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PRICE AND VARIANCE TRANSMISSION IN ADRs: EVIDENCE FROM 1990 TO 1994

FRANCO PARISI*
Universidad de Chile

Abstract

The ADR pricing and variance were examined under the hypothesis of multi-prices and multi-variances effects. The model implemented was a multivariate EGARCH(1,1), where the U.S. and foreign conditional variances were included in the ADR conditional variance, also in the ADR conditional mean the U.S. and foreign returns were considered as explanatory variables. The results validate the theoretical model proposed by Alexander, Eun and Janakiramanan (1987) where the dual-listed security pricing depends upon the correlation between the ADR and the two markets where the security is traded. The model presents significant results in thirty four ADRs where their pricing and variance are explained by the U.S. and the foreign returns, at the same time, over a total of seventy-nine dual-listed securities. In particular, the conditional variance of the ADRs is significantly affected by the U.S. conditional variance in sixty-four cases, the foreign conditional variance is significant in sixty-two ADRs, where the combined effect of the U.S. and foreign conditional variance is significant on fifty-two occasions. The explanatory power of the U.S. return in the ADR pricing is significant in fifty-one cases, and the foreign return is significant in seventy-two cases. The combined effect from the U.S. and foreign returns is significant on forty-seven cases.

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I. Introduction

Alexander, Eun and Janakiramanan (1987) prove, in mathematical terms, that pricing dual-listed securities depends on the relationship of the security and each of the two markets. Rosenthal (1983) and Kato, Linn and Schallheim (1991) do not find arbitrage opportunity in the ADR market. Hamao, Masulis and Ng (1990); King and Wadhwani (1990); and Chan, Karolyi and Stulz (1992) study the variance transmission from the U.S. to the most important capital markets, all of them concluding that U.S. information is significant and is transmitted rapidly to other markets.

This paper examines the hypothesis of price variation and volatility transmission from U.S. and foreign markets into American Depository Receipt (ADR) portfolios. The hypothesis is based on three facts. The first is the evidence of price volatility spillovers from the New York Stock Exchange to the London and Tokyo stock exchanges. Second, pricing mistakes from the foreign stock exchange will be transmitted to the ADR prices to maintain the no arbitrage condition. Third, pricing dual-listed securities depends on the security's independent correlation with the two markets where it is traded.

To test the hypothesis, a multivariate EGARCH model will be implemented to quantify: i) how much of the ADR's variance can be explained by innovations in U.S. and foreign markets, and ii) how much and how rapidly the price movements in each market are transmitted to the ADR prices.

Officer (1973); Black (1976); Christie (1982); Merton (1980); Pindyck (1984); Poterba and Summers (1986); and Schwert (1989) posit that changes in macroeconomic variables and financial leverage explain changes in stock return variance. Bollerslev, Engle and Woolridge (1988); French and Roll (1986); and French, Schwert and Stambaugh (1987) suggest that a multivariate generalized autoregressive conditional heteroscedastic process (GARCH) is an appropriate model to capture the time-variation in stock variance, in both portfolios and individual stocks.

King and Wadhwani (1990) find strong linkage between international equity markets using hourly data during the 1987 crash. They test the contagion model using high-frequency data from the stock markets in London, New York and Tokyo for an eight-month period around the crash. Their results suggest that a channel exists which transmits mispricing from one market to another. Eun and Shim (1989) analyze the international transmission of stock market movements between nine major stock markets using daily closing prices and find that the U.S. market accounts for an average of 26% of the innovations in the other eight markets over a 20-day period. In the same area, King, Sentana and Wadhwani (1994) conclude that changes in correlations between markets are driven primarily by movements in "unobservable" variables[1]. Therefore, building models which help predict changes in covariances between markets on the basis of observed economic data is likely to prove difficult.

Hamao, Masulis and Ng (1990) study the interdependence of daily prices and volatility between the major stock indices for the Tokyo, London and New York stock exchanges. The price quotations were close-to-open and close-to-close returns for each country's market portfolio. The authors point out that there are price volatility spillovers from New York to Tokyo and from New York to London, but no price volatility spillover effects in other directions[2].

Kato, Linn and Schallheim (1993), KLS hereafter, investigate arbitrage opportunities in the ADR market. They find evidence to support the law of one price. Rosenthal (1983) studies efficiency in the ADR market, concluding that ADRs listed on the NYSE and NASDAQ are consistent with the weak form efficiency.

In the international diversification literature, Officer and Hoffmeister (1988) suggest that investors can reduce their risk exposure between 20 and 25 percent when as few as four ADRs are combined with four domestic securities, without any reduction in expected return. Wahab and Khandwala (1993) analyze the merits of ADRs compared to the respective underlying stock as international diversification vehicles. Their results indicate when seven ADRs are added to the S&P 500, representing a 10 percent weight of the respective combined portfolio, the annualized standard deviation of daily returns drops from 30.2 to 21.23 percent, a drop of almost 30 percent. The authors point out that a portfolio containing ADRs has lower variance than one with foreign shares; therefore diversification benefits stand to be gained by including ADRs, according to simple dominance arguments.

The interdependence of price and volatility between the ADR portfolio returns, the U.S. market returns and the foreign market returns is tested using a multivariate EGARCH model[3], proposed by Nelson (1990), where the estimation of the model is performed using the maximum likelihood procedure defined by Berndt, Hall, Hall and Hausman (1974).

This research is described in seven parts. Following the introduction, section two contains the sample description. The third part describes the methodology and presents the extended EGARCH(1,1) model. The fourth part presents the trading hours in the stock sample. The fifth part contains the empirical results. The sixth section is a summary of the results. Finally, the seventh part presents the conclusions.

II. Sample Description

The sample consists of ninety-five firms from thirteen countries with ADRs traded on the NYSE and NASDAQ, during the period of December 28, 1989 to December 30, 1994. Forty-seven firms are traded on the NYSE and the rest on NASDAQ. The data used are the daily returns of ADRs, a U.S. market index and various foreign market indices, all of them in U.S. currency. The ADR and the U.S. returns are taken from the CRSP tape. The foreign market returns are the "Financial Time Actuaries World Indices" (FTAWIs).

The FTAWIs are available for a relatively extended period for most countries and have been used elsewhere to investigate other topics concerning international equities. The FTAWIs include only the largest and most liquid individual stocks; thus, smaller markets have fewer constituent securities in their indices in each country.

In addition, in Annex I the particular information about each ADR is given. This information includes the Cusip number, the permanent number in the CRISP data tape, the name and the country.

III. Methodology and the Model

This section is included to present the Multivariate EGARCH Model used to test the hypothesis of price and volatility influence from the U.S. and the foreign returns into ADRs, based on the models of Bollerslev (1986); Bollerslev, Engle and Woolridge (1988); Nelson (1990); and Alexander, Eun and Janakiramanan (1987). These models incorporate three facts. First, the conditional covariance matrix of the asset returns is strongly autoregressive. Second, the model allows good and bad news to have different impacts on volatility, and for bad to have a greater impact on volatility than in the standard GARCH model. Third, pricing of dual-listed securities depends on the two markets in which they are traded. The estimation of this model is through the maximum likelihood procedure, using the Berndt, Hall, Hall and Hausman (1974) iteration process, where the EGARCH(1,1) model is the following:

$$y_{it} = \alpha_{i0} + \alpha_{i2} \sum_{j} x_t + \epsilon_{it} \tag{1}$$

$$\epsilon_{it}/\psi_{t-1} \sim N(0, H_t) \tag{2}$$

$$\log(h_{ij,t}) = a_0 + a_1 \log(h_{tij,-1}) + a_2 \frac{\epsilon_{ij,t-1}}{\sqrt{h_{ij,t-1}}} + a_3 \left[\frac{|\epsilon_{ij,t-1}|}{\sqrt{h_{ij,t-1}}} - \sqrt{2/\Pi} \right] \tag{3}$$

$$H_t = \begin{vmatrix} h_{11,t} & h_{12,t} & h_{13,t} \\ h_{21,t} & h_{22,t} & h_{23,t} \\ h_{31,t} & h_{32,t} & h_{33,t} \end{vmatrix} \tag{4}$$

here, the subscript i refers to the ith element of the corresponding vector and ij to the ijth element of the corresponding matrix, with i,j=1,...,3. Equation 1 is known as the conditional mean, where y is the dependent variable, x is the independent variable and epsilon is the common error term normally distributed with zero mean and variance h_t. ψ_{t-1} is the information set available at time t. h_t is the conditional variance, which depends on the past variance (h_{t-1}) and the square past errors (e_{t-1}). H_t denotes the 3x3 variance-covariance conditional matrix on the information at time t, and ϵ_t denotes the vector of disturbances. The multivariate EGARCH model used to test the hypothesis is composed of three equation systems, one for the U.S. return, another for the foreign return and one for the ADR return. The EGARCH model for the U.S. return and the foreign return is the following:

$$R_{(i,\,t)} = \alpha_0 + \alpha_1\, R_{(i,\,t-1)} + \alpha_2\, \mathrm{dmon}_{(i,\,t)} + \epsilon_{(i,\,t)} \tag{5}$$

$$\log(h_{(i,\,t)}) = a_{i0} + a_{i1}\, \log(h_{(i,\,t-1)}) + a_{i2}\, \Big[\frac{\epsilon_{(i,\,t-1)}}{\sqrt{h_{(i,\,t-1)}}} + a_{i3}\, \Big(\frac{|\epsilon_{(i,\,t-1)}|}{\sqrt{h_{(i,\,t-1)}}} - \sqrt{2/\Pi}\Big)\Big] + a_{i4}\, \mathrm{dmon}_{(i,\,t)} \tag{6}$$

where i indicates the U.S. or the foreign returns. $R_{(i,t)}$ is the daily return. $\mathrm{dmon}_{(i,t)}$ is a dummy variable that takes a value of one on Mondays and after holidays, and zero otherwise; the inclusion of this variable is justified by the empirical results suggested by Jaffe and Westerfield (1985) and Jaffe, Westerfield and Ma (1989). In the conditional variance, $h_{(i,t)}$, the independent variables are the previous conditional variance $h_{(i,t-1)}$, the dummy effect, $\mathrm{dmon}_{(i,t)}$, and the lag of the errors.

Because foreign countries have holidays different than those of the United States, it is assumed that the conditional variance in the foreign country is zero for those days and the market return is the same as the previous trading day. Based on this assumption, the equation for the ADR is the following:

$$R_{(adr,\,t)} = \gamma_0 + \gamma_1 R_{(adr,\,t-1)} + \gamma_2 R_{(us,\,t)} + \gamma_3 R_{(for,\,t)} + \gamma_4\, \mathrm{dmon}_{(us,\,t)} + \epsilon_{(adr,\,t)} \tag{7}$$

$$\log(h_{(adr,\,t)}) = c_0 + c_1 \log(h_{(adr,\,t-1)}) + c_2 \log(h_{(us,\,t)}) + c_3 \log(h_{(for,\,t+1)}) + c_5\, \Big[\frac{\epsilon_{(adr,\,t-1)}}{\sqrt{h_{(adr,\,t-1)}}} + c_6\, \Big(\frac{|\epsilon_{(adr,\,t-1)}|}{\sqrt{h_{(adr,\,t-1)}}} - \sqrt{2/\Pi}\Big)\Big] + c_7\, \mathrm{dmon}_{(us,\,t)} \tag{8}$$

$$h_{(US\text{-}adr,\,t)} = g_i\, (\sqrt{h_{US,\,t} * h_{adr,t}}) \tag{9}$$

$$h_{(for\text{-}adr,\,t)} = g_i\, (\sqrt{h_{(for,\,t+1)} * h_{(adr,t)}}) \tag{10}$$

Where the covariances equations are:

$$h_{(US\text{-}for,\,t)} = g_i\, (\sqrt{h_{(US,\,t)} * h_{(for,\,t+1)}}) \tag{11}$$

here the ADR's conditional mean (7) depends on its lagged return, the U.S. and foreign returns and a dummy variable for the Monday and after holiday effect, taking one for the event and zero otherwise.

The conditional variance, equation (8), is explained by the EGARCH(1,1) plus the contemporary U.S. and lead foreign conditional variances. The conditional covariances between the dependent variables are assumed to be constant.

The conditional covariances between the foreign and the other two dependent variables are evaluated at time t+1. The effect of the conditional variance from the foreign market is at time t+1, since all the information that is needed to estimate the foreign conditional variances at time t+1 is known because all the foreign markets in the sample close before the New York Stock Exchange closing. The conditional covariances are stationary, as is suggested by Ng (1991). To be consistent with the theoretical model, we present the conditional variance-covariance matrix:

$$H_t = \begin{vmatrix} h_{us} & h_{us\text{-}for} & h_{us\text{-}adr} \\ h_{us\text{-}for} & h_{for} & h_{for\text{-}adr} \\ h_{us\text{-}adr} & h_{for\text{-}adr} & h_{adr} \end{vmatrix} \tag{12}$$

IV. Trading Hours in the Stock Exchange Sample

The information in Table 4.1 is based on the trading hours in each of the stock markets[4]. Each market is compared to the NYSE, on Eastern Standard Time. Australia, Hong Kong, Italy, Japan and South Africa all close before the New York opening. Only Denmark's closing is simultaneous with the New York opening. The rest of the countries close before the New York closing. These countries are France, the Netherlands, Spain, Sweden, Switzerland and the United Kingdom.

The Australian ADR portfolio comprises ten stocks, six traded on the NYSE and four on NASDAQ. The French and Swiss portfolios are each comprised of two ADRs, traded on the NYSE. The Italian portfolio has three ADRs, all of them traded on the NYSE. The Japanese ADR portfolio is composed of twenty-one securities, eight from the NYSE and the rest from NASDAQ. The Dutch ADR portfolio has four ADRs, all of them traded on the NYSE. The Spanish ADR portfolio is comprised of six dual-listed securities, all of them traded on the NYSE. Fourteen ADRs from South Africa are in the sample, all of them traded on NASDAQ. The Swedish ADR portfolio has four securities, all of them traded on NASDAQ. Finally, the British ADR portfolio has twenty-seven securities, nineteen traded on the NYSE and the rest on NASDAQ.

V. The Empirical Results

This section presents the main results of the pricing and variance transmission from the U.S. and foreign returns into the ADR securities. It is important to mention that in the ADR's conditional variance and covariance between the ADR and foreign returns, the latter is evaluated at time t+1, since the conditional variance in this model depends only on past information.

TABLE 4.1

STANDARD TIME AND TRADING HOURS

Country	Hour w/r/t 12:00 ET	Opening trading	Closing trading	Difference NY/c-L/c
Australia	0.3:00*	19:00	02:00	14:00
Denmark	18:00	04:00	09:30	6:30
France	18:00	03:00	11:00	5:00
Hong Kong	01:00*	21:00	04:30	11:30
Italy	18:00	04:00	07:45	8:15
Japan	02:00*	19:00	03:00	13:00
Netherlands	18:00	03:00	11:00	5:00
South Africa	19:00	02:30	09:00	7:00
Spain	18:00	05:00	11:00	5:00
Sweden	18:00	04:00	10:00	6:00
Switzerland	18:00	04:00	10:00	6:00
UK	17:00	04:30	11:30	4:30
US	12:00	09:00	16:00	

* Indicates a new day, in relation to NY time.

a. The U.S. and foreign effects on the conditional mean and variance of ADRs traded on the NYSE

The results of the Australian ADR portfolio indicate that the U.S. effect on pricing is significant at the five percent level. Similar results are found for the foreign and its own lagged returns. However, no effects from the U.S. and foreign returns in the portfolio's conditional variance are present, nor is the coefficient significant at conventional levels (see Table 5.1). The Australian portfolio of ADRs traded on the NYSE presents an insignificant effect from the asymmetric conditional variance. An analysis of the impact on variance for each particular ADR from Australia indicates that the U.S. variance transmission is significant on five occasions. The foreign effect in the conditional variance is significant at conventional levels in only three cases. In the conditional mean results, the effect in pricing from the U.S. and foreign returns is significant at the five percent level (see Table 5.1). The unconditional correlation coefficients between the portfolio and the U.S. returns and the portfolio and the foreign returns are both significant at the five percent level and at the ten percent level, respectively. The ADRs in this portfolio present a significant asymmetric effect in the conditional variance on four occasions, at the five percent level. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant in five cases, four at the five percent level and one at the ten percent level. The unconditional correlation coefficient between the ADRs and the foreign returns is significant on five occasions, at the five percent level (see Table 5.3).

The ADR from Denmark is affected significantly (at the five percent level) by its own lagged return, the U.S. returns and foreign returns. The conditional

TABLE 5.1

MULTIVARIATE EGARCH(1,1) MODEL WITH THE U.S. AND THE FOREIGN VARIANCE EFFECTS FOR THE ADR RETURNS

$$R_{(adr,\,t)} = \alpha_0 + \alpha_1 R_{(adr,\,t-1)} + a_2 R_{(us,\,t)} + \alpha_3 R_{(for,\,t)}\ \alpha_4\ dmon_{(t)} + \epsilon_{(adr,\,t)}$$

$$\log(h_{(adr,\,t)}) = a_0 + a_1 \left(\frac{\epsilon_{(t-1)}}{\sqrt{h_{(t-1)}}} + g_0 \left[\frac{|\epsilon_{(t-1)}|}{\sqrt{h_{(t-1)}}} - \sqrt{2/\pi}\right]\right) + a_2 \log(h_{(adr,\,t-1)})$$

$$+\ a_3 \log(h_{us,\,t}) + a_4 \log(h_{For,\,t}) + a_5 dmon$$

ADR	α_0	α_1	α_2	α_3	α_4	a_0	a_1	a_2	a_3	a_4	a_5
Australia NY-Nq	0036 (0.22)	-0.121 (0.00)*	-0.377 (0.01)*	1.091 (0.00)*	-0.090 (0.03)*	0.069 (0.00)*	0.233 (0.00)*	0.786 (0.00)*	0.031 (0.00)*	0.039 (0.12)	0.168 (0.00)*
Australia NYSE	0.037 (0.21)	-0.110 (0.00)*	0.287 (0.00)*	0.590 (0.00)*	-0.050 (0.37)	0.057 (0.10)**	0.272 (0.00)*	0.820 (0.00)*	0.017 (0.26)	0.160 (0.11)	-0.192 (0.01)*
75039	0.088 (0.00)*	-0.108 (0.00)*	-0.353 (0.00)*	1.220 (0.00)*	0.120 (0.01)*	0.066 (0.01)*	0.166 (0.00)*	0.712 (0.00)*	0.058 (0.00)*	0.091 (0.06)**	0.226 (0.00)*
75387	0.051 (0.18)	-0.144 (0.00)*	-0.011 (0.90)	1.449 (0.00)*	-0.064 (0.34)	0.326 (0.00)*	0.208 (0.00)*	0.519 (0.00)*	0.050 (0.10)**	0.055 (0.38)	0.100 (0.09)**
75343	-0.013 (0.90)	-0.195 (0.00)*	-0.030 (0.90)	1.297 (0.00)*	-0.323 (0.09)**	0.406 (0.00)*	0.296 (0.00)*	0.830 (0.00)*	0.007 (0.59)	0.051 (0.41)	0.041 (0.50)
75301	0.089 (0.00)*	-0.117 (0.00)*	-0.151 (0.05)*	0.911 (0.00)*	-0.109 (0.04)*	0.099 (0.00)*	0.197 (0.00)*	0.873 (0.00)*	0.054 (0.00)*	0.099 (0.00)*	-0.033 (0.52)
69593	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
75301	0.057 (0.21)	-0.100 (0.00)*	-0.887 (0.00)*	1.081 (0.00)*	-0.127 (0.21)	0.310 (0.00)*	0.255 (0.00)*	0.753 (0.00)*	0.045 (0.00)*	0.056 (0.36)	0.097 (0.12)
Australia Nasdaq	-0.091 (0.24)	-0.171 (0.00)*	0.517 (0.00)*	0.477 (0.00)*	-0.040 (0.78)	0.155 (0.00)*	0.216 (0.00)*	0.905 (0.00)*	-0.010 (0.29)	0.062 (0.23)	0.062 (0.35)
22163	-0.004 (0.97)	-0.231 (0.00)*	0.464 (0.10)**	0.052 (0.80)	-0.281 (0.27)	0.399 (0.00)*	0.238 (0.00)*	0.905 (0.00)*	0.030 (0.00)*	0.026 (0.16)	-0.203 (0.00)*
11486	0.052 (0.22)	-0.203 (0.00)*	-0.272 (0.00)*	1.744 (0.00)*	-0.174 (0.01)*	0.167 (0.00)*	0.056 (0.00)*	0.855 (0.00)*	0.059 (0.00)*	0.050 (0.00)*	0.109 (0.00)*
68815	0.055 (0.36)	-0.117 (0.00)*	-0.310 (0.00)*	0.777 (0.00)*	-0.163 (0.07)**	0.097 (0.00)*	0.208 (0.00)*	0.968 (0.00)*	0.028 (0.00)*	-0.051 (0.10)**	-0.105 (0.10)**
71571	0.028 (0.85)	-0.224 (0.00)*	0.270 (0.35)	0.454 (0.01)*	-0.527 (0.09)**	0.362 (0.00)*	0.318 (0.00)*	0.917 (0.00)*	0.023 (0.00)*	0.067 (0.03)*	-0.043 (0.50)
Denmark	0.040 (0.31)	-0.094 (0.00)*	0.330 (0.02)*	0.775 (0.00)*	-0.010 (0.89)	0.409 (0.00)*	0.163 (0.00)*	0.128 (0.55)	0.066 (0.21)	0.001 (0.99)	-0.174 (0.02)*

ADR	α_0	α_1	α_2	α_3	α_4	a_0	a_1	a_2	a_3	a_4	a_5
France NY-Nq	-0.034 (0.46)	0.032 (0.14)	0.424 (0.02)*	0.316 (0.01)*	0.080 (0.32)	1.070 (0.00)*	-0.062 (0.00)*	-0.731 (0.00)*	0.359 (0.00)*	0.084 (0.52)	-0.145 (0.00)*
39570	-0.038 (0.25)	0.077 (0.00)*	0.879 (0.00)*	-0.005 (0.37)	0.160 (0.08)**	0.178 (0.00)*	0.382 (0.00)*	0.683 (0.00)*	0.009 (0.65)	-0.145 (0.01)*	0.537 (0.00)*
75508	-0.010 (0.87)	-0.001 (0.96)	0.232 (0.17)	0.655 (0.00)*	-0.022 (0.86)	0.175 (0.01)*	0.057 (0.00)*	0.842 (0.00)*	0.017 (0.34)	0.094 (0.01)*	0.020 (0.76)
Italy NY	0.025 (0.50)	-0.089 (0.00)*	-0.120 (0.23)	0.442 (0.00)*	-0.110 (0.10)*	0.058 (0.00)*	0.152 (0.00)*	0.967 (0.00)*	0.036 (0.00)*	0.014 (0.28)	0.006 (0.87)
75594	-0.162 (0.00)*	-0.155 (0.00)*	0.691 (0.00)*	0.535 (0.00)*	0.228 (0.06)**	0.096 (0.00)*	0.162 (0.00)*	0.971 (0.00)*	0.039 (0.00)*	0.029 (0.01)*	-0.035 (0.00)*
75456	-0.034 (0.42)	-0.095 (0.00)*	-0.047 (0.68)	0.594 (0.00)*	-0.078 (0.39)	0.017 (0.33)	0.196 (0.00)*	0.962 (0.00)*	0.014 (0.00)*	0.017 (0.23)	0.155 (0.01)*
75178	0.125 (0.05)*	-0.060 (0.02)*	-0.062 (0.74)	0.700 (0.00)*	-0.059 (0.62)	0.357 (0.00)*	0.222 (0.00)*	0.737 (0.00)*	0.037 (0.10)**	0.113 (0.00)*	-0.185 (0.01)*
Japan NY-NQ	0.032 (0.12)	0.014 (0.38)	0.017 (0.71)	0.782 (0.00)*	-0.066 (0.02)*	-0.181 (0.00)*	0.372 (0.00)*	0.730 (0.00)*	0.079 (0.00)*	0.329 (0.00)*	-0.199 (0.00)*
Japan NYSE	0.042 (0.13)	-0.023 (0.15)	-0.046 (0.53)	0.620 (0.00)*	-0.135 (0.00)*	0.008 (0.68)	0.295 (0.00)*	0.837 (0.00)*	0.046 (0.00)*	0.139 (0.00)*	-0.118 (0.02)*
64231	0.024 (0.46)	-0.065 (0.00)*	-0.380 (0.00)*	0.765 (0.00)*	-0.035 (0.50)	0.147 (0.00)*	0.353 (0.00)*	0.816 (0.00)*	0.066 (0.00)*	0.139 (0.00)*	-0.073 (0.00)*
59555	0.146 (0.00)*	-0.102 (0.00)*	-0.602 (0.00)*	0.421 (0.00)*	-0.165 (0.08)**	0.118 (0.00)*	0.321 (0.00)*	0.659 (0.00)*	-0.052 (0.00)*	0.210 (0.00)*	0.132 (0.014)*
53727	0.019 (0.62)	-0.088 (0.00)*	-0.266 (0.02)*	0.835 (0.00)*	-0.156 (0.04)*	0.218 (0.00)*	0.281 (0.00)*	0.663 (0.00)*	0.103 (0.00)*	0.175 (0.00)*	0.039 (0.45)
75811	0.035 (0.40)	0.030 (0.28)	0.039 (0.65)	0.399 (0.00)*	-0.155 (0.03)*	0.073 (0.02)*	0.253 (0.00)*	0.852 (0.00)*	0.006 (0.50)	0.176 (0.00)*	-0.187 (0.04)*
59424	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
51131	0.047 (0.24)	-0.119 (0.00)*	0.003 (0.97)	0.593 (0.00)*	-0.165 (0.03)*	0.317 (0.00)*	0.240 (0.00)*	0.599 (0.00)*	0.140 (0.00)*	0.255 (0.00)*	-0.069 (0.32)
64362	0.032 (0.48)	0.037 (0.14)	0.434 (0.00)*	0.685 (0.00)*	-0.200 (0.03)*	0.124 (0.00)*	0.249 (0.00)*	0.860 (0.00)*	0.027 (0.05)*	0.072 (0.00)*	-0.023 (0.79)
61778	0.022 (0.65)	-0.008 (0.74)	0.246 (0.05)*	0.588 (0.00)*	-0.029 (0.74)	0.175 (0.00)*	0.311 (0.00)*	0.786 (0.00)*	0.222 (0.00)*	0.123 (0.00)*	-0.132 (0.13)
Japan Nasdaq	0.046 (0.03)*	0.007 (0.64)	-0.023 (0.69)	0.861 (0.00)*	-0.102 (0.00)*	-0.067 (0.22)	0.470 (0.00)*	0.713 (0.00)*	0.103 (0.00)*	0.302 (0.00)*	-0.221 (0.00)*
26060	0.023 (0.65)	0.061 (0.04)*	0.562 (0.00)*	1.141 (0.00)*	-0.105 (0.31)	0.223 (0.00)*	0.851 (0.00)*	0.244 (0.00)*	0.057 (0.26)	0.770 (0.00)*	-0.188" (0.00)*

ADR	α_0	α_1	α_2	α_3	α_4	a_0	a_1	a_2	a_3	a_4	a_5
21152	0.035 (0.40)	-0.173 (0.00)*	0.054 (0.59)	0.305 (0.00)*	-0.105 (0.13)	0.122 (0.00)*	0.154 (0.00)*	0.973 (0.00)*	0.048 (0.00)*	0.001 (0.78)	-0.121 (0.08)**
28303	-0.083 (0.29)	-0.030 (0.28)	0.204 (0.18)	0.936 (0.00)*	0.248 (0.06)**	0.311 (0.00)*	0.473 (0.00)*	0.424 (0.00)*	0.267 (0.00)*	0.058 (0.22)	-0.264 (0.00)*
37867	0.097 (0.02)*	-0.046 (0.03)*	-0.424 (0.00)*	0.515 (0.00)*	-0.231 (0.00)*	0.138 (0.00)*	0.273 (0.00)*	0.858 (0.00)*	0.055 (0.00)*	0.062 (0.00)*	0.035 (0.58)
46085	0.023 (0.66)	-0.071 (0.01)*	-0.062 (0.63)	0.521 (0.00)*	0.116 (0.26)	0.165 (0.09)**	0.252 (0.00)*	0.603 (0.00)*	0.017 (0.64)	0.263 (0.00)*	0.046 (0.60)
51087	-0.057 (0.34)	-0.131 (0.00)*	0.241 (0.02)*	1.350 (0.00)*	0.103 (0.32)	0.337 (0.00)*	0.266 (0.00)*	0.811 (0.00)*	0.076 0(0.00)*	0.091 (0.00)*	0.012 (0.86)
54579	-0.003 (0.93)	-0.076 (0.00)*	0.022 (0.86)	0.820 (0.00)*	-0.068 (0.45)	0.145 (0.00)*	0.188 (0.00)*	0.898 (0.00)*	0.067 (0.00)*	0.098 (0.00)*	-0.103 (0.28)*
54782	0.077 (0.22)	-0.113 (0.00)*	-0.232 (0.10)*	0.713 (0.00)*	-0.190 (0.09)*	0.342 (0.00)*	0.14 (0.00)*	0.640 (0.00)*	0.032 (0.00)*	0.253 (0.00)*	-0.136 (0.09)**
57681	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
46309	-0.011 (0.85)	-0.104 (0.00)*	-0.096 (0.49)	1.009 (0.00)*	0.062 (0.56)	0.199 (0.00)*	0.292 (0.00)*	0.892 (0.00)*	0.071 (0.00)*	0.107 (0.00)*	-0.031 (0.74)
68823	-0.019 (0.72)	-0.084 (0.00)*	0.165 (0.15)	1.195 (0.00)*	0.105 (0.29)	0.174 (0.00)*	0.861 (0.00)*	0.820 (0.00)*	0.002 (0.89)	0.116 (0.00)*	-0.245 (0.00)*
76428	0.053 (0.30)	-0.146 (0.00)*	-0.250 (0.03)*	1.045 (0.00)*	-0.249 (0.01)*	0.112 (0.00)*	0.197 (0.00)*	0.870 (0.00)*	0.021 (0.21)	0.100 (0.00)*	-0.064 (0.53)
81331	-0.001 (0.98)	-0.037 (0.13)	0.184 (0.30)	0.799 (0.00)*	-0.056 (0.65)	0.088 (0.00)*	0.121 (0.00)*	0.947 (0.00)*	0.017 (0.01)*	0.025 (0.07)**	-0.077 (0.35)
Nether- lands NY	0.022 (0.31)	-0.045 (0.00)*	-0.251 (0.00)*	0.961 (0.00)*	0.108 (0.00)*	0.011 (0.00)*	0.146 (0.00)*	0.854 (0.00)*	0.035 (0.00)*	0.101 (0.01)*	0.109 (0.00)*
28310	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
75886	0.145 (0.00)*	0.015 (0.49)	-0.450 (0.00)*	0.717 (0.00)*	-0.241 (0.00)*	0.185 (0.00)*	0.167 (0.00)*	0.796 (0.00)*	0.030 (0.08)**	0.173 (0.00)*	0.324 (0.00)*
26163	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
25267	0.044 (0.09)**	0.019 (0.31)	-1.050 (0.00)*	0.643 (0.00)*	0.224 (0.00)*	0.034 (0.00)*	0.163 (0.00)*	0.890 (0.00)*	0.020 (0.00)*	-0.018 (0.33)	0.015 (0.54)
South Africa	0.039 (0.53)	-0.006 (0.83)	-0.011 (0.91)	0.401 (0.00)*	-0.061 (0.62)	-0.007 (0.73)	0.096 (0.00)*	0.995 (0.00)*	0.027 (0.00)*	0.032 (0.00)*	0.146 (0.05)*
14382	0.077 (0.19)	-0.044 (0.07)**	0.067 (0.56)	0.388 (0.00)*	-0.232 (0.03)*	0.003 (0.85)	0.165 (0.00)*	0.976 (0.00)*	0.026 (0.00)*	0.037 (0.01)*	0.160 (0.02)*
14403	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

ADR	α_0	α_1	α_2	α_3	α_4	a_0	a_1	a_2	a_3	a_4	a_5
18543	0.048 (0.72)	-0.190 (0.00)*	-0.905 (0.00)*	0.497 (0.00)*	-0.168 (0.54)	0.019 (0.10)**	0.145 (0.00)*	0.990 (0.00)*	0.028 (0.00)*	0.029 (0.00)*	0.145 (0.00)*
19669	-0.081 (0.20)	-0.142 (0.00)*	-0.491 (0.00)*	-0.010 (0.92)	0.144 (0.13)	0.009 (0.24)	0.085 (0.00)*	0.997 (0.00)*	0.044 (0.00)*	0.041 (0.00)*	0.093 (0.00)*
11631	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
30796	0.077 (0.41)	-0.051 (0.10)**	-0.214 (0.29)	0.385 (0.00)*	0.051 (0.78)	-0.012 (0.68)	0.126 (0.00)*	0.970 (0.00)*	0.015 (0.04)*	0.040 (0.00)*	0.288 (0.00)*
68583	-0.027 (0.78)	-0.073 (0.00)*	-0.318 (0.10)**	0.434 (0.00)*	-0.097 (0.67)	0.010 (0.58)	0.154 (0.00)*	0.983 (0.00)*	0.023 (0.00)*	0.031 (0.00)*	0.187 (0.00)*
68866	0.170 (0.01)*	-0.052 (0.19)	-0.211 (0.19)	0.325 (0.00)*	-0.216 (0.12)	0.586 (0.00)*	0.390 (0.00)*	0.487 (0.00)*	0.036 (0.37)	0.201 (0.00)*	0.148 (0.02)*
79899	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
82211	0.161 (0.05)*	0.068 (0.01)*	-0.599 (0.00)*	0.197 (0.03)*	-0.285 (0.07)**	-0.002 (0.87)	0.149 (0.00)*	0.989 (0.00)*	0.008 (0.00)*	0.009 (0.39)	0.172 (0.00)*
10060	0.139 (0.13)	0.006 (0.82)	-0.325 (0.07)**	0.135 (0.25)	-0.247 (0.17)	0.028 (0.10)**	0.138 (0.00)*	0.964 (0.00)*	0.015 (0.00)*	0.040 (0.00)*	0.153 (0.01)*
41930	0.122 (0.03)*	-0.020 (0.45)	0.239 (0.01)*	0.375 (0.00)*	-0.554 (0.00)*	0.065 (0.00)*	0.168 (0.00)*	0.989 (0.00)*	0.045 (0.00)*	0.018 (0.04)*	0.108 (0.17)
47934	0.057 (0.57)	-0.061 (0.83)	-0.163 (0.38)	0.144 (0.23)	0.066 (0.73)	-0.012 (0.55)	0.131 (0.00)*	0.976 (0.00)*	-0.001 (0.28)	0.023 (0.04)*	0.202 (0.00)*
50294	-0.033 (0.54)	-0.128 (0.00)*	0.210 (0.05)*	0.415 (0.00)*	0.037 (0.72)	0.086 (0.00)*	0.165 (0.00)*	0.966 (0.00)*	0.041 (0.00)*	0.025 (0.07)**	-0.016 (0.82)
Spain	0.026 (0.18)	0.003 (0.80)	-0.086 (0.10)**	0.961 (0.00)*	0.116 (0.00)*	-0.223 (0.00)*	0.339 (0.00)*	0.575 (0.00)*	0.059 (0.08)**	0.076 (0.24)	0.091 (0.14)
75381	-0.015 (0.69)	-0.011 (0.55)	-0.222 (0.01)*	1.064 (0.00)*	-0.015 (0.84)	-0.013 (0.48)	0.098 (0.00)*	0.876 (0.00)*	0.015 (0.00)*	0.160 (0.00)*	0.296 (0.00)*
65146	-0.005 (0.89)	-0.066 (0.01)*	-0.279 (0.00)*	0.362 (0.00)*	-0.075 (0.31)	0.057 (0.00)*	0.270 (0.00)*	0.953 (0.00)*	0.013 (0.05)*	0.010 (0.53)	0.051 (0.34)
75152	0.078 (0.07)**	0.051 (0.02)*	-0.062 (0.62)	1.262 (0.00)*	-0.070 (0.42)	0.541 (0.00)*	0.263 (0.00)*	0.295 (0.00)*	0.100 (0.02)*	0.318 (0.00)*	0.184 (0.00)*
75290	0.100 (0.02)*	0.04 (0.07)**	-0.224 (0.25)	0.796 (0.00)*	-0.036 (0.66)	0.363 (0.00)*	0.216 (0.00)*	0.563 (0.00)*	0.164 (0.00)*	0.209 (0.00)*	0.080 (0.31)
75632	-0.010 (0.80)	0.003 (0.85)	-0.268 (0.06)*	0.491 (0.00)*	0.214 (0.00)*	0.114 (0.00)*	0.266 (0.00)*	0.882 (0.00)*	0.029 (0.01)*	0.075 (0.01)*	0.075 (0.27)
75049	0.060 (0.11)	-0.010 (0.63)	-0.223 (0.06)**	0.530 (0.00)*	-0.055 (0.46)	0.467 (0.00)*	0.439 (0.00)*	0.428 (0.00)*	0.152 (0.00)*	0.081 (0.08)*	0.645 (0.33)
Sweden NQ	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

ADR	α_0	α_1	α_2	α_3	α_4	a_0	a_1	a_2	a_3	a_4	a_5
15238	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
38106	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
91620	-0.123 (0.11)	-0.029 (0.31)	0.588 (0.00)*	0.025 (0.00)*	0.231 (0.15)	0.063 (0.03)*	0.280 (0.00)*	0.903 (0.00)*	-0.024 (0.00)*	0.030 (0.26)	0.277 (0.00)*
92930	-0.136 (0.00)*	0.025 (0.09)**	0.858 (0.00)*	0.005 (0.45)	0.431 (0.00)*	0.031 (0.10)**	0.088 (0.00)*	0.976 (0.00)*	0.050 (0.00)*	0.056 (0.01)*	0.100 (0.00)*
Swetzer- land NQ	-0.159 (0.00)*	0.032 (0.19)	0.798 (0.00)*	0.746 (0.00)*	0.247 (0.01)*	0.165 (0.00)*	0.212 (0.00)*	0.942 (0.00)*	0.029 (0.00)*	0.016 (0.43)	-0.251 (0.00)*
11485	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
33452	-0.120 (0.12)	0.055 (0.04)*	0.931 (0.00)*	0.472 (0.00)*	0.152 (0.27)	0.303 (0.00)*	0.192 (0.00)*	0.930 (0.00)*	0.061 (0.00)*	-0.050 (0.09)**	-0.366 (0.00)*
UK NY-NQ	-0.022 (0.37)	-0.147 (0.00)*	0.270 (0.00)*	1.142 (0.00)*	0.112 (0.00)*	-0.166 (0.11)	0.260 (0.00)*	0.159 (0.05)*	0.114 (0.01)*	0.172 (0.00)*	0.074 (0.08)**
UK NY	0.000 (0.96)	-0.074 (0.00)*	0.305 (0.00)*	0.811 (0.00)*	0.007 (0.82)	-0.316 (0.00)*	0.329 (0.00)*	0.516 (0.00)*	0.134 (0.00)*	0.206 (0.00)*	0.037 (0.64)
69761	0.018 (0.74)	-0.069 (0.00)*	0.739 (0.00)*	0.382 (0.00)*	-0.083 (0.47)	0.128 (0.00)*	0.130 (0.00)*	0.911 (0.00)*	0.040 (0.00)*	0.089 (0.00)*	0.173 (0.02)*
75151	-0.058 (0.28)	-0.008 (0.65)	-0.003 (0.98)	1.203 (0.00)*	0.146 (0.20)	0.071 (0.00)*	0.061 (0.00)*	0.981 (0.00)*	0.027 (0.00)*	-0.065 (0.00)*	-0.014 (0.76)
71589	-0.027 (0.57)	0.027 (0.28)	0.798 (0.00)*	0.254 (0.01)*	0.134 (0.17)	0.471 (0.00)*	0.334 (0.00)*	0.720 (0.00)*	0.124 (0.00)*	-0.062 (0.26)	0.030 (0.75)
70404	0.020 (0.570)	0.059 (0.00)*	-0.369 (0.01)*	0.479 (0.00)*	0.037 (0.66)	0.031 (0.00)*	0.083 (0.00)*	0.915 (0.00)*	0.048 (0.00)*	0.001 (0.47)	0.379 (0.00)*
29890	0.048 (0.21)	0.134 (0.00)*	-0.063 (0.00)*	0.558 (0.00)*	0.074 (0.41)	-0.005 (0.00)*	0.208 (0.00)*	0.872 (0.00)*	0.025 (0.00)*	0.165 (0.00)*	0.344 (0.00)*
75386	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
66835	0.052 (0.16)	0.067 (0.00)*	-0.412 (0.00)*	0.365 (0.00)*	0.017 (0.79)	0.425 (0.00)*	0.247 (0.00)*	0.037 (0.75)	0.063 (0.31)	0.081 (0.18)	0.097 (0.09)**
75807	0.055 (0.29)	-0.050 (0.03)*	0.010 (0.95)	-0.021 (0.87)	-0.015 (0.88)	1.567 (0.00)*	0.195 (0.00)*	-0.214 (0.07)**	0.105 (0.10)**	0.063 (0.37)	0.018 (0.77)
30947	0.026 (0.63)	-0.129 (0.00)*	0.676 (0.00)*	-0.047 (0.83)	-0.141 (0.24)	0.190 (0.00)*	0.062 (0.00)*	0.787 (0.00)*	0.241 (0.10)**	0.199 (0.00)*	0.334 (0.00)*
75064	-0.039 (0.45)	-0.084 (0.00)*	0.349 (0.04)*	0.396 (0.00)*	0.312 (0.00)*	0.327 (0.00)*	0.239 (0.00)*	0.749 (0.00)*	0.030 (0.00)*	0.095 (0.10)**	-0.078 (0.32)
70682	0.004 (0.90)	-0.124 (0.00)*	0.242 (0.10)**	0.257 (0.00)*	0.043 (0.57)	0.098 (0.00)*	0.106 (0.00)*	0.902 (0.00)*	0.058 (0.00)*	0.073 (0.04)*	0.169 (0.00)*

ADR	α_0	α_1	α_2	α_3	α_4	a_0	a_1	a_2	a_3	a_4	a_5
42893	-0.263	0.006	1.367	0.297	-0.153	-0.020	0.166	0.983	0.036	0.116	0.343
	(0.00)*	(0.62)	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*
33072	-0.041	0.007	0.193	0.404	0.273	0.011	0.283	0.808	0.016	0.176	0.169
	(0.27)	(0.76)*	(0.05)*	(0.00)*	(0.00)*	(0.78)	(0.00)*	(0.00)*	(0.38)	(0.00)*	(0.03)*
70885	0.018	0.421	0.421	0.005	-0.009	0.078	0.107	0.909	0.054	0.149	0.418
	(0.68)	(0.06)**	(0.00)*	(0.99)	(0.99)	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*
68364	-0.067	-0.244	0.431	0.249	-0.237	0.408	0.347	0.947	0.100	-0.096	-0.236
	(0.50)	(0.00)*	(0.19)	(0.01)*	(0.20)	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*
26083	0.028	0.015	-0.388	0.616	0.124	0.141	0.317	0.477	0.116	0.228	-0.113
	(0.35)	(0.54)	(0.00)*	(0.00)*	(0.03)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.15)*
75648	0.004	-0.009	0.618	0.667	0.077	0.049	0.331	0.826	-0.051	0.296	-0.088
	(0.92)	(0.72)	(0.00)*	(0.00)*	(0.38)	(0.13)	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.39)
28302	0.007	-0.010	0.142	0.119	0.031	0.211	0.053	0.797	0.029	0.136	0.143
	(0.85)	(0.69)	(0.32)	(0.27)	(0.66)	(0.63)	(0.4)*	(0.00)*	(0.07)**	(0.02)*	(0.14)
75418	-0.069	0.030	0.537	1.165	0.172	0.614	0.336	0.502	0.107	0.245	-0.060
	(0.16)	(0.23)	(0.00)*	(0.00)*	(0.07)**	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.43)
UK (8)	-0.120	-0.088	0.748	0.629	0.229	0.075	0.119	0.981	0.025	-0.025	-0.055
Nasdaq	(0.02)*	(0.00)*	(0.00)*	(0.00)*	(0.02)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.15)	(0.47)
18914	-0.012	-0.055	0.386	0.675	0.086	0.018	0.136	0.990	0.030	-0.027	0.207
	(0.74)	(0.02)*	(0.00)*	(0.00)*	(0.29)	(0.19)	(0.00)*	(0.00)*	(0.00)*	(0.10)**	(0.00)*
19845	0.021	0.090	0.063	0.455	-0.040	0.120	0.045	0.924	0.051	0.117	-0.083
	(0.65)	(0.00)*	(0.66)	(0.00)*	(0.64)	(0.00)*	(0.01)*	(0.00)*	(0.00)*	(0.00)*	(0.31)
11054	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
36637	-0.096	-0.042	0.043	0.821	0.057	0.044	0.000	0.991	0.050	0.015	0.113
	(0.00)*	(0.00)*	(0.19)	(0.00)*	(0.03)*	(0.00)*	(0.93)	(0.00)*	(0.00)*	(0.94)	(0.00)*
12207	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
65702	-0.035	0.003	0.373	0.636	-0.063	0.054	0.116	0.990	0.035	0.043	0.055
	(0.48)	(0.87)	(0.00)*	(0.00)*	(0.50)	(0.04)*	(0.00)*	(0.00)*	(0.00)*	(0.06)**	(0.46)
66713	0.062	0.042	0.104	0.382	0.029	0.318	0.265	0.889	0.080	0.077	-0.318
	(0.25)	(0.11)	(0.39)	(0.00)*	(0.76)	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.05)*	(0.00)*
11845	-0.255	-0.050	0.822	0.473	0.262	0.114	0.291	0.975	-0.002	-0.010	-0.085
	(0.00)*	(0.09)*	(0.00)*	(0.00)*	(0.20)	(0.00)*	(0.00)*	(0.00)*	(0.86)	(0.70)	(0.17)
Hong	0.067	-0.096	-0.225	0.198	0.035	0.446	0.368	0.559	0.050	0.521	0.099
Kong	(0.11)	(0.00)*	(0.10)*	(0.00)*	(0.68)	(0.00)*	(0.00)*	(0.00)*	(0.07)*	(0.10)*	(0.13)

* Significant at the five percent (critical value of 5.99), from a Chi-Squared Distribution.
** Significant at the ten percent (critical value of 4.66), from a Chi-Squared Distribution.

variance of this does not present significant impacts from the U.S. and the foreign conditional variances, at conventional levels (see Table 5.1). The conditional variance of the ADR from Denmark is affected significantly by the asymmetric effect, at the five percent level. In the unconditional correlation coefficients between the ADR and the other two returns, only the relationship between the ADR and the foreign returns is significant at the five percent level.

The French ADR security presents a significant effect from its own lagged returns and the U.S. returns, at the five percent level. The Monday dummy significantly affects the ADR pricing, at the ten percent level. The statistics for the standardized errors from the conditional mean equation present a mean of -0.004, a variance of 1.068, a skewness of 0.897 and a kurtosis of 14.329 (see Table 5.2).

The dual-listed security from Hong Kong is affected significantly (at the five percent) by its own lagged returns and the U.S. and foreign returns. The conditional variance of this security is explained by the U.S. and foreign conditional variances, all at the five percent level (see Table 5.1). The ADR from Hong Kong presents an insignificant asymmetric effect in its conditional variance, at conventional levels. The unconditional correlation coefficients between the ADR and the U.S. returns and between the ADR and the foreign returns are significant at the five percent level (see Table 5.3). The statistics of the standardized errors from the conditional mean equation present a mean of 0.027, a variance of 1.045, a skewness of 0.283 and a kurtosis of 2.010 (see Table 5.2).

The Italian ADR portfolio traded on the NYSE presents a significant effect from the U.S. and foreign conditional variances in the portfolio's conditional variance, but no effect from the U.S. return in the portfolio's conditional mean. The Italian ADR portfolio presents a significant asymmetric effect in the conditional variance, at the five percent level. The unconditional correlation coefficients between the portfolio and the U.S. returns and between the portfolio and the foreign returns are both significant at the five percent level. Also, the basic statistics for the conditional mean's standardized errors are close to the ones of a normally-distributed variable with zero mean and a variance equal to one. The U.S. effect in the conditional variance in each ADR from Italy shows that it is significant in all cases, and the foreign effect is significant in one case. The Italian ADRs present a significant asymmetric effect in their conditional variances in two cases, at the five percent level. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant in all the dual-listed securities, two at the five percent level and one at the ten percent level. The unconditional correlation coefficient between the ADRs and the foreign returns is significant on three occasions, one at the five percent level, and the rest at the ten percent level (see Table 5.3). The basic statistics for each standardized error indicate that these parameters are in the same range as those from a variable normally distributed with zero mean and variance equal to one.

The Japanese ADR portfolio does not have a significant asymmetric coefficient in the conditional variance. Only the unconditional correlation coefficient between the portfolio and the U.S. returns is significant at the five percent level. ADRs from Japan present a significant effect in pricing from foreign countries

TABLE 5.2

MAIN STATISTIC OF THE STANDARDIZED ERRORS IN THE ADR MULTIVARIATE EGARCH(1,1) WITH THE U.S. AND THE FOREIGN EFFECTS

ADR	Mean	Variance	Skewness	Kurtosis	Maximum Likelihood	Likelihood Ratio
Australia NY-NQ	0.061	1.438	1.589	11.742	-262.47	0
Australia	-0.012	0.977	0.099	1.258	-774.96	0.26
75387	-0.009	1.065	0.144	0.218	-833.11	0
65039	-0.012	1.096	0.058	0.278	-1081.06	0
75343	0.001	1.069	0.006	1.966	-2466.18	1.62
75466	0.002	1.183	0.041	0.846	-1046.44	0
69593	0.059	1.386	1.789	0.384	-1894.23	0
75301	0.009	1.178	-0.269	1.597	-1571.26	0
Australia Nasdaq	0.050	1.205	3.252	31.203	-1982.16	0
22163	0.025	1.167	0.833	3.553	-2862.99	2.48
11486	-0.004	1.400	-0.001	0.217	-1359.94	0
68815	0.016	1.100	0.080	1.036	-1591.13	0
71571	0.046	1.108	2.226	15.156	-3081.88	8.94*
Denmark	-0.000	1.013	0.066	1.874	-1117.21	9.06*
France NY-Nq	-0.017	1.091	0.802	7.248	-1140.68	55.66*
39570	-0.004	1.068	0.897	14.329	-1416.92	31.56*
75508	0.007	1.093	0.241	3.494	-1706.97	10.52*
Italy	0.022	1.213	0.277	2.134	-1793.71	0
75594	0.022	1.146	0.360	3.789	-2524.84	0
75456	0.025	1.134	-0.023	2.246	-2137.19	3.1
75178	-0.008	0.958	0.142	2.438	-2137.00	11.92*
Japan NY-Nq	-0.002	0.880	0.623	3.344	-1048.57	44.88*
Japan	0.015	0.920	0.648	2.950	-1059.04	22.26*
64231	0.009	0.964	0.380	1.410	-1469.32	20.2*
59555	-0.015	0.972	0.101	1.420	-1794.29	28.4*
53727	0.031	1.040	0.507	2.759	-1557.83	26.52*
75811	0.011	0.898	0.075	7.188	-1623.29	22.48
59424	-0.007	1.006	0.239	2.666	-2018.40	3.12
51131	0.001	0.965	0.342	2.725	-1564.15	51.94*

ADR	Mean	Variance	Skewness	Kurtosis	Maximum Likelihood	Likelihood Ratio
64362	0.003	0.993	0.182	2.161	-1766.58	15.24*
61778	0.019	0.978	0.424	2.671	-1769.21	18.00*
Japan Nasdaq	0.002	0.909	0.488	2.199	-913.00	58.16*
26060	-0.028	0.939	1.358	13.820	-2378.74	77.12*
21152	0.010	1.019	0.266	1.768	-1531.63	4.22
28303	-0.007	0.998	0.588	3.890	-2195.02	35.48*
37867	0.013	1.035	0.241	1.614	-1618.77	8.86*
46085	0.006	0.961	-0.252	3.750	-1721.09	59.84*
51087	0.013	1.011	0.033	0.934	-2052.62	33.26*
54579	0.008	0.985	0.228	1.950	-1708.47	16.50*
54782	0.005	0.905	0.528	2.145	-1903.76	35.66*
57681	0.015	1.004	0.160	1.160	-1973.51	1.66
46309	0.006	0.931	0.004	1.516	-1981.55	43.72*
68823	-0.002	1.018	0.474	2.202	-1894.20	45.82
76428	0.025	0.952	0.100	0.935	-1802.63	28.30*
81331	0.001	0.996	0.172	0.677	-1934.45	9.60*
Netherlands	-0.000	1.132	0.106	0.957	-256.94	0
28310	0.006	1.117	0.008	1.001	-398.64	1.36
75886	0.007	1.100	0.009	1.514	-1088.81	10.08*
26163	0.052	1.264	0.453	2.675	-1532.64	0
25267	0.003	1.041	-0.072	1.136	-317.24	0
South Africa	0.015	0.836	0.213	2.611	-2374.94	0
14382	0.015	0.969	0.061	1.985	-2292.40	0
14403	0.046	0.988	-0.225	5.560	-2743.85	0
18543	0.028	0.941	0.798	7.654	-3667.98	0
19669	0.052	1.349	0.733	6.133	-3303.45	0
11631	0.010	1.102	0.260	3.747	-2275.17	0
30796	0.002	0.884	0.142	2.290	-2810.73	0
68583	0.039	0.956	0.035	3.424	-3018.87	4.68**
68866	0.004	1.022	0.385	2.308	-2542.79	23.30*
79899	0.021	0.950	0.356	2.011	-2885.53	0
82211	0.007	0.968	0.079	2.008	-2803.54	4.92**
10060	0.019	0.985	0.171	3.939	-2880.96	0
41930	0.014	0.957	0.069	3.447	-2786.67	0
47934	0.013	0.950	0.415	2.259	-2894.01	0

ADR	Mean	Variance	Skewness	Kurtosis	Maximum Likelihood	Likelihood Ratio
50294	0.014	1.135	0.330	3.759	-2474.62	0
Spain	-0.006	1.111	0.107	0.769	-554.68	8.66*
75381	0.036	1.055	0.394	3.688	-1532.96	0
65146	0.006	1.017	-0.113	2.597	-1553.63	6.24*
75152	-0.017	1.021	0.429	1.829	-1478.99	32.64*
75290	0.006	1.036	0.386	1.873	-1378.92	24.12*
75632	0.014	1.024	0.186	1.342	-1401.09	0
75049	0.015	1.037	0.235	3.145	-1298.94	14.62*
Sweden	n/a	n/a	n/a	n/a	n/a	n/a
15238	n/a	n/a	n/a	n/a	n/a	n/a
38106	n/a	n/a	n/a	n/a	n/a	n/a
91620	-0.004	1.007	-0.168	-0.307	-5330.33	47.34*
92930	-0.029	1.837	-0.784	0.746	-5777.81	0
Switzerland	0.003	1.036	0.593	2.461	-1665.45	11.00*
11485	0.045	1.683	0.640	3.941	-1958.65	0
33452	0.000	1.024	0.319	3.440	-1985.00	17.08*
UK NY- Nq	-0.006	1.041	0.143	2.240	-229.44	18.92*
UK	-0.005	1.034	0.285	1.879	-92.01	28.02*
69761	0.010	1.015	0.025	0.997	-1505.21	18.12*
75151	-0.017	1.303	-0.533	5.242	-1962.98	0
71589	0.008	1.016	0.321	3.293	-1421.07	11.56*
70404	0.025	1.172	0.026	1.353	-1175.68	0
29890	0.004	1.917	-0.223	5.351	-1039.45	143.3*
75386	0.022	1.309	0.276	7.790	-1248.47	95.54*
66835	0.000	1.036	0.042	0.634	-904.74	15.66*
75807	0.000	1.033	0.004	0.632	-1392.75	6.68*
30947	0.010	1.037	0.222	4.019	-1512.05	32.5*
75064	0.010	1.055	0.358	1.388	1496.71	0
70682	0.001	1.099	-0.069	1.044	-1097.35	0
42893	0.042	2.220	-2.124	26.954	-2500.21	0
33072	-0.000	1.001	0.402	2.203	-1025.29	10.08*
70885	0.009	1.104	0.474	3.097	-1286.72	40.86*
68364	-0.006	1.049	1.001	11.306	-2589.64	11.08*
26083	0.004	1.032	0.265	0.815	-703.20	35.66*
75648	-0.010	0.999	0.131	2.219	-1249.04	22.88*

ADR	Mean	Variance	Skewness	Kurtosis	Maximum Likelihood	Likelihood Ratio
28302	0.028	1.321	0.467	3.335	-710.38	149.92*
75418	0.019	1.049	0.178	0.635	-1373.23	17.36*
UK (8) Nasdaq	-0.005	0.988	-0.306	4.270	-1387.27	0
18914	0.010	1.030	0.368	2.334	-1429.41	0
19845	0.003	1.072	0.207	3.213	-1133.01	12.58*
11054	n/a	n/a	n/a	n/a	n/a	n/a
36637	0.001	0.930	-0.190	3.740	-1063.02	76.00*
12207	n/a	n/a	n/a	n/a	n/a	n/a
65702	0.001	1.084	-0.565	6.687	-1475.87	0
66713	-0.015	1.088	-0.779	7.022	-1452.09	2.5
11845	0.012	1.034	-0.120	11.946	-2684.93	2.64
Hong Kong	0.027	1.045	0.283	2.010	-1621.93	5.74**

* Significant at the five percent (critical value of 5.99), from a Chi-Squared Distribution.
** Significant at the ten percent (critical value of 4.66), from a Chi-Squared Distribution.

but not from their own lagged returns, nor from the U.S. returns. However, the conditional variance is well explained by the EGARCH(1,1) model as well as by the U.S. and foreign conditional variances. In the conditional mean, six securities present a significant effect from the U.S. returns, and all the ADRs are affected by the foreign returns in pricing. In the conditional variance, all of the Japanese ADRs present a significant effect from the foreign conditional variances, and the conditional variances from the United States affects all the dual-listed securities, except in one case. The ADRs in this portfolio present a significant asymmetric coefficient in four cases, at the five percent level. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant on seven occasions, at the five percent level. The unconditional correlation coefficient between the ADRs and the foreign returns is significant in six cases, five at the five percent level and one at the ten percent level (see Table 5.3). The conditional mean's standardized errors indicate that the EGARCH(1,1) model along with the U.S. and foreign effects present mean, variance, skewness and kurtosis close to ones from a variable normally distributed with a zero mean and a variance equal to one.

The ADR portfolio from the Netherlands and the individual securities' pricing are explained by the U.S. and foreign returns, and by the Monday effect. The conditional variance of the Netherlands ADR portfolio is significantly affected by the asymmetric effect. The unconditional correlation coefficient between the portfolio and the U.S. returns is significant at the five percent level. The unconditional correlation coefficient between the portfolio and the foreign returns is sig-

TABLE 5.3

THE ASYMMETRIC AND UNCONDITIONAL CORRELATION COEFFICIENTS IN THE EGARCH(1,1) PLUS THE U.S AND FOREIGN EFFECTS

ADR	g_0	g_1	g_2
Australia NY-NQ	-0.123	0.369*	-0.397*
Australia NY	0.055	0.315*	0.125**
75387	0.382*	0.475*	-0.368*
75039	0.045	0.083**	-0.574*
75343	0.265*	0.082	-0.290*
75466	0.287	0.307*	-0.254*
69593	0.283*	0.503*	0.424*
75301	0.318*	0.457*	-0.096
Australia NQ	0.593*	0.002	0.017
22163	0.604*	0.001	0.123
11486	0.969*	0.206*	-0.621*
68815	-0.004	0.270*	-0.209*
71571	0.103*	0.024	-0.026
Denmark	0.431*	0.014	-0.236*
France NK-NQ	0.941*	0.095	0.124
39570	0.657*	-0.013	0.065
75508	1.414*	0.046	0.115
Italy NY	0.407*	0.293*	0.273*
75594	0.133*	-0.168**	0.009
75456	-0.004	0.126*	0.125**
75178	0.485*	0.203*	-0.148**
JapanNY-NQ	-0.039	0.336*	-0.171*
Japan NY	-0.100	0.416*	0.073
64231	0.018	0.486*	-0.127*
59555	0.249*	0.429*	0.234*
53727	0.256*	0.314*	-0.193*
75811	0.167*	0.141*	0.294*
59424	0.295*	0.224*	0.163*
51131	-0.124	0.3334*	0.063
64362	-0.030	0.011	-0.117**
61778	0.034	0.145*	0.044
Japan NQ	-0.044	0.320*	-0.218*
26060	0.283*	-0.061*	-0.260*
21152	0.361*	0.198*	0.309*
28303	-0.040	0.024	-0.110*

ADR	g_0	g_1	g_2
37867	0.158*	0.428*	0.223*
46085	0.318*	0.122*	0.094
51087	0.122	-0.37**	-0.496*
54579	0.333*	0.114*	0.100
54782	0.667*	0.323*	0.166*
57681	n/a	n/a	n/a
46309	-0.143	0.151*	-0.148*
68823	-0.085	0.057*	-0.260*
76428	0.181	0.240*	-0.113**
81331	0.195	-0.024	-0.160*
South Africa	-0.085	-0.015	0.102
14382	0.185	0.114*	0.343*
14403	n/a	n/a	n/a
18543	0.170*	0.065	0.179**
19669	0.207*	0.054*	0.384*
11631	n/a	n/a	n/a
30796	0.041	-0.017	0.085
68583	-0.029	-0.026	0.076
68866	0.038	0.102*	0.206*
79899	n/a	n/a	n/a
82211	0.115**	0.070**	0.333*
10060	-0.055	-0.031	0.351*
41930	0.322*	0.028	0.031
47934	0.208*	-0.017	0.281**
50294	0.332*	-0.055	0.018
Netherlands	0.284*	0.521*	-0.221*
28310	n/a	n/a	n/a
75886	-0.222	0.395*	0.080
26163	n/a	n/a	n/a
25267	0.078	0.741*	0.104**
Spain	-0.079	0.237*	-0.449*
75381	0.877*	0.190*	-0.327*
65146	0.183*	0.160*	0.031
75152	-0.115	0.029	-0.424*
75290	0.875	0.266*	-0.078
75632	0.141*	0.465*	0.208*
75049	0.086*	0.434*	0.151*
Sweden	n/a	n/a	n/a
15238	n/a	n/a	n/a

ADR	g_0	g_1	g_2
38106	n/a	n/a	n/a
91620	n/a	n/a	n/a
92930	0.519*	0.127*	0.202*
Switzerland	n/a	n/a	n/a
11485	n/a	n/a	n/a
33452	0.414*	0.133	0.012
UK NY-NQ	0.118**	0.056	-0.620*
UK NY	-0.012	0.197*	-0.243*
69761	0.041	-0.048	0.240
75151	1.198*	0.017	-0.185**
71589	0.217*	0.148*	0.232*
70404	n/a	n/a	n/a
29890	n/a	n/a	n/a
75386	n/a	n/a	n/a
66835	-0.191	0.466*	0.418*
75807	0.141	0.379*	0.527*
30947	0.231	-0.049	0.179
75064	0.297*	0.405*	0.518*
70682	n/a	n/a	n/a
42893	n/a	n/a	n/a
33072	0.116*	0.265*	0.213*
70885	0.266*	0.156*	0.467*
68364	0.164*	0.72	0.059
26083	-0.021	0.346*	-0.045
75648	-0.070	0.032	-0.052
28302	1.336**	0.265*	0.441*
75418	0.079	0.043	-0.306*
UK NQ	0.547*	-0.030	-0.092
18914	0.802*	-0.143*	-0.254*
19845	-0.129	0.076	0.092
11054	n/a	n/a	n/a
36637	0.548*	0.080	0.035
12207	n/a	n/a	n/a
65702	0.392*	0.008	0.009
66713	0.039	0.255*	0.206*
11845	0.257*	0.036	0.018
Hong Kong	0.030	0.457*	0.314*

nificant at the five percent level. The Dutch ADRs present an insignificant asymmetric coefficient in their conditional variance, at conventional levels. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant in two cases, one at the five percent level and the other at the ten percent level. Only one Dutch ADR presents a significant unconditional correlation coefficient, at the five percent level (see Table 5.3). The standardized errors for the ADR portfolio and individual dual-listed securities from the Netherlands are close to ones of a variable normally distributed with a zero mean and a variance equal to one (see Table 5.2).

The Spanish ADR portfolio and each Spanish dual-listed securities' pricing are explained by the U.S. and foreign returns. The Spanish ADR portfolio's conditional variance is not affected by the asymmetric effect, at conventional levels. The unconditional correlation coefficients between the portfolio and the U.S. returns and between the portfolio and the foreign returns are significant at the five percent level. In particular, three ADRs are affected significantly by the U.S. returns, two at the five percent level and one at the ten percent level. Only two securities are affected significantly by the Monday effect. In the Spanish ADR portfolio, the conditional variance is affected significantly by the U.S. conditional variances but not by the foreign conditional variances. The variance transmission from the U.S. and foreign returns into the Spanish ADRs are significant in six and five cases, respectively (see Table 5.1). The asymmetric effect in the conditional variance of the Spanish ADRs is significant in four cases, at the five level percent. The unconditional correlation coefficients between the ADRs and the U.S. returns is significant in five cases, at the five percent level. The unconditional correlation coefficient between the ADRs and the foreign returns is significant in four cases, also at the five percent level (see Table 5.3).

The pricing of ADRs from the United Kingdom traded on the NYSE presents a significant effect from the U.S. and foreign returns in fifteen cases. These ADRs as a portfolio present a conditional mean that is explained by the U.S. and foreign returns, at a significant level. The conditional variance in the British ADR portfolio depends significantly (at the five percent level) on the U.S. and foreign conditional variances. The British portfolio has a conditional variance not significantly influenced by the asymmetric effect. The conditional variances from the U.S. significantly affect the conditional variance of the ADRs from the United Kingdom on sixteen occasions. The effect of the foreign conditional variances is significant in fourteen cases. The ADRs present a significant asymmetric effect in seven cases out of a total of fourteen. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant on eight occasions, at the five percent level. The same coefficient but between the ADRs and the foreign returns is significant in nine cases at the five percent level (see Table 5.3). Finally, the standardized errors for the ADR portfolio and ADRs from the United Kingdom are close to the mean, variance, skewness and kurtosis presented for a variable normally distributed with a zero mean and a variance equal to one.

b. The U.S. and foreign effects on the conditional mean and variance in ADRs traded on NASDAQ

The effects from the U.S. and foreign returns in the conditional mean and variance of the ADRs are tested by the EGARCH(1,1) expanded model. In particular, the Australian ADR portfolio presents a significant effect (at the five percent level) from its own lagged returns and the U.S. and foreign returns. The conditional variance of this security is explained only by the standard EGARCH(1,1) model coefficient; the U.S. and foreign conditional variances are not significant in the conditional variance in the Australian dual-listed securities portfolio. The Australian ADR portfolio presents a significant asymmetric coefficient in the conditional variance. Neither the unconditional correlation coefficients between the portfolio and the U.S. returns nor the coefficient between the portfolio and the foreign returns are significant. The U.S. and foreign effects in pricing and variance on each particular Australian ADR indicates that three of them present a conditional mean affected significantly by the U.S. returns, on two occasions at the five percent and on one occasion at the ten percent level. The impact of the foreign returns on the conditional mean of each particular security is significant in three cases, all of them at the five percent level. Its own lagged returns explain the pricing equation of each of the Australian securities. The conditional variance of each Australian ADR is affected significantly by the U.S. conditional variances in all cases, while the foreign conditional variances affect the conditional variances of the Australian ADRs in two cases, all at the five percent level. The lagged errors and past conditional variances present significant coefficients. The symmetric coefficient for the ADRs included in this portfolio is significant in three cases. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant in two cases, at the five percent level. The same coefficient but between the ADRs and the foreign returns is significant at five percent on two occasions (see Table 5.3). The standardized errors from the pricing equations present mean, variance, skewness and kurtosis close to the statistic parameters of a normally distributed variable with a zero mean and a variance equal to one (see Table 5.2).

The Australian portfolio is composed of ADRs traded on the NYSE and NASDAQ. It presents a conditional mean that is explained by its own lagged returns, the U.S. and foreign returns, as well as the Monday effect. The security's conditional variance presents significant coefficients for the independent variables of lagged errors, past conditional variances and the U.S and foreign conditional variances, at the five percent level of significance (see Table 5.1). This Australian portfolio presents an insignificant asymmetric effect in the conditional variance. The unconditional correlation coefficients between the portfolio and the U.S. returns and between the portfolio and the foreign returns are significant, at the five percent level (see Table 5.3). The standardized errors from the conditional mean present a mean, variance, skewness and kurtosis close to those obtained from a variable normally distributed with zero mean and a variance equal to one (see Table 5.2).

The French ADR's pricing is explained by the foreign returns only. The conditional variance presents a significant (five percent level) effect from the lagged errors and its own lagged and foreign conditional variances (see Table 5.1). This ADR has a significant asymmetric effect on the conditional variance. The unconditional correlation coefficient between the ADR and the U.S. returns and between the ADR and the foreign returns are both insignificant at the conventional levels. The statistics for the standardized errors indicate that these are close to ones from a variable normally distributed with a zero mean and a variance equal to one (see Table 5.2). The pricing of the combined French ADRs traded on the NYSE and NASDAQ is explained by the U.S. and foreign returns, at the five percent level. The conditional variance of this portfolio presents significant coefficients in the independent variables of the lagged errors, past conditional variances, the U.S. conditional variances and the Monday effect, all at the five percent level (see Table 5.1). This French portfolio presents a significant asymmetric coefficient in the conditional variance. The unconditional correlation coefficients between the portfolio and the U.S. returns and between the portfolio and the foreign returns are both insignificant at conventional levels (see Table 5.3).

The portfolio composed of the Japanese ADRs traded on NASDAQ demonstrates a pricing that is explained by the U.S. and foreign returns. The conditional variance of this security is significantly explained at the five percent level by the four coefficients considered in the model. This Japanese portfolio does not present a significant asymmetric effect in its conditional variance. The unconditional correlation coefficients between the portfolio and the U.S. returns and the portfolio and the foreign results are significant at the five percent level. The pricing equations for each particular Japanese ADR present a significant effect from its own lagged returns and the U.S. and foreign returns on ten, five and twelve occasions, respectively (see Table 5.1). The conditional variance equations of the Japanese ADRs traded on NASDAQ indicate that the lagged errors and past conditional variances are significant at the five percent level, while the U.S. conditional variance is significant at the five percent level on eight occasions. The foreign conditional variances affect the Japanese ADRs on nine occasions, eight at the five percent and one at the ten percent level (see Table 5.1). Only five Japanese ADRs present a significant asymmetric effect in their conditional variance. The unconditional correlation between the ADRs and the U.S. returns is significant in ten cases, nine at the five percent level and one at the ten percent level. The unconditional correlation coefficient between the ADRs and the foreign return is significant on ten occasions, nine at the five percent level and the rest at the ten percent level (see Table 5.3). The statistics on the standarized errors from the conditional mean demonstrate a behavior close to those of a variable normally distributed with a zero mean and a variance equal to one (see Table 5.2).

The Japanese ADR portfolio, comprising ADRs traded on the NYSE and NASDAQ, presents a symmetric effect in the conditional variance. The unconditional correlation coefficient between the portfolio and the U.S and foreign returns are significant at the five percent level.

The South African ADR portfolio's pricing is significantly affected only by the foreign returns, at the five percent level. The conditional variance is explained by the lagged errors, past conditional variances, and the U.S and foreign conditional variances, all at the five percent level. This South African portfolio presents a significant asymmetric effect in the conditional variance. The unconditional correlation coefficients between the portfolio and the U.S. and the foreign returns are significant at the five percent level. The statistics on the conditional mean's standardized errors present a behavior close to those of a variable normally distributed with a zero mean and a variance equal to one (see Table 5.2). Using equations 13 and 14 to estimate the pricing and conditional variance of each South African ADR, the results indicate that eleven firms present convergence. Of these, seven are affected significantly by their own lagged returns in their pricing. Also, the individual pricing indicates that the U.S. and foreign returns are significant on seven and eight occasions, respectively (see Table 5.1). The conditional variances of these securities are significantly explained at the five percent level by the lagged errors and past conditional variances in all cases where the system converges. The effect from the U.S. and foreign conditional variances is significant on nine and ten occasions. The Monday and after holiday effect in the conditional mean and variance is significant at the five percent level on three and nine instances, respectively. The South African ADRs present a significant asymmetric coefficient in the conditional variance in six cases, five of them at the five percent level, and one at the ten percent level. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant on four occasions, three at the five percent level and one at the ten percent level. The unconditional correlation coefficient between the ADRs and the foreign returns is significant in nine cases, eight at the five percent level and one at the ten percent level (see Table 5.3). The statistics for the conditional mean's standardized errors are close to those from a normally distributed variable with zero mean and a variance equal to one (see Table 5.2).

The Swedish portfolio and two ADRs from this country's equation system do not converge. The two that do converge present a conditional mean that is explained by its own lagged returns and the U.S. and foreign returns, all at the five percent significance level (see Table 5.1). The conditional variance of these securities is explained by the lagged errors, past conditional variances, the U.S. and the foreign conditional variances, and the Monday effect, all of them on two occasions. Only one ADR from Sweden converged. In this case, the asymmetric effect in the conditional variance is significant at the five percent level. The unconditional correlation coefficients between the ADR and the U.S. returns and the ADR and the foreign returns are both significant at the five percent level (see Table 5.3).

The Switzerland portfolio and one security demonstrate convergence in the equation system. The pricing of these securities is explained by the U.S. and foreign returns at the five percent level. The securities' conditional variances present a significant effect from the lagged errors, the past conditional variance, the U.S. and foreign conditional variances, and the Monday effect, all at the five percent level. Only the Swiss portfolio's conditional variance presents a significant impact from the foreign conditional variance. The ADR from Switzerland that converges presents a significant asymmetric effect in the conditional variance. Only the unconditional correlation coefficient between the ADR and the foreign returns is significant at the five percent level (see Table 5.3).

The portfolio of British ADRs traded on NASDAQ presents a pricing equation that is influenced significantly by its own lagged returns, the U.S. and foreign returns, and the Monday effect, all at the five percent level (see Table 5.1). The conditional variance of this portfolio presents significant coefficients for the lagged errors, their own past conditional variances, and the U.S. and foreign conditional variances. This British portfolio presents a significant asymmetric effect in the conditional variance. The unconditional correlation coefficients are not significant at conventional levels. Six British ADR equations' systems converge, where their own lagged return, and the U.S. and foreign returns are significant in the ADRs' conditional mean on four, three and six occasions, respectively. The conditional variances of those securities are explained significantly by lagged errors in four cases and past conditional variances in five cases (see Table 5.1). The U.S. and foreign conditional variances and the Monday and after holiday phenomenon affect the ADR securities significantly on five, four and three occasions, respectively. The ADRs in this portfolio present a significant asymmetric coefficient in four cases, all of them at the five percent level. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant on two occasions, at the five percent level. The same coefficient, but between the ADRs and the foreign returns, is significant in only one case, at the five percent level (see Table 5.3). The conditional mean's standardized errors present statistics similar to ones from a variable normally distributed with zero mean and variance equal to one (see table 5.2).

The British ADR portfolio, comprising the British dual-listed securities traded on the NYSE and NASDAQ, presents a significant influence by its own lagged returns, the U.S. and foreign returns, and the Monday effect, all at the five percent level. The conditional mean of this security is explained by the five independent variables, at the five percent level, with the exception of the Monday effect which is significant at the ten percent level (see Table 5.1). This British portfolio presents a significant asymmetric effect in the conditional variance. The unconditional correlation coefficient between the portfolio and the foreign returns is significant at the five percent level (see Table 5.3). The conditional mean's standardized errors have a mean, variance, skewness and kurtosis of -0.006, 1.041, 0.143 and 2.240, respectively (see Table 5.2).

VI. Summary of the Results

This section summarizes the results as they relate to the hypothesis of the paper, which states that the U.S. and foreign returns impact the pricing and conditional variance of ADRs.

The total number of ADRs that present behavior validating the hypothesis of this research is thirty-four, out of a total of seventy-nine firms that converges, while fifty percent of the ADRs traded on the NYSE and thirty percent of the

ADRs traded on NASDAQ confirm the hypothesis of this research. The U.S. and foreign returns affect the pricing of ADRs in forty-seven cases, and the U.S. and foreign conditional variances affect the conditional variances of the ADRs in fifty-two cases. The total number of ADRs that present a significant asymmetric effect in their conditional variance is forty-five. Of these, twenty-three are from ADRs traded on the NYSE, and the rest are ADRs traded on NASDAQ. The unconditional correlation coefficient between the ADRs and the U.S. returns is significant on fifty occasions. Thirty-one of these ADRs are traded on the NYSE and the rest are traded on NASDAQ. The unconditional correlation coefficient between the ADRs and the foreign returns is significant in fifty-one cases; twenty-nine of them are traded on the NYSE and the rest are traded on NASDAQ.

The results for the ADR country portfolios validate the hypothesis of this research only in two out of a total of fourteen cases. However, the U.S. and foreign returns affect the ADR country portfolios' pricing in nine cases, where five of them are also affected in their conditional variance by the U.S. conditional variance. In the country portfolio analysis, the asymmetric coefficient in the conditional variance is significant in five out of a total of fourteen cases. The unconditional correlation coefficient between the portfolio and the U.S. returns is significant on five occasions. The same coefficient but between the portfolio and the foreign returns is significant in eight cases, at the five percent level.

Officer and Hoffmeister (OH, 1987) observe that most of the unsystematic risk is eliminated with a portfolio of eight ADRs selected randomly, from different countries. In our sample only a few ADR country portfolios have eight or more securities. Moreover, the selection criteria is not random; therefore the implications regarding market integration between foreign and American markets must be viewed cautiously.

In order to analyze the integration between foreign and American markets, we can select only the ADR country portfolios with more than eight securities, based on the OH (1987) research. The ADR country portfolios selected are Australian, Japanese, South African, and British. In particular, Japanese and South African ADR portfolios are not affected significantly by the U.S market return, implying that these portfolios are semi-segmented in relation to the U.S market. However, in Parisi (1995), it has been proved that the Japanese and South African capital markets are integrated to the U.S. capital market.

The Japanese ADRs were considered coming from semi-segmented markets by Jarayaman, Shastri and Tandon (JST, 1993), since they present abnormal returns after the international issue. Our results are consistent with those of JST (1993); however, though JST (1993) did not include an ADR portfolio from South Africa, we can conclude from our results that the South African dual-listed securities belong to a semi-segmented capital market.

All of the portfolios selected are significantly affected by the U.S. conditional variance, where changes in the level of risk in the American economy affect the variance or level of risk of the portfolios, indicating that the information generated in the U.S. market is rapidly incorporated in the pricing and variance formation in the ADR portfolios.

Finally, a dummy variable was included based on the international phenomena of the Monday effect. The Monday effect has been observed in daily data for 10 or more years of observation, proving that the Monday effect is a significantly an important variable that has to be considered in the pricing and variance equations. Our research indicates that the Monday effect is significant in the cases of the Australian ADR portfolio, the Japanese ADR portfolio and the British ADR portfolio. The South African ADR portfolio presents a significant Monday effect only in its variance. The results discussed validate the inclusion of this variable in our model.

The main conclusions are not altered when the model is tested using different lags and lend for the U.S. returns and variance in the equations estimated. Also, the same results are achieved using different periods in the estimation of the model.

VII. Conclusions

This research provides an analysis of the impact of the U.S and foreign returns in ADR pricing and variance, using an extended EGARCH(1,1) multivariate model. The hypothesis tested postulates that pricing of dual-listed securities depends on the covariances between the security and each of the two markets. At the same time, the conditional variance of the security is explained by its own past conditional variance, its own lagged errors, the conditional variances from the United States and the foreign country, and a dummy variable representing for the Monday effect.

The results suggest that the hypothesis of Alexander, Eun and Janakiramanan (1987), that the pricing of dual-listed securities depends on the covariances between the security and each of the two markets, is valid in forty-seven occasions, out of a total of seventy-nine cases. The same hypothesis is valid in nine occasions when ADR country portfolios are tested, out of a total of fourteen portfolios. The variance transmission effect from the United States and the foreign country into the dual-listed security hypothesis is valid in fifty-two firms out of a total of seventy-nine companies. Finally, this investigation´s hypothesis is validated on thirty-four occasions in the security sample, and on two occasions in the country portfolio sample.

In these cases where the dual-listed security is not affected by one of the markets in pricing or in variance, the explanation can be found in Chowdhry and Nanda (1991). They posit that cross-listed securities are more intensely traded in the market in which it is more liquid. Also, Barclay, Litzenberger and Warner (1990) argue that cross-listed U.S. securities in Japan do not present significant variation in their variances, since the traded volume is negligible in the latter market. However, the ADR´s volume is difficult to obtain, since holders ADRs have the right to exchange the ADRs for the underlying securities, and the volume traded in the U.S. market can be increased by the brokers in order to match the demand of a particular ADR.

The implications for the U.S investor are addressed to the diversification benefit that they can obtain restructuring their portfolios incorporating ADRs less sensitive to the U.S. return. On the other hand, the foreign investor can invest in underlying securities more sensitive to the U.S. return, in both pricing and variance, achieving in the local market international diversification.

The results suggest that the U.S. and the different foreign markets in the study present different degrees of integration, validating the results of HM (1990) and JST (1993), where they prove that the markets are not completely integrated in some type of firms, but are integrated in other type of firms. Moreover, Bekaert and Harvey (1995) state that world capital markets are becoming more integrated, but it is not true in all cases. However, the degree that a national capital market is integrated into the world capital market is notoriously difficult to measure, difficulty that is increased at the level of a particular ADR.

Notes

1 The unobservable factors might represent the effect of fundamental influences on returns that are not captured by innovations in published statistics or changes in investors sentiment.
2 Both return quotations were found to be significant and very similar to each other.
3 EGARCH model means Exponential Generalized Autoregresive Conditional Heteroscedastic model.
4 Based on Fry (1994) and The Almanac (1994).

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APPENDIX I

ADR INFORMATION

This appendix presents the individual information for each ADR considered in the dissertation sample. The information included is the stock exchange on which each dual-listed security is traded, the cusip number, the permanent number, the name and the country of the ADR.

ADRs traded on the NYSE:

Cusip	Perm	Name	Country
5945820	75381	Banco Bilbao Vizcallas	Spain
5947040	65146	Banco Central Hispanoamericano	Spain
5957420	75152	Banco Santander	Spain
6738E20	69761	Barclays PLC	United Kingdom
8179540	75594	Benetton Group	Italy
05538H20	75151	Bet Holding	United Kingdom
11041930	71589	British Airway	United Kingdom
11090140	70404	British Gas PLC	United Kingdom
11088940	29890	British Petromeum	United Kingdom
11101530	75386	British Steel	United Kingdom
11102140	66835	British Telecommunications	United Kingdom
11216960	75039	Broken Hill Proprietary	Australia
12683020	75807	Cable&Wireless	United Kingdom
19387040	75387	Coles Myer	Australia
22268740	30974	Courtaulds Plc	United Kingdom
29244720	75290	Emp Nacional de Electricidad	Spain
30239360	75343	FAI insurance	Australia
31562160	75456	Fiat SPA	Italy
37732730	75064	Glaxo Holding	United Kingdom
41135230	70682	Hanson Plc	United Kingdom
43357850	64231	Hitachi Ltda	Japan
43812830	59555	Honda Motor	Japan
43857920	75400	Hong Kong Telecommunications	Hong Kong
44589120	42893	Huntingdon International	United Kingdom
45270450	33072	Imperial Chemical PLC	United Kingdom
48251610	26163	KLM Royal Dutch Airls	Netherlands
50155620	61778	Kyocera Corp	Japan
57687920	53727	Matsushita Electric	Japan
60674230	75811	Mitsubishi Bank	Japan
61237630	75178	Montedison SPA	Italy
63252540	75301	Nartinal Australia	Australia
63853940	70885	National Westminster	United Kingdom
65248770	69593	News Corp	Australia
67010020	63263	Novo Nordisk AS	Denmark
72365740	59424	Pioneer Electronic Corp	Japan
73173310	75886	Polygram NV	Netherlands
76242T10	39570	Rhone Poulenc Rorer	France
78025770	25267	Royal Dutch Pete	Netherlands
78514340	68364	Saatchi&Saatchi C	United Kingdom
82270360	26083	Shell Transportation	United Kingdom
83237830	75648	Smithkline Beecham	United Kingdom
83569930	51131	Sony Corp	Japan
87235140	64362	TDK Corp	Japan
87938220	75049	Telefonica de Espana	Spain

90476760	28302	Unilever PLC	United Kingdom
90478450	28310	Unilever NV	Netherlands
92857T10	75418	Vodafone Group	United Kingdom
96121430	75466	Westpac Banking Corp Ltd	Australia

ADRs traded on NASDAQ:

Cusip	Perm	Name	Country
3486130	14382	Anglo America of South Africa	South Africa
3487050	14403	Anglo America Gold	South Africa
4365520	15238	Asea AB	Sweden
9656320	18543	Blyvocruitzicht Gold Mining	South Africa
10220020	18914	Bowater	United Kingdom
11987120	19669	Buffelsfontein Gold Mining	South Africa
12216930	19845	Burmach Castrol	United Kingdom
12637520	26060	CSK Corp	Japan
13800630	21152	Canon Inc	Japan
14287220	11054	Carlton Communications	United Kingdom
15476230	22163	Central Pacific Minerals	Australia
23379820	28303	Dai Ei Inc	Japon
24025330	11631	De Beers Cons Mine	South Africa
26202620	30796	Driefontein Consolidated	South Africa
28537830	11485	Electrolux AB	Switzerland
29482140	33452	Ericsson LM Telec	Switzerland
33812330	36637	Fisons	United Kingdom
35614220	10060	Free State Consol Gold	South Africa
35958630	37867	Fuji Photo Film	Japan
36464320	38106	Gambro	Sweden
43123220	41930	Highveld Steel&Vanadium	South Africa
46571430	46085	Ito Yokado	Japan
47103430	46309	Japan Airline	Japan
49874650	47934	Kloof Gold Mining	South Africa
52668920	12207	LEP Group	United Kingdom
55082620	50295	Lydenburg Platimum	South Africa
56087730	51087	Makita Corp	Japan
60682720	54579	Mitsui&Co	Japan
62905020	55782	NEC Corp	Japan
65474440	57681	Nissan Motor	Japan
69418520	11486	Pacifec Dunlop ltd	Australia
75304170	65702	Rank Organization	United Kingdom
76132420	66713	Reuter Holding	United Kingdom
78437540	91620	SKF AB	Sweden
78967020	68583	Saint Helena Gold mine	South Africa
80302160	68815	Santos Ltd	Australia
80303830	68823	Sanyo Electronic	Japan
80386620	68866	Sasol	South Africa
84358130	71571	Southern Pacific Petroleum	Australia
88509440	75508	Thomson CSF	France
88909020	76428	Tokoi Marine&Fire	Japan
91850620	79899	Vaal Reefs Expl&Mine	South Africa
92885640	92930	Volvo Aaktiebolaget	Sweden
92930920	11845	WPP Group	United Kingdom
93000420	81331	Wacoal	Japan
95807720	82211	Western Deep Level	South Africa