JORDAN PETROLEUM REF.	Jordan	10		-0.033	-0.032	-0.026	-0.018	
JORDAN PHOSPHATE MINES	Jordan	1	-0.011	-0.005	-0.005	-0.004		
JORDAN PHOSPHATE MINES	Jordan	10	-0.015	-0.011	-0.011	-0.012		
KUWAIT FINCE HOUSE	Kuwait	1	-0.018	-0.016	-0.011	-0.010		
TIOL BANK OF KUWAIT	Kuwait	1						0.011
STATE BANK OF MAURITIUS	Mauritius	100						0.119
ATTIJARIWafa BANK	Morocco	100				0.022		
DOUJA PROM ADDOHA	Morocco	100			-0.036	-0.032	-0.029	-0.024
ACCESS BANK NIGERIA	Nigeria	1	-0.010	-0.007	-0.005	-0.005		
FBN HOLDINGS	Nigeria	1	-0.011	-0.006				
FBN HOLDINGS	Nigeria	10	-0.019	-0.011	-0.011	-0.009		
GUARANTY TRUST BANK	Nigeria	1	-0.005					
UNITED BANK FOR AFRICA	Nigeria	1	-0.012	-0.011	-0.009	-0.007	-0.006	
ZENITH INTERTIOL BK.	Nigeria	1	-0.005					
JAHANGIR SIDDIQUI & CO.	Pakistan	10		-0.016				
MCB BANK	Pakistan	10	-0.005	-0.004	-0.003			
OIL & GAS DEVELOPMENT	Pakistan	100					-0.016	
PAKISTAN OILFIELDS	Pakistan	10		-0.003				
T.BANK OF PAKISTAN	Pakistan	1		-0.004				
T.BANK OF PAKISTAN	Pakistan	10	-0.011	-0.011	-0.009	-0.007	-0.005	
UNITED BANK	Pakistan	1		-0.003				
UNITED BANK	Pakistan	10		-0.007	-0.005			

Table 12: BDB Price Barriers: Conditional Returns Effects (contd.)

Company Name	Country	Barrier	BDB1	BDB2	BDB3	BDB4	BDB5	BDB10
AL KHALIJ COML.BANK	Qatar	10						0.016
COMMERCIAL BK.OF QATAR	Qatar	10	-0.010	-0.007				
COMMERCIAL BK.OF QATAR	Qatar	100			0.018		0.016	
DOHA BANK	Qatar	100			0.026		0.033	
INDUSTRIES QATAR	Qatar	10	-0.008	-0.006	-0.005			
INDUSTRIES QATAR	Qatar	100	-0.025		-0.016	-0.014	-0.011	
BRD GROUPE SOCIETE GL.	Romania	1		-0.005				
ARABTEC HOLDING	United Arab Emirates	1						-0.010
ARABTEC HOLDING	United Arab Emirates	10	-0.098					
BAO VIET SECURITIES	Vietnam	1		-0.008	-0.010	-0.015	-0.017	-0.022
BAO VIET SECURITIES	Vietnam	10		-0.008	-0.010	-0.015	-0.017	-0.022
BAO VIET SECURITIES	Vietnam	100		-0.008	-0.010	-0.015	-0.017	-0.022
BAO VIET SECURITIES	Vietnam	1000		-0.006	-0.006	-0.008	-0.009	-0.008
BAO VIET SECURITIES	Vietnam	10000		-0.009			-0.010	
BAO VIET SECURITIES	Vietnam	100000		-0.046			-0.051	
FPT	Vietnam	1000	-0.006	-0.004				
FPT	Vietnam	10000	-0.012	-0.008	-0.009	-0.008	-0.009	-0.006
FPT	Vietnam	100000			-0.031	-0.032	-0.034	-0.030
HOA PHAT GROUP	Vietnam	1000		-0.004				
PHA LAI THERMAL PWR.	Vietnam	1		-0.005				
PHA LAI THERMAL PWR.	Vietnam	10		-0.005				
PHA LAI THERMAL PWR.	Vietnam	100		-0.005				
PHA LAI THERMAL PWR.	Vietnam	1000		-0.004				
SONDA URBAN &.INZ.INVDL.	Vietnam	1		-0.006	-0.007	-0.009		
SONDA URBAN &.INZ.INVDL.	Vietnam	10		-0.006	-0.007	-0.009		
SONDA URBAN &.INZ.INVDL.	Vietnam	100		-0.006	-0.007	-0.009		
SONDA URBAN &.INZ.INVDL.	Vietnam	1000	-0.007	-0.006	-0.005			
SONDA URBAN &.INZ.INVDL.	Vietnam	10000		-0.009				
VINCOM	Vietnam	1000	-0.005					
VINCOM	Vietnam	10000	-0.011	-0.008	-0.008	-0.007	-0.007	