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iShares Australia: a clinical study in international behavioral finance

Robert B. Durand*, Douglas Scott

Department of Accounting and Finance, University of Western Australia, 35 Stirling Highway, Crawley, Western Australia, 6009 Australia

Abstract

Using iShares Australia returns as a proxy for the influence of overseas investors in the Australian market, we found that U.S.-based investors in the Australian market overreact to contemporaneous and lagged returns of the U.S. equity market, the U.S.–Australian dollar exchange rate, and past iShares Australia returns. In response to changing conditional risk, however, investors behave rationally: increasing (decreasing) expected risk is associated with falling (rising) prices. In light of these findings, we hypothesize that behavioral finance might explain the observed correlations between international equity markets.

JEL classification: G1; G14; G15
Keywords: Asset pricing models; Feedback trading; Overreaction; iShares Australia

1. Introduction

If equity markets are weak form efficient (Fama, 1970), we should not be able to forecast tomorrow's return using information available today. In an international context, if returns in one market today could be used to forecast returns in another market tomorrow, international equity markets are arguably weak form inefficient (Becker, Finnerty, & Gupta, 1990).

There is a large body of empirical evidence suggesting that international markets violate this criterion for weak form efficiency. A number of studies demonstrate that international equity returns may be forecasted. These studies include Durand, Koh and Watson (2001), Eun and Shim (1989), Ghosh, Saidi, and Johnson (1999), Kahya (1997), Theodossiou, Kahya,

* Corresponding author. Tel.: +61-8-9380-3764; fax: +61-8-9380-1047.
E-mail address: Robert.Durand@uwa.edu.au (R.B. Durand).

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Table 1
Variables

Description of variable	Mnemonic
The daily percentage change in the ASX All Ordinaries Index	AOPIRET
The daily percentage change in iShares Australia	EWAPIRET
The daily natural log change in iShares Australia volume	EWAVOLN
The daily percentage change in the S&P 500 Composite Index	SPPIRET
The daily natural log change in volume of the stocks comprising the S&P 500 Composite Index	SPVOLLN
The daily percentage change in the U.S.–Australia exchange rate—expressed in A$ as how many A$ can be bought by US$1	XRATE

Koutmos, and Christofi (1997), and Theodossiou and Lee (1993). Durand et al. (2001) illustrate the general findings of this literature. Using 11 years of daily data, they test a number of variables for their influence on seven Pacific-Rim markets and find that the U.S. equity markets have a significant leading relationship with those markets (Australia, Hong Kong, South Korea, Malaysia, Singapore, Taiwan, and Thailand). In the equation modelling Australian returns, for example, the R^2 is, at around 27%, surprisingly high. In a related work, Olienyk, Schweback, and Zumwalt (1999) approach the topic of global market integration using World Equity Benchmark Shares (WEBS), now known as iShares,[1] and Standard & Poor's Depository Receipts (SPDRs) and find that the markets represented by the WEBS have equilibrium relationships with the U.S. market and that there are short-run inefficiencies among the instruments which might be arbitraged.

This paper focuses on iShares Australia to examine why such a relationship might exist between the United States and a foreign market. While we might have chosen any number of markets, we have chosen Australia due to the strong relationship documented by Durand et al. (2001). In particular, we explore how foreign investors (in this case, investors active

[1] The American Stock exchange provides a general introduction to iShares at http://www.amex.com/indexshares/index_shares_intl.stm. Formerly known as WEBS Australia, iShares Australia trades on the AMEX and passively tracks the Morgan Stanley Capital International (MSCI) Australia Index. In practice, iShares must have at least 80% of its total assets in stocks prescribed by the benchmark MSCI index. Half of the other 20% must be invested in stocks either included in the benchmark index or not included in the benchmark index. The remaining 10% must be invested in other securities, including money market instruments, derivatives, and forward currency exchange contracts for the express purpose of reducing the tracking error (iShares MSCI Index Funds' *Prospectus and Statement of Additional Information* dated 30 December 1999 and revised 22 May 2000). Further aspects of relevance to this study are discussed in Olienyk et al. (1999). That study highlighted that, unlike market proxies used in previous studies, iShares represent directly tradeable assets and overcome problems of nonsynchronous trading and illiquidity. It is particularly important to note that units may be created or redeemed for net asset value. Therefore, there should not be bias in the analysis due to a close-end fund discount (Dimson & Minio-Kozerski, 1998). In addition, buying and selling of iShares may be done through most brokers in the United States in the same way as purchasing common equity stock; iShares settle in the same manner as other U.S. equities (i.e., 3 days after the transaction is entered, which is also the case in Australia) and they can also be sold short and bought on margin (iShares MSCI Index Funds' *Prospectus and Statement of Additional Information* dated 30 December 1999 and revised 22 May 2000).

in the U.S. market) in the Australian market respond to changes in their domestic information set. We cannot directly observe these overseas investors' participation in the Australian market.[2] Therefore, we use iShares Australia to proxy for American-based investors' interest in the Australian market. Therefore, through analysing iShares Australia, we can learn valuable lessons about the behavior of international investors.

Recent empirical studies analysing the behavior of foreign investors have found evidence of positive feedback behavior (Choe, Kho, & Stulz, 1999; Froot, O'Connell, & Seasholes, 2001; Grinblatt & Keloharju, 2000). De Long, Shleifer, Summers, and Waldmann (1990) demonstrate how positive feedback trading affects stock prices. Barberis, Shleifer, and Vishny (1998) and Daniel, Hirshleifer, and Subrahmanyam (1998) demonstrate how overreaction influences prices. We also find phenomena which are consistent with behavioral models. Furthermore, we also find investors responding rationally to perceived risk in keeping with Bekaert and Wu (2000).

Our behavioral story is similar to Kim, Szakmary, and Mathur (2000) who use American Depository Receipts (ADRs) to examine transmission of stock price movements between ADRs and their underlying stocks, traded on their home markets. They found that, although the most influential factor in pricing ADRs is their underlying shares, exchange rates and the U.S. market are also factors. They further found that the full effect is not immediate and persists over several days. This is indicative of an underreaction by investors to exchange rate and underlying stock movements, possibly caused by market inefficiencies. We find similar results, with the return on iShares Australia being strongly related to both its own lagged values and contemporaneous and lagged values of the return on the U.S. market. Moreover, iShares Australia has a strong relationship with the contemporaneous value of the change in the U.S.–Australia exchange rate.

Our finding with respect to expected risk and the returns of iShares Australia is consistent with Bekaert and Wu (2000). It appears that the anticipated increase in volatility raises the required return on iShares Australia, which leads to an immediate decline in price. In this regard, investors are behaving rationally, rather than quasi-rationally, as indicated by the

[2] In Australia, the only publicly available data source that provides foreign investment statistics is the quarterly *National Balance of Payments* produced by the Australian Bureau of Statistics (ABS). Problems with these data make it unsuitable for this study. These are mainly related to the way it is collected and subsequently reported. International portfolio flow is reported in the *National Accounts—Balance of Payments* under "portfolio and other investment." This item is a residual measurement covering all capital account transactions, which are not classified as either "direct investment" or "reserve assets," and thus it may include flows extraneous to this study. Added to the low frequency, the collection method also seems subject to large errors and significant revisions are often necessary. Furthermore, the reporting format has undergone several significant changes in definition as well as in the frequency (quarterly to yearly) in which it is published throughout the last 15 years, thus making it incomparable through time. These factors have made the data set cumbersome and in practice difficult to use in an accurate, and perhaps any, empirical study. Another potential source of data, the Clearing House Electronic Subregister System (CHESS), the Australian Stock Exchange's electronic register of holdings, must record the residency of transferees (domestic, foreign, or mixed) when shares subject to foreign ownership restrictions are transferred. CHESS data are currently highly confidential and we do not have access to it. We cannot, therefore, gauge its usefulness in a study such as the one conducted in the present paper.

Table 2
Summary statistics for the time series detailed in Table 1 for the period from 19 March 1996 to 25 July 2000

	AOPIRET	EWAPIRET	EWAVOLN	SPPIRET	SPVOLLN	XRATE
Mean	0.0004	0.0002	0.0028	0.0008	0.0010	0.0003
Median	0.0004	0.0000	0.0000	0.0008	0.0033	0.0000
Maximum	0.0590	0.0833	7.6019	0.0512	1.1808	0.0353
Minimum	− 0.0676	− 0.0891	− 5.6062	− 0.0687	− 1.0717	− 0.0504
S.D.	0.0090	0.0167	1.7066	0.0116	0.1896	0.0069
Skewness	− 0.4655	− 0.0452	0.1249	− 0.3097	0.1452	− 0.5544
Kurtosis	8.7257	5.3363	3.6928	6.6637	10.8297	8.7920
Jarque–Bera	1539.48	250.08	24.81	631.64	2808.49	1591.02
Probability	.000	.000	.000	.000	.000	.000
Observations	1098	1098	1098	1098	1098	1098

results for return and volume. This relationship is also in keeping with Busse (1999). Busse attributes the negative association with expected volatility to the incentives of fund managers who are compensated based on risk-adjusted return performance. Unlike the fund managers that Busse studied, however, we assume that iShares Australia attracts predominately retail investors.[3]

We examine volume for its possible relationship to returns and vice versa (following, for example, Brennan, Chordia, & Subrahmanyam, 1998; Lo & Wang, 2000).[4] We do not find any relationship between volume and returns, returns and volume, or volume and conditional risk. There is a suggestion in our analysis that trading patterns may be consistent with the pattern of overreaction to U.S. market movements that we document.

The remainder of this paper is organized as follows. Section 2 outlines the data analysed in this study. Section 3 discusses the relationship of iShares Australia to the Australian market and the appropriateness of iShares Australia as a proxy for the Australian market. Section 4 discusses the determinants of changes in iShares Australia price and volume. Section 5 reports the results when conditional risk is incorporated in the analysis. Section 6 concludes the paper.

2. Data

The data used in this study span the period from 19 March 1996 to 25 July 2000 and contains 1136 daily observations. Nontrading days were identified as the days when no

[3] iShares Australia might be considered a retail investment vehicle for several reasons. Firstly, the daily volume traded in the fund is relatively low. Secondly, institutions are more likely to invest in the underlying stock, or take a position in iShares Australia using creation units (an off-market transaction).

[4] In a slightly different vein, Chordia, Subrahmanyam, and Anshuman (2001) find a relationship of returns to the volatility of trading activity. Edelen and Warner (2001) study daily mutual fund returns and flows following Warther (1995). While iShares Australia is open-ended, and we observe trading volume and not net flows, Edelen and Warner's study is not strictly comparable to this paper. It is interesting to note, however, that Edelen and Warner find that unexpected flows into funds are positively related to returns and that the flow of money into funds is not inconsistent with a positive feedback story.

Table 3
Correlation matrix

	AOPIRET	EWAPIRET	EWAVOLN	SPPIRET	SPVOLLN	XRATE
AOPIRET	1.000					
EWAPIRET	.423	1.000				
EWAVOLN	.014	.037	1.000			
SPPIRET	.108	.315	− .006	1.000		
SPVOLLN	− .049	− .014	.066	− .018	1.000	
USAUSTRET	− .025	− .350	− .019	− .048	− .012	1.000

Correlation matrix of the variables described in Table 1. Note that shares incorporated in the ASX All Ordinaries Share Price Index trade in a time zone earlier in the same day.

volume was recorded on the U.S. market[5] and are deleted from the sample, reducing the number of observations to 1099.[6] Table 1 details the variables used in this study and the mnemonic used to refer to the variable. All data were sourced from Datastream.

Table 2 presents descriptive statistics for the data. The stock return data (AOPIRET, EWAPIRET, and SPPIRET) and the exchange rate data are negatively skewed. The volume data are positively skewed. All distributions appear leptokurtic.

Table 3 reports correlations between the variables. AOPIRET (earlier in the same calendar day) has a moderate correlation with EWAPIRET and a low correlation with SPPIRET. The correlation between AOPIRET and EWAPIRET is expected as the Australian market opens and closes first on the sample calendar. However, as we do not expect the Australian market to influence the U.S. market, the correlation between AOPIRET and SPPIRET is unexpected. EWAPIRET is also moderately correlated with SPPIRET, as well as with the exchange rate variable USAUSTRET. This initial correlation is consistent with Kim et al. (2000) who found that ADRs are correlated with the U.S. market as well as the relevant exchange rate. No other variables exhibit a correlation of more than .10.[7]

3. iShares Australia and the All Ordinaries Index

If iShares Australia is to be used to proxy for the Australian market, its returns should be strongly correlated with the returns of the Australian market. In order to examine this, we regress the returns of iShares on the return of the Australian market (represented by the benchmark All Ordinaries Index)[8] on the same calendar day. Due to time differences, the Australian and U.S. markets are never open at the same moment in time. Thus, the change in

[5] Consistent with both volume on the AMEX and NYSE.

[6] The deletion dates were checked against public holidays in the United States and were found to be consistent with the average eight public holidays per year.

[7] The sample was split into two subsamples with a breakpoint of May 18, 1999. Descriptive statistics of the two subsamples were inspected and found to have similar properties to the whole sample.

[8] The All Ordinaries Index is a value-weighted index indicative of the performance of all but the smallest and least liquid companies listed on the Australian Stock Exchange.

the value of the Australian market represents the information set iShares investors possess at the beginning of their trading day and allows investors to adjust prices to reflect the value of the underlying asset. We should not find that the change in iShares Australia is significantly different from the change in value in the Australian market if iShares Australia is informationally efficient. We would reject iShares Australia as a suitable proxy if the intercept did not equal 0 or if the coefficient of the changes in the All Ordinaries Index proved to be significantly different from 1. The regression analysis for the change in iShare Australia value (EWAPIRET) following the change in the All Ordinaries (AOPIRET) is presented in the following equation (the standard errors are in brackets beneath the estimated coefficients).[9]

$$\mathrm{EWAPIRET}_t = \underset{(0.002)}{-.002} \; - \underset{(0.1002)}{0.9426} \; \mathrm{AOPIRET}_t + u_t \tag{1}$$

where $u_t = \varepsilon_t - \underset{(0.0373)}{0.4886}\,\varepsilon_{t-1}$, R^2=.3306, R^2 (adjusted)=.3293, F statistic = 270.35.

The coefficient of 0.9426 and S.E. of 0.1002 indicate that the hypothesis that changes in iShares Australia equal changes in the All Ordinaries (that is, that the coefficient of AOPIRET is 1) cannot be rejected within conventional confidence intervals. Given notions of market efficiency, to find that the regression coefficient was not 1 would have been surprising. Thus, iShares Australia satisfies our criterion to serve as a proxy for the Australian market. We note, however, that the adjusted R^2 of 32.9% indicates that, although movements in the Australian market explain a considerable proportion of the movements of iShares Australia,[10] not all the variance is explained by Eq. (1).

4. The determinants of iShare price and volume

Table 4 presents the Vector Autoregressions (VARs) for EWAPIRET and EWAVOLN for the study period and two subperiods (discussed below). The VAR methodology has been chosen to enable returns and volume to be modelled simultaneously.[11] EWAPIRET and EWAVOLN are the iShares Australia variables that measure the daily change in price and volume, respectively (as noted above, the details may be found in Table 1). The exogenous variables are SPPIRET, SPVOLLN, and XRATE. SPPIRET proxies for the daily return on the U.S. market and SPVOLLN, likewise, proxies for U.S. volume. XRATE is the daily U.S.–Australian dollar exchange rate. A positive movement in the exchange rate indicates a weakening of the Australian dollar relative to the U.S. dollar. Two dichotomous variables are also included in the analysis. The first, HOLDUMMY, is a dummy that takes the value of 1

[9] The optimal modified transfer function was chosen using Akaike's Information Criterion and the Schwarz Bayesian criterion.

[10] In other words, there is a correlation (ρ) of 57.4% between the predicted and actual percentage change in the closing price of iShares Australia and the Australian market.

[11] Hamilton (1994) discusses VAR in Chapter 11.

on days when there is a nontrading day in the Australian market but there is trading in the U.S. market, otherwise 0. This variable has been included to control for any effects that nontrading in Australia, earlier in the same calendar day, may have on iShares Australia.[12] The second dummy variable, MONDUMMY, is a dummy that takes the value of 1 on Mondays and 0 otherwise, to control for a day of the week effect.[13]

EWAPIRET has a positive though monotonically declining association with SPPIRET with the contemporaneous and lagged values of SPPIRET.[14] When the American market is up, iShares Australia is up too, and ceteris paribus, continues to increase for the next 3 days although the level of increase is progressively smaller. We may explain a contemporaneous impact by arguing that movements in the United States convey information about the future of the Australian market and that this information is efficiently incorporated in the price. The lagged impact, however, may be more in line with the behavioral approach of De Long et al. (1990)[15] or the findings of overreaction[16] to changes in the United States found by Kim et al. (2000).[17] This finding is consistent with Barberis et al. (1998) and Daniel et al. (1998). The overreaction story in this paper is also supported by the relationship of EWAPIRET to its lagged values where the coefficients for lags 1 to 3 are negative and monotonically decreasing. Gains (losses) today being "corrected" by a loss tomorrow (and again the next day and a fall the day after that)[18] are consistent with investor overreaction, ceteris paribus. Contemporaneous changes in the exchange rate function as hypothesized: a fall in the value of the Australian dollar leads to a fall in the value of iShares Australia. Negative movements (contemporaneous and lagged) in the exchange rate that increase the value of the Australian dollar are associated with a positive price movement of iShares Australia. This is consistent with Kim et al.'s finding

[12] As it is hypothesised that iShares Australia proxies for the Australian market, its movement should be correlated with those of the Australian market. However, if the Australian market is closed on a particular calendar day but iShares (trading in the United States) is not, movements in iShares may be influenced by information released to the market that would normally be impounded in the price of the underlying stocks.

[13] Tuesday, Thursday, and Friday dummies were also examined but it was found that only Monday had significance with any of the endogenous variables at the 1%, 5%, or 10% levels. Wang, Li, and Erickson (1997) summarize literature on the Monday effect.

[14] The similarity of the sensitivity of Australian to U.S. returns, and the surprisingly high R^2 are consistent with the analysis in Durand et al. (2001). This is further evidence that iShares Australia is a good proxy for the Australian market in the context of this study.

[15] The lagged terms are representative of positive feedback trading by uninformed (naïve) investors who react to positive price movements caused by the behavior of rational speculators, as described by De Long et al. (1990). For example, the naïve investors buy (sell) iShares Australia based on the continuing strength (weakness) of the U.S. market, believing that the price trend of the U.S. market will be extrapolated into future periods for iShares Australia. Rational speculators, realizing this, also invest, pushing up the price in day t away from its fundamental value. The next day, $t+1$, rational speculators sell (buy) iShares Australia knowing that the fund is over (under) priced, causing the price movement of EWAPIRET to reverse.

[16] While De Bondt and Thaler's (1985) seminal article of overreaction and subsequent analyses (discussed and criticized in Fama, 1998) examined overreaction using monthly data, our analysis of the daily phenomenon is consistent with the central idea of prices overshooting their correct level.

[17] Investors, according to this explanation, overestimate the influence that the U.S. market holds for Australia.

[18] In other words, not only do investors overreact but they also overshoot their target when they are correcting their errors.

Table 4
VARs for EWAPIRET and EWAVOLN

Regressor	VAR 1-EWAPIRET			VAR 1-EWAVOLN		
	Whole sample	Subsample 1	Subsample 2	Whole sample	Subsample 1	Subsample 2
C	0.0005	0.0002	0.0013	− 0.0252	− 0.0419	0.0230
	(0.9670)	(0.2834)	(1.2368)	(− 0.5584)	(− 0.7766)	(0.2744)
EWAPIRET(− 1)	− 0.4063 **	− 0.3760 **	− 0.4931 **	− 3.1481	− 0.4229	− 9.0647
	(− 11.9879)	(− 9.3752)	(− 7.7563)	(− 1.0614)	(− 0.1139)	(− 1.9496)
EWAPIRET(− 2)	− 0.2571 **	− 0.2306 **	− 0.3397 **	− 0.2554	− 2.0437	5.1095
	(− 7.0659)	(− 5.4146)	(− 4.5926)	(− 0.0807)	(− 0.5198)	(1.0470)
EWAPIRET(− 3)	− 0.1541 **	− 0.1687 **	− 0.1147	− 3.6650	− 5.2680	− 1.4499
	(− 4.3481)	(− 4.1227)	(− 1.6692)	(− 1.1456)	(− 1.3072)	(− 0.2850)
EWAPIRET(− 4)	− 0.0462	− 0.0399	− 0.0552	0.4176	0.2454	1.0969
	(− 1.31)	(− 1.0158)	(− 0.7467)	(0.1373)	(0.0661)	(0.2190)
EWAPIRET(− 5)	− 0.0375	− 0.0580	0.0097	− 3.7202	− 2.7056	− 6.5792
	(− 1.3083)	(− 1.8601)	(0.1678)	(− 1.3486)	(− 0.8069)	(− 1.4460)
EWAPIRET(− 6)	− 0.0784 **	− 0.0783 *	− 0.0981	0.4369	0.7850	− 0.0218
	(− 2.6309)	(− 2.2092)	(− 1.6338)	(0.1586)	(0.2342)	(− 0.0050)
EWAPIRET(− 7)	0.0161	0.0360	0.0197	1.1190	2.5797	− 2.1775
	(0.5640)	(1.1053)	(0.3571)	(0.4431)	(0.84161)	(− 0.4811)
EWAPIRET(− 8)	0.0241	0.0526	− 0.0692	− 3.7467	− 3.0108	− 10.2748 *
	(0.9150)	(1.7249)	(− 1.2742)	(− 1.5261)	(− 1.0301)	(− 2.2332)
EWAVOLN(− 1)	− 0.0003	− 0.0002	− 0.0011	− 0.8104 **	− 0.8157 **	− 0.7785 **
	(− 0.81839)	(− 0.5343)	(− 1.1794)	(− 26.2412)	(− 23.6862)	(− 10.3520)
EWAVOLN(− 2)	− 0.0001	0.0000	− 0.0006	− 0.6762 **	− 0.6690 **	− 0.6764 **
	(− 0.29066)	(− 0.0558)	(− 0.5730)	(− 17.6143)	(− 15.2774)	(− 7.9439)
EWAVOLN(− 3)	− 0.0002	− 0.0002	− 0.0010	− 0.5257 **	− 0.5350 **	− 0.4141 **
	(− 0.39528)	(− 0.3309)	(− 0.8471)	(− 12.1318)	(− 10.9296)	(− 4.7832)
EWAVOLN(− 4)	− 0.0001	0.0002	− 0.0015	− 0.4479 **	− 0.4758 **	− 0.2960 **
	(− 0.24168)	(0.3099)	(− 1.4019)	(− 9.7423)	(− 9.2405)	(− 3.0388)
EWAVOLN(− 5)	− 0.0001	0.0002	− 0.0019	− 0.3935 **	− 0.4309 **	− 0.1991 *
	(− 0.25055)	(0.3449)	(− 1.6210)	(− 8.4745)	(− 8.2136)	(− 2.3327)
EWAVOLN(− 6)	0.0001	0.0002	− 0.0003	− 0.3082 **	− 0.3299 **	− 0.1836 *
	(− 0.35444)	(0.4924)	(− 0.2572)	(− 7.0849)	(− 6.7536)	(− 2.0563)
EWAVOLN(− 7)	0.0003	0.0004	− 0.0002	− 0.2034 **	− 0.2253 **	− 0.0430
	(− 0.65261)	(0.8822)	(− 0.1565)	(− 5.4250)	(− 5.2415)	(− 0.5499)
EWAVOLN(− 8)	0.0002	0.0001	0.0006	− 0.0769 **	− 0.0907 **	− 0.0189
	(− 0.66052)	(0.4193)	(0.6583)	(− 2.6037)	(− 2.6568)	(− 0.3294)
SPPIRET	0.4145 **	0.4595 **	0.3163 **	− 4.2764	− 2.8938	− 7.3947
	(8.8544)	(7.7805)	(4.4615)	(− 1.3430)	(− 0.6902)	(− 1.5334)
SPPIRET(− 1)	0.3232 **	0.3142 **	0.3219 **	2.1320	4.2334	− 2.7852
	(7.1640)	(5.8199)	(4.0579)	(0.5921)	(0.9084)	(− 0.4895)
SPPIRET(− 2)	0.1677 **	0.1482 **	0.2414 **	− 0.4863	2.1354	− 3.1166
	(3.6973)	(2.8197)	(2.8664)	(− 0.1302)	(0.4686)	(− 0.5159)
SPPIRET(− 3)	0.1328 **	0.1394 **	0.1247	0.6351	2.9647	− 4.7390
	(3.1662)	(2.8622)	(1.4677)	(0.1695)	(0.5908)	(− 0.9277)

Table 4 (*continued*)

Regressor	VAR 1-EWAPIRET			VAR 1-EWAVOLN		
	Whole sample	Subsample 1	Subsample 2	Whole sample	Subsample 1	Subsample 2
SPPIRET(− 4)	0.0067	0.0473	− 0.0876	0.1054	0.1335	0.9987
	(0.1535)	(0.9153)	(− 1.1971)	(0.0268)	(0.0268)	(0.1710)
SPVOLLN	− 0.0021	− 0.0020	− 0.0052	0.4942 *	0.5016	0.4062
	(− 0.8636)	(− 0.6892)	(− 1.0141)	(2.2768)	(1.8719)	(1.0875)
SPVOLLN(− 1)	− 0.0017	0.0003	− 0.0087	0.5282 *	0.5020	0.5486
	(− 0.6983)	(0.1152)	(− 1.4934)	(2.1169)	(1.6536)	(1.2145)
SPVOLLN(− 2)	− 0.0005	− 0.0004	− 0.0018	0.4290	0.2889	1.1411 *
	(− 0.2121)	(− 0.1331)	(− 0.3467)	(1.5576)	(0.8591)	(2.2226)
SPVOLLN(− 3)	− 0.0006	− 0.0024	0.0023	0.2053	0.3192	0.0094
	(− 0.2348)	(− 0.7905)	(0.4031)	(0.7832)	(1.0536)	(0.0207)
SPVOLLN(− 4)	− 0.0044	− 0.0039	− 0.0080	0.6916 **	0.8999 **	0.1420
	(− 1.7652)	(− 1.3183)	(− 1.7490)	(3.0399)	(3.4518)	(0.3439)
XRATE	− 0.8398 **	− 0.8782 **	− 0.6377 **	− 2.2325	− 8.2218	23.8064 *
	(− 11.5480)	(− 10.2304)	(− 4.5898)	(− 0.3740)	(− 1.1876)	(2.0510)
XRATE(− 1)	− 0.5160 **	− 0.5658 **	− 0.3380	− 5.0656	0.4460	− 28.1354 *
	(− 6.5155)	(− 6.3055)	(− 1.9505)	(− 0.7965)	(0.0614)	(− 2.1638)
XRATE(− 2)	− 0.2473 **	− 0.2474 **	− 0.2087	− 3.1636	− 3.1774	0.3411
	(− 3.4805)	(− 2.8899)	(− 1.4010)	(− 0.4654)	(− 0.3853)	(0.0270)
XRATE(− 3)	− 0.3488 **	− 0.3646 **	− 0.2639	0.7502	− 1.2939	7.1173
	(− 5.1828)	(− 4.7042)	(− 1.9113)	(0.1044)	(− 0.1506)	(0.5786)
XRATE(− 4)	− 0.0698	− 0.0480	− 0.1754	− 11.0458	− 11.7357	− 10.5305
	(− 0.8859)	(− 0.5397)	(− 1.1527)	(− 1.7361)	(− 1.5319)	(− 0.9693)
MONDUMMY	− 0.0019	− 0.0014	− 0.0045	0.1663	0.2242	− 0.1196
	(− 1.7302)	(− 1.0362)	(− 1.8829)	(1.5770)	(1.6794)	(− 0.6889)
HOLDUMMY	− 0.0014	− 0.0007	− 0.0027	0.1607	0.3143	0.0012
	(− 0.5182)	(− 0.2074)	(− 0.6911)	(0.5751)	(0.8050)	(0.0041)
$\bar{R}^2$	.3502	.3566	.3384	.4111	.4114	.4250
F statistic	18.7840	14.7061	5.2163	24.0381	18.2848	7.0930
F statistic (*P* value)	.0000	.0000	.0000	.0000	.0000	.0000
Equation log-likelihood	3166.30	2395.00	791.48	− 1810.80	− 1387.30	− 394.90
System log-likelihood	1356.10	1008.00	397.01	1356.10	1008.00	397.01
Wald test			18.73			16.25
Wald test (*P* value)			.095			.015

This table reports the VARs for the variables defined in Table 1 for the entire sample period (19 March 1996 to 25 July 2000) and two subperiods (19 March 1996 to 17 May 1999 and 18 May to 25 July 2000) representing an expansionary and contractionary U.S. monetary policy, respectively.

T statistics are enclosed in parentheses and adjusted for heteroskedasticity (White, 1980).

* Indicates significance at the 5% significance level.

** Indicates significance at the 1% significance level.

as there is a large coefficient for XRATE for the contemporaneous change that dissipates over the following days. This indicates an underreaction by investors to exchange rate movements. It is possible that this underreaction is caused by uncertainty of information content as, initially, investors may not be sure of the total impact that a currency shock will have on the Australian market. Consequently, investors underreact and wait for the impact to become clearer before reacting fully.

In order to test the robustness of the model, we divide our sample into two periods. Approximately three quarters of the way through the sample period (May 18, 1999) the U.S. Federal Reserve announced that they were shifting towards a tightening bias in monetary policy.[19] As all series to be used are potentially affected by the U.S. economy, and there is evidence that U.S. monetary policy affects overseas returns (Conover, Jensen, & Johnson, 1999), the change in economic cycle indicated by the policy shift seems like an optimum point to break the sample into two subsamples. The results are also reported in Table 4. While the subperiods differ in minor details, the proportion of variance of changes in iShare values and inferences that may be drawn from the regression coefficients are in keeping with those made from analysing the entire sample. We cannot reject the hypothesis that the significant coefficients in the first period are equal to those found in the second period. Thus, the findings appear consistent across the two different periods.

In the analyses where EWAPIRET is endogenous, it is not influenced by changes in volume. The equations where EWAVOLN is endogenous suggest that changes in volume are slowly mean reverting. The coefficients are negative and significant for eight lags. Volume is affected by neither changes in the price of iShares Australia nor returns in the U.S. market. Interestingly, the hypotheses that there are positive relationships with volume in the United States, contemporaneous and at the fourth lag, cannot be rejected. That an active (dull) day for U.S. stocks should also result in an active (dull) day in iShare trading is consistent with the positive feedback story we have told for the price of iShares. Clearly, the insignificance of price indicates that variations in volume are not responses to price-sensitive news. Perhaps the joy of trading is itself contagious. It should be noted, however, that this relationship is found for the entire period only (although, in the second subperiod, the fourth lag is significant and positive).

5. The impact of conditional risk

Table 6 reports VAR models extending the models presented in Table 4 and discussed in the previous section. The model in Table 6 includes an additional exogenous variable: measure of risk—daily change in conditional risk of the Australian market. RISKY is the mnemonic used to represent change in conditional risk. It is measured as the daily percentage change in the conditional standard deviation of the daily change in ASX All Ordinaries Price Index (AOPI) as estimated by an EGARCH (1,3) model (Nelson, 1991). The parameters of

[19] U.S. Federal Reserve Press Release: May 18, 1999.

the EGARCH model chosen are reported in Table 5. While the mean equation is consistent with a random walk, the variance equation explains over 20% of the conditional variance of the All Ordinaries.

The choice of the EGARCH model was seen as appropriate: it better captures market responses to volatility shocks than the standard class of ARCH model as it overcomes asymmetric response biases. As risk is considered in this study to be determined exogenously, using iShares Australia (an endogenous variable) to estimate its own risk would have created an exogenous variable using endogenous input.

Like the other exogenous variables previously described, RISKY includes lagged as well as contemporaneous terms in the VAR. However, a forward-looking term for the next day is also included to capture expected risk of iShares Australia. Notably, the Australian market opens earlier in the same calendar day but is never open at the same time as either the AMEX or the New York Stock Exchange (NYSE). Thus, the exogenous variable RISKY in t_0 proxies for the expected change in risk today (in New York) of iShares Australia, and RISKY in $t+1$ is a proxy for the expected change in the risk of iShares tomorrow.

Table 5
Conditional variance of the All Ordinaries Index

	Coefficient	S.E.	Z statistic	P
C	0.000339	0.000251	1.349817	.177
AOPIRET(− 1)	0.01447	0.027196	0.53208	.595
Variance equation				
ω	− 0.3397	0.0934	− 3.6367	.000
α	0.0580	0.0103	5.6326	.000
γ	− 0.0599	0.0092	− 6.5247	.000
β_{t-1}	2.1730	0.0548	39.6284	.000
β_{t-2}	− 1.9866	0.0941	− 21.1046	.000
β_{t-3}	0.7828	0.0480	16.2973	.000
R^2	− .0001			
Adjusted R^2	− .0065			
Log-likelihood	3693.43			
Pagan–Schwert R^2	0.2248			

The following table reports the mean and variance equations used to calculate RISKY, the conditional variance of the All Ordinaries Index, used in the VARs reported in Table 6. The following equations are reported:

$$\mathrm{AOPIRET}_t = \alpha + \beta_t \mathrm{AOPIRET}_{t-1} + \varepsilon_t \qquad \varepsilon_t \mid \psi_{t-1} \approx N(0, h_t)$$

$$\log(h_t^2) = \omega + \sum_{t=0}^{3} \beta_t(\sigma_{t-1}^2) + \alpha\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + \gamma\frac{\varepsilon_{t-1}}{\sigma_{t-1}}$$

The Pagan–Schwert R^2 (Pagan & Schwert, 1990) reports the value of R^2 for the estimated equation

$$(\varepsilon_t)^2 = \alpha + \beta h_t^2 + \nu_t$$

where v_t is an iid error term.

Table 6
VARs for EWAPIRET and EWAVOLN including conditional risk (RISKY) as an endogenous variable

Regressor	VAR 2-EWAPIRET			VAR 2-EWAVOLN		
	Whole sample	Subsample 1	Subsample 2	Whole sample	Subsample 1	Subsample 2
C	0.0014 **	0.0013 **	0.0018	− 0.0449	− 0.0613	0.0062
		(2.6487)	(1.8030)	(− 0.9767)	(− 1.1086)	(0.0736)
EWAPIRET(− 1)	− 0.4812 **	− 0.4337 **	− 0.6032 **	− 0.9074	1.1389	− 5.1150
	(− 13.3998)	(− 10.3335)	(− 8.8677)	(− 0.2815)	(0.2769)	(− 1.0432)
EWAPIRET(− 2)	− 0.2898 **	− 0.2519 **	− 0.3988 **	0.3044	− 2.6023	8.7915
	(− 7.7277)	(− 5.9879)	(− 5.1666)	(0.0832)	(− 0.5689)	(1.4568)
EWAPIRET(− 3)	− 0.1435 **	− 0.1621 **	− 0.1083	− 1.9841	− 3.4896	1.7369
	(− 4.1208)	(− 4.0298)	(− 1.5275)	(− 0.5505)	(− 0.7690)	(0.3002)
EWAPIRET(− 4)	− 0.0128	− 0.0007	− 0.0249	1.9191	2.3474	1.2862
	(− 0.4326)	(− 0.0209)	(− 0.3883)	(0.6791)	(0.6896)	(0.2576)
EWAPIRET(− 5)	− 0.0325	− 0.0454	− 0.0149	− 3.5385	− 2.8605	− 6.2069
	(− 1.1965)	(− 1.4626)	(− 0.2511)	(− 1.1977)	(− 0.7995)	(− 1.1955)
EWAPIRET(− 6)	− 0.0945 **	− 0.0924 **	− 0.1135	1.9680	1.7955	1.8339
	(− 3.2540)	(− 2.6798)	(− 1.8866)	(0.6764)	(0.5070)	(0.3936)
EWAPIRET(− 7)	− 0.0014	0.0114	− 0.0068	2.4216	3.1872	2.0445
	(− 0.0496)	(0.3586)	(− 0.1256)	(0.9081)	(1.0032)	(0.4033)
EWAPIRET(− 8)	0.0097	0.0300	− 0.0540	− 2.8627	− 2.0440	− 7.7225
	(0.3961)	(1.0777)	(− 0.9792)	(− 1.1160)	(− 0.6745)	(− 1.4874)
EWAVOLN(− 1)	0.0000	0.0000	− 0.0004	− 0.8153 **	− 0.8172 **	− 0.8051 **
	(0.0548)	(0.0891)	(− 0.5102)	(− 25.8429)	(− 23.1024)	(− 10.7495)
EWAVOLN(− 2)	0.0002	0.0002	0.0000	− 0.6776 **	− 0.6692 **	− 0.7027 **
	(0.5025)	(0.5450)	(− 0.0260)	(− 17.3460)	(− 15.0227)	(− 7.9490)
EWAVOLN(− 3)	0.0002	0.0001	0.0002	− 0.5267 **	− 0.5332 **	− 0.4585 **
	(0.4883)	(0.2525)	(0.2026)	(− 11.8805)	(− 10.6743)	(− 4.8811)
EWAVOLN(− 4)	0.0001	0.0002	− 0.0003	− 0.4441 **	− 0.4660 **	− 0.3355 **
	(0.2380)	(0.4364)	(− 0.3123)	(− 9.4745)	(− 8.9280)	(− 3.2517)
EWAVOLN(− 5)	0.0000	0.0002	− 0.0009	− 0.3947 **	− 0.4276 **	− 0.2209 *
	(0.0373)	(0.4765)	(− 0.8181)	(− 8.3609)	(− 8.1286)	(− 2.3338)
EWAVOLN(− 6)	0.0003	0.0004	− 0.0002	− 0.3114 **	− 0.3296 **	− 0.2109 *
	(0.7661)	(0.9065)	(− 0.2249)	(− 6.9802)	(− 6.6393)	(− 2.1859)
EWAVOLN(− 7)	0.0003	0.0004	− 0.0001	− 0.2071 **	− 0.2254 **	− 0.0615
	(0.8089)	(0.9010)	(− 0.0851)	(− 5.4685)	(− 5.2369)	(− 0.7259)
EWAVOLN(− 8)	0.0003	0.0003	0.0005	− 0.0746 *	− 0.0853 *	− 0.0336
	(1.1732)	(1.0496)	(0.5959)	(− 2.5360)	(− 2.5066)	(− 0.5858)
RISKY(+ 1)	− 0.1549 **	− 0.1584 **	− 0.1326 **	1.5040	1.5629	1.2609
	(− 12.1151)	(− 10.7606)	(− 4.8009)	(1.3807)	(1.1672)	(0.6208)
RISKY	0.1294 **	0.1481 **	0.0698	− 0.9972	− 1.3305	1.3136
	(6.6992)	(6.5791)	(1.7632)	(− 0.5815)	(− 0.6419)	(0.3808)
RISKY(− 1)	− 0.0942 **	− 0.1157 **	− 0.0299	− 0.4212	− 0.7139	− 1.7611
	(− 4.3236)	(− 4.7743)	(− 0.6353)	(− 0.2084)	(− 0.2949)	(− 0.4415)
RISKY(− 2)	− 0.0014	0.0091	− 0.0298	2.4348	3.0038	2.7420
	(− 0.0642)	(0.3841)	(− 0.6100)	(1.1985)	(1.2028)	(0.7629)

Table 6 (*continued*)

Regressor	VAR 2-EWAPIRET			VAR 2-EWAVOLN		
	Whole sample	Subsample 1	Subsample 2	Whole sample	Subsample 1	Subsample 2
RISKY(− 3)	− 0.0310	− 0.0249	− 0.0462	− 2.0801	− 2.4285	− 2.0072
	(− 1.5666)	(− 1.1819)	(− 1.0679)	(− 1.2466)	(− 1.1529)	(− 0.7125)
RISKY(− 4)	− 0.0174	− 0.0232	− 0.0020	1.6694	1.3068	3.0243
	(− 1.4246)	(− 1.6285)	(− 0.0819)	(1.4264)	(0.8985)	(1.5882)
SPPIRET	0.3673 **	0.3957 **	0.2857 **	− 3.4221	− 1.8371	− 6.7437
	(8.7417)	(7.3134)	(4.2279)	(− 1.0741)	(− 0.4316)	(− 1.3509)
SPPIRET(− 1)	0.0982 *	0.0794	0.1640	3.6928	6.2493	− 3.2086
	(2.2499)	(1.5731)	(1.9454)	(0.9452)	(1.2391)	(− 0.4722)
SPPIRET(− 2)	0.1015 *	0.0837	0.1594	− 0.7284	1.4392	− 1.6760
	(2.3421)	(1.7181)	(1.8520)	(− 0.1824)	(0.28706)	(− 0.2726)
SPPIRET(− 3)	0.0695	0.0718	− 0.0816	− 1.1708	0.6759	− 8.1097
	(1.6839)	1.498	(0.9399)	(− 0.2952)	(0.12698)	(− 1.4341)
SPVOLLN	− 0.0009	− 0.0004	− 0.0054	0.3374	0.3246	0.1561
	(− 0.4338)	− 0.16575	(− 1.1083)	(1.6504)	(1.2843)	(0.4334)
SPVOLLN(− 1)	0.0010	0.0023	− 0.0043	0.2988	0.3106	0.0391
	(0.5291)	1.0472	(− 0.9135)	(1.3596)	(1.1906)	(0.0833)
XRATE	− 0.8207 **	− 0.8512 **	− 0.6728 **	− 3.9332	− 10.0517	21.3462
	(− 11.8274)	− 10.4237	(− 5.0547)	(− 0.6519)	(− 1.4281)	(1.8928)
XRATE(− 1)	− 0.5901 **	− 0.6033 **	− 0.4972 **	− 1.6802	2.9551	− 20.6071
	(− 8.5782)	− 7.8701	(− 3.2002)	(− 0.2621)	(0.3995)	(− 1.4929)
XRATE(− 2)	− 0.2577 **	− 0.2259 **	− 0.3022 *	− 2.4138	− 3.5938	5.1513
	(− 3.6505)	− 2.6966	(− 2.1696)	(− 0.3413)	(− 0.4151)	(0.4066)
XRATE(− 3)	− 0.3081 **	− 0.3293 **	− 0.2684	2.7855	0.4258	9.0448
	(− 4.8289)	− 4.5682	(− 1.9278)	(0.3810)	(0.0485)	(0.7265)
MONDUMMY	− 0.0016	− 0.0013	− 0.0034	0.2124 *	0.3019 *	− 0.1466
	(− 1.6286)	− 1.1488	(− 1.4026)	(2.1073)	(2.4121)	(− 0.8426)
$\bar{R}^2$	.4697	.4842	.4249	.4070	.4043	.4177
F statistic	30.2042	24.2090	7.0684	23.6292	17.7829	6.8897
F statistic (*P* value)	.0000	.0000	.0000	.0000	.0000	.0000
Equation log-likelihood	3273.60	2485.20	807.26	− 1813.40	− 1392.30	− 395.61
System log-likelihood	1462.00	1093.90	412.83	1462.00	1093.90	412.83
Wald test			20.91			15.23
Wald test (*P* value)			.075			.085

This table reports the VARs for the variables defined in Table 1 for the entire sample period (19 March 1996 to 25 July 2000) and two subperiods (19 March 1996 to 17 May 1999 and 18 May to 25 July 2000) representing an expansionary and contractionary U.S. monetary policy, respectively.

T statistics are enclosed in parentheses and adjusted for heteroskedasticity (White, 1980).

* Indicates significance at the 5% significance level.

** Indicates significance at the 1% significance level.

The EWAPIRET results in Table 6 are consistent with those presented in Table 4. For both the entire period and the two subperiods, however, the anticipated risk at time t ($RISKY_{t+1}$) has a negative coefficient.[20] The negative coefficient for the forward-looking term suggests that when an increase in risk is expected for iShares Australia, investors in the United States react negatively. This is empirical support for Bekaert and Wu (2000). An anticipated increase in volatility raises the required return on iShares Australia that leads to an immediate decline in the price of iShares Australia. This is a finding for rationality in share price behavior rather than the quasi-rational behavior indicated by the results of other variables in the VAR.

The relationship of price changes to expected risk is also consistent with Busse (1999) where the negative association with expected volatility to returns is attributed to the incentives of fund managers who are compensated based on risk-adjusted return performance. Unlike Busse, however, it can be assumed that the investors in iShares Australia are mostly retail investors. The evidence here suggests that a more general description of the relationship between return and expected risk is more appropriate. If retail investors are rational, their motivations should be similar to those of fund managers: they too would want to achieve the best risk-adjusted return possible. By selling their stock when there is an increase in expected risk, they reduce exposure to iShares Australia and are consequently, on average, exposed to less risk. Whether such an explanation is warranted, with transaction costs taken into account, is worthy of further exploration. $RISKY_{t+1}$ is also significant and negative in both subperiods.

Contemporaneous conditional volatility ($RISKY_t$) has a positive relationship with changes in EWAPIRET. Increased return for increased risk is a familiar feature of financial economics. $RISKY_{t-1}$ is also significant and negative, and while this may be consistent with the return/risk story, this result is difficult to interpret. Examination of the analyses in the subperiods, however, shows that these effects are limited to the first subperiod studied.

The inclusion of conditional risk slightly varies the interpretation of iShare volume (EWAVOLN). U.S. equity returns and the exchange rate are no longer statistically significant. The Monday dummy variable is significant at the 5% level in the analysis for the entire period and Subperiod 1 only.

6. Conclusion

This paper has studied the determinants of iShares Australia returns to examine how foreign investors in the Australian market respond to changes in their domestic information set. We have chosen iShares Australia due to the empirical evidence that the American market influences the Australian market. In understanding how foreigners in the Australian market are influenced, perhaps we learn something of why the U.S. market seems to drive the Australian market.

[20] The analysis is unchanged using alternate specifications of RISKY. We recalculated RISKY using data only from the first subsample. The predicted values from this equation were then used to forecast conditional risk for the second period. The resulting analysis used predictions of conditional variance derived from this model for the second period. The results of this analysis are consistent with results for the forward-looking term of RISKY presented in the paper.

We found that iShares Australia has a positive correlation with contemporaneous and lagged variation in the U.S. market; an inverse negative correlation with contemporaneous and lagged variation in the exchange rate and a negative relationship with its own lagged values. Thus, the evidence is inconsistent with weak form market efficiency. Indeed, the behaviors are consistent with investors overreacting to price-sensitive information. While we find no support for a price/volume relationship, we see some support for the notion that the joy of trading is infectious; we argue that this is consistent with our argument that iShares Australia traders are motivated by quasi-rational urges. We divide our sample into two subperiods, delimited by a change in the Federal Reserve's policy stance from expansionary to deflationary (the former being the first period, the second the latter), and found that our analysis is consistent in both subperiods.

The behavioral explanation of iShares Australia prices, however, is not the whole story. We found that the negative association of returns and expected risk is consistent with the familiar return/risk trade-off from the paradigms of financial economics. Similarly, we found a positive relationship, albeit one seemingly confined to the first of the subperiods we study, between contemporaneous risk and return.

Thus, our story for iShares Australia supports theories from both rational and quasi-rational finance. If, as we have argued, our analysis is a suitable proxy for overseas (predominately U.S. retail) activity in a foreign (in this case, the Australian) market we can perhaps offer some explanations for the violation of weak form efficiency in the international marketplace. We see weak form inefficiency because market participants overreact to available information. Prices cannot reflect all information efficiently if investors do not process such information efficiently. It remains an open question as to why investors might believe that daily movements in the U.S. market convey as much information about the Australian market as they appear to do. While Australia has growing exports in advanced goods and services, its major comparative advantage would still appear to be in agriculture and mining. While America is a major recipient of Australian exports (importing as much as South Korea), the Japanese market is far more important to Australia. The strength of the American economy may be important for Australia, but the strength of the relationship found in this paper suggests a far stronger linkage. Perhaps, this too, is consistent with our overreaction story.

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