STOCK MARKETS TURMOIL: WORLDWIDE EFFECTS OF MIDDLE EAST CONFLICTS

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Abstract

In this article, we analyze the impact of recent political conflicts in the Middle East on stock markets worldwide. In particular, we study how political instability—mainly due to the war in Iraq—has affected long-term volatility of stock markets. In doing so, we utilize two approaches to detecting structural breakpoints in volatility: Inclan and Tiao's Iterative Cumulative Sum of Squares (ICSS) algorithm and wavelet-based variance analysis. After controlling for conditional heteroskedasticity and serial correlation in returns, we conclude that Middle East conflicts have had an impact primarily on the stock markets of countries in that region and emerging Asian countries (e.g., Turkey, Morocco, Egypt, Pakistan, and Indonesia). Further evidence, from an international version of the CAPM, shows that political instability in the Middle East has increased the sensitivity of stock markets to exchange rate risk and, to a lesser extent, to market risk (e.g., Pakistan and Spain).

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I Introduction

To date, there is an extensive literature on the behavior of volatility of assets returns. Indeed, the GARCH model and numerous variations of it have been fitted to different financial time series around the world to account for the existence of conditional heteroskedasticity (see, for instance, the survey by Poon and Granger 2003).[2] However, less attention has been paid to the detection of multiple shifts in unconditional variance over time. For example, Lamoureux and Lastrapes (1990) conclude that persistence in variance may be overstated by not accounting for deterministic structural breakpoints in the variance model.

A relatively recent approach to testing for volatility shifts is Inclan and Tiao (1994)'s Iterative Cumulative Sums of Squares (ICSS) algorithm. This algorithm allows for detecting multiple breakpoints in variance in a time series. Aggarwal, Inclan and Leal (1999) present an application of this procedure for emerging markets over 1985-1995. They conclude that most events leading to volatility shifts tended to be local (e.g., the Mexican peso crisis, periods of hyperinflation in Latin America), and that the only global event over the sample period that affected several emerging markets was the October 1987 crash.

However, recent literature has shown that the ICSS algorithm tends to overstate the number of actual structural breaks in variance. Specifically, Bacmann and Dubois (2002) point out that the behavior of the ICSS algorithm is questionable under the presence of conditional heteroskedasticity. They show that one way to circumvent this problem is by filtering the return series by a GARCH (1,1) model, and applying the ICSS algorithm to the standardized residuals obtained from the estimation. Bacmann and Dubois conclude that structural breaks in unconditional variance are less frequent than it was previously shown.

An alternative approach to testing for variance homogeneity is wavelet analysis. This is a refinement of the Fourier analysis that, among many other applications, allows for a time-scale decomposing of financial data (i.e., high-frequency or noisy components and low-frequency or trend components). Early studies that utilize wavelet methods are Ramsey, Usikov, and Zaslavsky (1995) and Ramsey and Zhang (1996, 1997), which concentrate on stock markets and foreign exchange rate dynamics. More recent contributions have dealt with the permanent income hypothesis, the relation between futures and spot prices, the estimation of systematic risk of an asset (beta), seasonality filtering of time-series data, time and scale dependency of intraday Asian spot exchange rates, and heterogeneous trading in commodity markets, among other themes (e.g., Ramsey and Lampart 1998; Li and Stevenson 2001; Gençay, Whitcher, and Selcuk 2001, 2003, 2005; Whitcher 2004; Karuppiah and Los 2005; Connor and Rossiter 2005). A thorough discussion of the use of wavelets in economics and finance can be found in the survey articles by Ramsey (1999, 2002).

[2] Conditional heteroskedasticity means that the variance of a return series changes over time, conditional on past information. GARCH models are designed to capture the time-series dynamics of returns, in which we observe persistence or serial correlation in volatility.

This paper is organized as follows. Section 2 gives a brief background on wavelet analysis and the two methods we use to detect volatility breakpoints: Inclan and Tiao (1994)'s ICSS algorithm and wavelet-based variance analysis. Section 3 focuses on the empirical results. Our sample comprises stock indices of some selected Middle Eastern, African and Asian countries (Israel, Turkey, Morocco, Egypt, Jordan, Pakistan, and Indonesia) and developed countries (United Kingdom, Germany, Japan, the United States, and Spain), and four international indices (Europe and Middle East, Latin America, the World, and Emerging Markets), which are computed by Morgan Stanley Capital International. The sample period spans from April 2000 to March 2005. We test for variance homogeneity in the raw return series and in the return series filtered out for both conditional heteroskedasticity and serial correlation. In addition, by using an international version of the CAPM, we study the evolution of the sensitivity of stock returns to market and exchange risks of some countries within the sample for the period 2002-March 2005. Finally, Section 4 presents a summary of our main findings.

2 Theoretical issues

2.1 The discrete wavelet transform

A wavelet allows for decomposing a signal (e.g., a time series of inflation or stock returns) into high and low frequency components (see, for instance, Bruce and Gao 1996; Percival and Walden 2000). High frequency (irregular) components describe the short-run dynamics, whereas low-frequency components represent the long-term behavior of a signal. There are father and mother wavelets. Father wavelets (ϕ) capture the smooth and low-frequency parts of a signal, whereas mother wavelets (ψ) are good at representing the detailed and high-frequency parts of a signal.

The most commonly used wavelets are the orthogonal ones. In particular, the orthogonal wavelet series approximates a continuous signal f(t) as

$$f(t) \approx \sum_k s_{J,k}\phi_{J,k}(t) + \sum_k d_{J,k}\psi_{J,k}(t) + \sum_k d_{J-1,k}\psi_{J-1,k}(t) + \ldots + \sum_k d_{1,k}\psi_{1,k}(t) \qquad (1)$$

where J is the number of multi-resolution components or scales, and k ranges from 1 to the number of coefficients in the corresponding component. The coefficients $s_{J,k}$, $d_{J,k}$,..., $d_{1,k}$ are the wavelet transform coefficients, whereas the functions $\phi_{j,k}(t)$ and $\psi_{j,k}(t)$ are the approximating wavelet functions.

Applications of wavelet analysis commonly utilize a discrete wavelet transform (DWT). The DWT calculates the coefficients of the approximation in (1) for a discrete signal of final extent, $f_1, f_2,.., f_n$. That is, it maps the vector $\mathbf{f}=(f_1, f_2,\ldots,f_n)'$ to a vector $\boldsymbol{\omega}$ of n wavelet coefficients that contains $s_{J,k}$ and $d_{j,k}$, j=1,2,…, J. The $s_{J,k}$ are called the smooth coefficients and the $d_{j,k}$ are called the detail coefficients. Intuitively, the smooth coefficients represent the underlying smooth behavior of the data at the coarse scale 2^J, whereas the detail coefficients provide the coarse scale deviations from it.

When the length of the data n is divisible by 2^J, there are n/2 coefficients $d_{1,k}$ at the finest scale $2^1=2$. At the next finest scale, there are $n/2^2$ coefficients $d_{2,k}$. Similarly, at the coarsest scale, there are $n/2^J$ $d_{J,k}$ coefficients and $n/2^J$ $s_{J,k}$ coefficients. Altogether, there are

$n\left(\sum_{i=1}^{J}\frac{1}{2^i}+\frac{1}{2^J}\right)=n$ coefficients. The number of coefficients at a given scale is related to the width of the wavelet function. For instance, at the finest scale, it takes n/2 terms for the functions $\psi_{1,k}(t)$ to cover the interval $1\le t\le n$. In other words, at the lowest scales, more details of the original time series will be captured.

Expression (1) can be rewritten as

$$f(t) \approx S_J(t)+D_J(t)+D_{J-1}(t)+...+D_1(t), \qquad (2)$$

where $S_J(t)=\sum_k s_{J,k}\phi_{J,k}(t)$ and $D_J(t)=\sum_k d_{j,k}\psi_{J,k}(t)$ are denominated the smooth and detail signals, respectively. The terms in expression (2) represent a multi-resolution decomposition (MRD) of the signal into the orthogonal components $S_J(t)$, $D_{J(}t)$, $D_{J-1}(t)$,.., $D_1(t)$ at different scales. For instance, when analyzing daily data, wavelet scales are such that scale 1 is associated with 2-4 day dynamics, scale 2 with 4-8 day dynamics, scale 3 with 8-16 day dynamics, scale 4 with 16-32 day dynamics, scale 5 with 32-64 day dynamics, etcetera.

2.2 Breakpoints in Volatility

We focus on two methods to detect permanent shifts in volatility: Inclan and Tiao (1994)'s Iterative Cumulative Sum of Squares (ICSS) algorithm and a wavelet-based variance shift test. The attractiveness of the ICSS algorithm is that yields us the exact date at which a breakpoint may have occurred. Its downside is that it tends to overestimate the number of breakpoints. Wavelet-variance analysis is an alternative approach that allows decomposing the total variance of a time series into pieces that account for the variability of the series at different time horizons. For instance, a series may exhibit a variance shift at its high frequency components (i.e., short-term dynamics), but not at its low-frequency components (i.e., trend components). As we will see later in Section 3, wavelet-variance analysis seems to be more robust to detect volatility shifts in the presence of volatility clustering and inertia in stock returns.

2.2.1 The ICSS Algorithm

Inclan and Tiao's ICSS algorithm can be summarized as follows. A time series of interest has a stationary unconditional variance over an initial time period until a sudden break takes place. The unconditional variance is then stationary until the next sudden change occurs. This process repeats through time, giving a time series of observations with a number of M breakpoints in the unconditional variance along the sample:

$$\sigma_t^2=\begin{cases}\tau_0^2 & 1<t<\iota_1\\ \tau_1^2 & \iota_1<t<\iota_2\\ \quad .... & \\ \tau_M^2 & \iota_M<t<n\end{cases} \qquad (3)$$

In order to estimate the number of variance shifts and the point in time at which they occur, a cumulative sum of square residuals is computed, $C_k = \sum_{t=1}^{k} \varepsilon_t^2$, k=1, 2, .., n, where $\{\varepsilon_t\}$ is a series of uncorrelated random variables with zero mean and unconditional variance σ_t^2 , as in (3). Inclan and Tiao define the statistic:

$$Đ_k = \frac{C_k}{C_n} - \frac{k}{n} \qquad k=1, 2,.., n, \qquad Đ_0 = Đ_n = 0. \tag{4}$$

If there are not variance shifts over the whole sample period, $Đ_k$ will oscillate around zero. Otherwise, if there is one or more variance shifts, $Đ_k$ will departure from zero. The ICSS algorithm systematically looks for breakpoints along the sample. A full description of the algorithm is given in Inclan and Tiao's article.

However, there is evidence in the literature that the ICSS algorithm tends to overestimate the number of breakpoints, due to the fact that the assumption of independence in time-series data is usually violated. In particular, Bacmann and Dubois (2002) point out that the behavior of the ICSS algorithm is questionable under the presence of conditional heteroskedasticity. They show that one way to circumvent this problem is by filtering the return series by a GARCH (1,1) model, and applying the ICSS algorithm to standardized residuals. By applying this procedure (and an alternative one they propose) to stock market indexes of ten emerging markets, Bacmann and Dubois obtain results that differ considerably from Aggarwal, Inclan and Leal (1999)'s. They conclude that structural breaks in unconditional variance are less frequent than it was shown previously.

2.2.2 Wavelet Variance Analysis
2.2.3

Wavelet variance analysis consists in partitioning the variance of a time series into pieces that are associated to different time scales. In other words, it tells us what scales are important contributors to the overall variability of a series (see Percival and Walden 2000). In particular, let $x_1, x_2,..., x_n$ be a time series of interest, which is assumed to be a realization of a stationary process with variance σ_X^2. If $\upsilon_X^2(\tau_j)$ denotes the wavelet variance at scale $\tau_j \equiv 2^{j-1}$, then the following relationship holds:

$$\sigma_X^2 = \sum_{j=1}^{\infty} \upsilon_x^2(\tau_j) \tag{5}$$

Given that scale τ_j can be related to range of frequencies in the interval $[1/2^j, 1/2^{j-1}]$, the wavelet variance usually leads to a more succinct decomposition than that obtained from spectral analysis. Moreover, the square root of the wavelet variance is expressed in the same units as the original data.

Let $n'_j = n/2^j$ be the number of discrete wavelet transform (DWT) coefficients at level j, where n is the sample size, and let $L'_j \equiv (L-2)(1-2^{-j})$ be the number of DWT boundary coefficients[3] at level j (provided that $n'_j > L'_j$), where L is the width of the wavelet filter[4]. An unbiased estimator of the wavelet variance is defined as

$$\hat{\upsilon}_x^2(\tau_j) \equiv \frac{1}{(n'_j - L'_j)2^j} \sum_{t=L'_j-1}^{n'_j-1} d_{j,t}^2 \qquad (6)$$

Given that the DWT de-correlates the data, the non-boundary wavelet coefficients at the jth level ($\mathbf{d}_j$) are zero-mean Gaussian white noise processes. For a homogeneous distribution of $d_{j,t}$, there is an expected linear increase in the cumulative energy as a function of time.[5] The D-statistic, which is based on normalized cumulative sums of squares involving the DWT-wavelet coefficients, denotes the maximum deviation of $d_{j,t}$ from a hypothetical linear cumulative energy trend. The D-statistic is compared to the critical value of the distribution of D, for a given significance level, under the null hypothesis of variance homogeneity (see Percival and Walden 2000, chapter 9, for technical details).

3 Data and estimation results

3.1 Description of the data

We consider stock indices of some selected Middle Eastern, African and Asian countries (Israel, Turkey, Morocco, Egypt, Jordan, Pakistan, and Indonesia) and developed countries (the United Kingdom, Germany, Japan, the United States, and Spain), and four international indices (Europe & Middle East, Latin America, the World, and Emerging Markets), which are computed by Morgan Stanley Capital International (MSCI). All indices are free-float adjusted by market capitalization. The time period spans from April 2000 to March 2005. Returns are logarithmic and computed at a daily frequency from the stock index values at closing time. Descriptive statistics for returns in local currency and US dollars are reported on Table 1. (A detailed description of the countries included in each international index is provided at the bottom of the table).

In general, returns in local currency and US dollars tend to exhibit large kurtosis and negative skewness. In other words, the likelihood of observing extremely large negative returns is greater than under a normal distribution. For instance, over the sample period, the minimum daily return in local currency for Indonesia was–16.3 percent, that is, –88.2

[3] Boundary coefficients are those that are formed by combining together some values from the beginning and the end of the time series.

[4] In practical applications, we deal with sequences of values (i.e., time series) rather than functions defined over the entire real axis. Therefore, instead of using actual wavelets, we work with short sequences of values named wavelet filters. The number of values in the sequence is called the width of the wavelet filter, and it is denoted by L.

[5] The energy in a given crystal is calculated as the sum of squares of all of its elements over the sum of squares of all observations in the original time series. One appealing characteristic of the DWT is that it is an energy preserving transform.

percent using annual compounding. On the other hand, according to the Ljung-Box serial correlation test, daily returns tend to behave like white noise even when taking a relative large number of sample autocorrelations. Some exceptions are the dollar returns on the selected international indices.

As reported in previous studies, stock returns of emerging markets tend to be more volatile than those of developed countries. For instance, over the sample period, the standard deviation of the Turkish stock index return averaged almost 3 percent per day, as opposed to the 1.2-daily percent dispersion of the US and Japanese stock index returns.

3.2 Detection of volatility breakpoints by the ICSS algorithm and wavelet analysis

In this section, we test for volatility breakpoints using the two statistical techniques earlier described. We look at daily returns in local currency and US dollars, and concentrate on two subperiods of the sample: April 2000-2001 and 2002-April 2005. The choice of these subperiods is based on the idea of studying whether stock markets have become noticeably more volatile worldwide since the United States declared war on terrorism following September 11, 2001. In order to identify the potential events triggering structural shifts in volatility, we have summarized on Table 2, Panels (a)-(c), the major international events occurred over the sample period, especially those connected with the Iraq war and the Israeli-Palestinian conflict.

In particular, the period 2002-early 2005 was characterized by some massive terrorist attacks (e.g., Bali, October 2002; Madrid, March 2004; various suicide bombings in both Iraq and Israel), terrorist threats to countries cooperating with the United States in the war against Iraq (i.e., the United Kingdom), and some attempts to end the Israeli-Palestinian conflict (e.g., the road map and Israel's disengagement plan). Other events have had to do with financial scandals (e.g., Enron and WorldCom), a severe economic crisis in Argentina starting by the end of 2001, and by the recovery of the Japanese economy since 2003 approximately, among other events.

[Table 2]

Table 3 reports the breakpoints detected by the ICSS algorithm for the raw and filtered returns in local currency. The filter consists of fitting an AR(1) model to daily returns with a GARCH(1,1) specification for the conditional variance of innovations, and next applying the ICSS algorithm to the standardized residuals obtained from the estimation. That way, we eliminate the bias of the ICSS algorithm towards finding too many breakpoints caused by serially correlated volatility.

When looking at the raw data, the stock index countries that seemed to have experienced volatility shifts around September 11, 2001 are Jordan and Pakistan. Surprisingly no breaks are detected by the United States around that time. The United Kingdom, Spain, Morocco, Jordan exhibited some breakpoints around October-November 2001. These might have been the result of Enron's scandal, political instability in the Middle East (e.g., the Israeli tourism minister was assassinated in mid October 2001), and to the unsafe environment following the terrorist attack on the World Trade Center and the Pentagon.

Over the period 2002-March 2005, more countries seem to have experienced turmoil in their stock markets. This is not surprising given the U.S. Congress' authorization

to attack Iraq (October 2002) and the beginning of the war in March 2003, the massive terrorist attacks occurred in Bali (October 2002) and Spain (March 2004), which were masterminded by the Al Qaeda network, and the ongoing Palestinian-Israeli conflict.

However, most of these apparent structural breaks in volatility vanish when controlling for volatility persistence. Indeed, only Jordan appears to have been affected by the lack of worldwide safety following September 11. Israel's stock market exhibits a variance shift at the time of the assassination of the head of the Hamas Izzeldin-El Kassam brigades. Both Turkey and Indonesia show a volatility shift around the beginning of the Iraq war, whereas Latin America exhibits a breakpoint in mid October 2002, which coincides with the U.S. Congress' authorization to attack Iraq and the terrorist strike on Bali.

Table 4 shows similar computations for returns in US dollars[6]. Filtering the data again reduces enormously the number of breakpoints detected by the ICSS algorithm. As before, only Jordan's stock market appears affected by September 11. This time, however, the assassination of the head of the Hamas Izzeldin-El Kassam brigades does not hit Israel's stock market but Europe & Middle East's as a whole. Instead, Israel experiences a variance breakpoint around the date in which its safety barrier is found to violate international law. Unlike the findings on Table 3, the terrorist attack on Bali in mid-October 2002 is captured by Indonesia's U.S. dollar returns. Moreover, the beginning of the Iraq war only seems to have had an impact on Turkey's stock market.

We next contrast the results yielded by the ICSS algorithm with those obtained from wavelet analysis. The D statistic, which was described in Section 2.2.2, is able to detect variance breakpoints at each time scale. Let us recall that when dealing with daily data, wavelet scales are such that scale 1 is associated with 2-4 day dynamics, scale 2 with 4-8 day dynamics, scale 3 with 8-16 day dynamics, scale 4 with 16-32 day dynamics, and scale 5 with 32-64 day dynamics. In other words, wavelet-variance analysis tells at what frequencies of the data breakpoints have taken place.

Testing results for the raw and filtered returns in local currency are presented on Tables 5 and 6, respectively. The null hypothesis assumes variance homogeneity at each scale for the period under analysis. The value of the D statistic along with 10, 5 and 1 percent-significance levels are reported for the whole sample, and the April 2000-2005 and 2002-March 2005 subperiods ("T" indicates that the null hypothesis cannot be rejected and "F", otherwise). We find the following regularities for the raw data. First, when looking at the whole sample period, we in general reject variance homogeneity at the lower scales d1 and d2 (i.e., short-term dynamics). For some countries, such as Pakistan and the United States, we even reject variance homogeneity at all time scales at the 10 and 5 percent-significance levels. That implies that not only at the short-term dynamics their stock indices underwent variance shifts, but also at the trend component. Second, there are in general more rejections of variance homogeneity along the 2002-March 2005 subperiod than along

[6] Returns in U.S. dollars will reflect fluctuations in asset prices in the local stock market and an appreciation or a depreciation of the domestic currency against the U.S. dollar, whenever the exchange rate regime is a dirty/free float.

the April 2000-2001 subperiod. Examples of this phenomenon are Turkey, Indonesia, Germany, the United States, and the World Index.

When the data is filtered[7], the null hypothesis tends not to be rejected, especially at the upper scales of the data. For instance, for the case of Jordan, variance homogeneity is rejected at all significance levels only at the first time scale when taking the whole sample period, at the first and third time scales over the first subperiod, and at the first two scales over the second subperiod (at the 5 and 10 percent significance levels).

Tables 7 and 8 show a similar exercise, but using returns denominated in US dollars. In general, as is also the case for Tables 5 and 6, we observe that Indonesia and Middle Eastern countries are those that exhibit a larger number of variance breakpoints, even after controlling for serial correlation in returns and clusters in volatility.

From Tables 6 and 8, we notice that variance homogeneity is rejected for the whole sample period, but it is not for each subperiod, for the United Kingdom, Spain, and Europe & Middle East (filtered returns in domestic currency), and Israel, Morocco, and Latin America (filtered returns in U.S. dollars). Hence, we next computed wavelet-based variances in order to check whether the volatility of those stock indices had noticeably increased after September 11, 2001.

Table 9 shows our computations. We find that volatility at scale 5 (i.e., trend component) increased over the period 2002-April 2005 for the U.K., Spain, Europe & Middle East, and Latin America. In addition, we find some evidence of more volatility at shorter-term components of that data for the UK, Spain and Israel (scale 3: 8-16 day dynamics). In other words, the severe political instability in the Middle East from 2002 onwards, particularly due to the invasion of Iraq, appears to have caused structural breaks in the medium- and long-term behavior of some stock indices, whose dynamics are now characterized by more dispersion.

3.3 Evolution of market and exchange rate risks

In order to further investigate the effect of the Middle Eastern conflicts on stock markets, we concentrate on the evolution of the sensitivities of stock indices returns to market and exchange rate risks. In doing so, we resort to a two-country international CAPM. Under this framework, the expected risk premium of a domestic asset is given by (see Sercu and Uppal 1995, chapter 22)

$$E(r_i - r) = \psi_1 \, \mathrm{cov}(r_i, r_w) + \psi_2 \, \mathrm{cov}(r_i, s) \qquad (7)$$

where r_i and r_w are the returns on the domestic asset and the world market portfolio, respectively (both expressed in local currency), s is the percent change in the exchange rate between the domestic and the foreign currency, and ψ_1 and ψ_2 represent the prices of the corresponding covariance risks. In order to determine ψ_1 and ψ_2, two benchmarks are

[7] Separate GARCH models are fitted to the whole sample and the two subperiods.

taken, namely, the world market portfolio and the foreign Treasury bond. Sercu and Uppal show that, under the assumption that cov(r_w,s)=0, $\psi_1 = \frac{E(r_w) - r}{var(r_w)}$ and $\psi_2 = \frac{E(s) + r^* - r}{var(s)}$, where $E(s)+r^*$ is the expected return on the Treasury bond in terms of the local currency. And, hence, equation (7) boils down to

$$E(r_i - r) = \alpha_{1i} E(r_w - r) + \alpha_{2i} E(s + r^* - r) \qquad (8)$$

where $\alpha_{1i} = \frac{cov(r_i, r_w)}{var(r_w)}$ is the sensitivity of asset i to the world market portfolio, and $\alpha_{2i} = \frac{cov(r_i, s)}{var(s)}$ is the asset's relative exchange rate risk.

If the world market portfolio is denominated in the foreign currency instead (e.g., U.S. dollars), equation (8) can be restated as

$$E(r_i - r) = \frac{cov(r_i, r_w^*)}{var(r_w^*)} E(r_w^* - r^*) + \frac{cov(r_i, s)}{var(s)} E(s + r^* - r) \equiv \beta_{1i} E(r_w^* - r^*) + \beta_{2i} E(s + r^* - r)$$

In practice, however, the return on the world market portfolio (measured in either local or foreign currency) and the exchange rate variation will not necessarily be orthogonal. Then the sensitivities to the risk factors have to be jointly estimated from a linear regression model.

Figure 1 depicts rolling-least squares estimates of the sensitivities to the two sources of risk—along with 95-percent confidence bands— for the returns on the UK and Indonesia stock indices over 2002-March 2005. The proxy for the world market portfolio for the U.K. is the World index, and the Emerging Markets index for Indonesia (both in U.S. dollars). Our choice is based on the fact that financial integration is more likely to happen among countries of similar economic development. Percent changes of the British pound and the Indonesia rupiah against the U.S. dollar are calculated from the exchange rate data available at the web site of the Bank of Canada.

The estimation shows that market risk exhibits an increasing trend for both Indonesia and the U.K., whereas exchange risk shows a decreasing trend until 2003, approximately, and an increasing trend thereafter for both countries. Similar computations that we carried out for Spain and Pakistan show that market risk has been relatively stable over the same time period. (An increase in market risk is observed for Pakistan around the beginning of the Iraq war in 2003, and for Spain around March 11, 2004). The sensitivity to exchange risk of Spain's stock market exhibits a similar pattern to U.K. and Pakistan's, whereas Pakistan's exchange risk shows a more pronounced increasing trend from the beginning of 2003 onwards.

In sum, we conclude from the cases analyzed that the Middle East conflicts, particularly the Iraq war, had led to an increase of exchange risk, and, to a lesser extent, to an increase in market risk.

4 Conclusions

In this article, we analyze the impact of recent political conflicts in the Middle East on stock markets worldwide. In particular, we study how political instability in the region has affected long-term volatility of stock markets. Our sample comprises stock indices of some selected Middle Eastern, African and Asian and developed countries, and four international indices for the sample period April 2000-March 2005.

As previously reported by other studies, the ICSS algorithm is extremely sensitive to the presence of clusters in volatility and inertia in returns. And, hence, wavelet-variance analysis arises as a more robust tool for testing shifts in long-term volatility. We conclude that structural breakpoints in volatility have primarily occurred in stock markets of Middle Eastern and emerging Asian countries. Moreover, based on an international version of the CAPM, we conclude that political instability in the Middle East has increased the sensitivity of stock markets to exchange risk and, to a lesser extent, to market risk.

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Table 1 Descriptive statistics of returns of MSCI stock indices in local currency and U.S. dollars

	Local currency						U.S. dollars					
	Mean	Std. dev	Skew	Kurt	Q(30)		Mean	Std. dev	Skew	Kurt	Q(30)	
					stat	p-value					stat	p-value
(a) Selected Middle Eastern, African, and Asian country indices												
Israel	0.000	0.012	–0.176	6.906	43.07	0.06	0.000	0.014	–0.264	7.005	47.65	0.02
Turkey	0.000	0.029	0.057	8.639	41.93	0.07	0.000	0.037	–0.168	10.389	50.24	0.01
Morocco	0.000	0.008	0.835	11.075	87.94	0.00	0.000	0.009	0.454	7.945	54.38	0.00
Egypt	0.001	0.017	0.348	6.399	50.16	0.01	0.000	0.018	0.138	6.295	54.89	0.00
Jordan	0.001	0.009	–0.188	13.315	38.57	0.14	0.001	0.009	–0.170	13.084	38.14	0.15
Pakistan	0.000	0.018	–0.047	6.633	38.88	0.13	0.000	0.018	–0.038	6.436	38.41	0.14
Indonesia	0.001	0.018	–0.610	10.025	39.74	0.11	0.000	0.021	–0.663	10.934	57.34	0.00
(b) Selected developed country indices												
United Kingdom	0.000	0.012	–0.212	5.408	87.95	0.00	0.000	0.012	–0.216	6.093	92.63	0.00
Germany	0.000	0.017	–0.125	4.838	54.63	0.00	0.000	0.017	–0.029	5.276	61.75	0.00
Japan	0.000	0.014	–0.164	4.613	16.66	0.98	0.000	0.013	–0.184	4.748	34.35	0.27
United States	0.000	0.012	0.116	5.311	38.55	0.14	0.000	0.012	0.116	4.320	38.55	0.14
Spain	0.000	0.015	0.093	4.722	52.28	0.01	0.000	0.015	0.052	6.093	34.76	0.25
(c) Selected international indices												
Europe &Middle East	0.000	0.012	–0.129	5.693	39.04	0.12	0.000	0.013	–0.223	5.455	59.16	0.00
Latin America	0.000	0.011	–0.240	5.120	44.50	0.04	0.000	0.014	–0.300	5.048	60.72	0.00
The World	0.000	0.010	0.079	5.270	64.82	0.00	0.000	0.010	0.029	5.022	69.41	0.00
Emerging Markets	0.000	0.009	–0.468	5.239	99.73	0.00	0.000	0.010	–0.473	5.164	116.43	0.00

Notes: (1) The data was obtained from Morgan Stanley Capital International (MSCI), and it covers April 2000-March 2005. Returns are logarithmic and are recorded at a daily frequency. (2) The MSCI Europe & Middle index consists of The Czech Republic, Hungary, Israel, Jordan, Poland, Russia, and Turkey; The MSCI Latin America index consists of Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela; The MSCI World Index consists of 23 developed market country indices: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the United States; and, The MSCI Emerging Markets Index consists of 26 emerging market country indices: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, Turkey and Venezuela. All indices are free-float adjusted by market capitalization, and are measured at closing time. (3) Q(30) denotes the Ljung-Box statistic computed for the first thirty sample autocorrelations of daily returns. Under the null hypothesis, daily returns are uncorrelated.

Table 2 Main international events in the period 2000-beginning 2005

(a) Key international events

Dec. 15, 2000	George W. Bush officially wins the US presidential election, defeating Al Gore.
June 28, 2001	Tokyo Stock Exchange crashes. The Nikkei reaches its lowest level since 1984.
Sept. 11, 2001	Terrorist attacks on World Trade Center in New York and the Pentagon carried out by Islamic Al-Qaeda group headed by Osama Bin Laden. US war on terrorism begins.
Oct. 15, 2001	Enron announces losses for over US$1,000 millions.
Dec. 19, 2001	IMF announces that Argentina's economic crisis is serious. President De la Rua resigns on Dec. 21.
Jan. 29, 2002	President Bush identifies Iraq, along with Iran and North Korea, as an "axis of evil."
Jun. 27, 2002	WorldCom involved in major accounting fraud in U.S. history.
Oct. 12, 2002	Terrorist attack in Bali (Indonesia)—believed to be masterminded by Al-Qaeda network—kills 200 and injures over 300.
March 20, 2003	The war against Iraq begins.
March 11, 2004	Four bombs planted at Atocha station, Madrid, kill 177 at the scene.
Feb 14, 2005	Assassination of Rafik Hariri, architect of Lebanese reconstruction.

(b) War in Iraq

Oct. 11, 2002	U.S. Congress authorizes an attack on Iraq.
Dec. 21, 2002	President Bush approves the deployment of U.S. troops to the Gulf region.
March 17, 2003	President Bush delivers an ultimatum to Saddam Hussein to leave the country within 48 hours.
March 20, 2003	The war against Iraq begins when the U.S. launches Operation Iraqi Freedom.
May 22, 2003	The UN Security Council approves a resolution lifting the economic sanctions against Iraq and supporting the U.S.-led administration in Iraq.
July 13, 2003	Iraq's interim governing council, composed of 25 Iraqis appointed by American and British officials, is inaugurated.
Aug. 19, 2003	Suicide bombing destroys UN headquarters in Baghdad, killing 24, including top envoy Sergio Vieira de Mello, and wounding more than 100.
Oct. 27, 2003	Four coordinated suicide attacks in Baghdad kill 43 and wounded more than 200.
Nov. 14, 2003	The Bush Administration agrees to transfer power to an interim government in early 2004.
Dec. 13, 2003	Iraq's deposed leader Saddam Hussein is captured by American troops.
Feb. 1, 2004	About 109 Iraqis are killed by suicide bombings in Erbil.
Feb. 10, 2004	About 54 Iraqis are killed in a car bombing. The next day an attack kills about 47.
March 2, 2004	Suicide attacks in Karbala killed more than 85 and wound 233 others.
March 17, 2004	At least 27 people are killed and 41 wounded in the car bombing of a hotel in Baghdad.
April 4, 2004	U.S. troops begin assault on Falluja. Cease-fire is ordered by the U.S. on April 11.
April 30, 2004	Physical and sexual abuse and humiliation of Iraqi prisoners at Abu Ghraib prison comes to light.
May 17, 2004	A suicide bomber kills the head of Iraq's Governing Council, Izzedin Salim.
June 1-17, 2004	At least 100 people are reported killed in car bombs across Iraq.
June 16, 2004	The 9/11 Commission concludes that there is no credible evidence that Iraq and al-Qaeda cooperated on attacks against the United States.
June 30, 2004	The interim government of Iraq takes legal custody of Saddam Hussein.
July 28, 2004	At least 68 were killed in a car bombing in Baqouba.
Nov 8, 2004	U.S. forces initiate an assault on Falluja, which has been under the control of insurgents since May.
Dec. 19, 2004	Car bombers target Shiites and election workers in Najaf and Karbala. More than 60 people killed and 120 wounded.
Dec. 21, 2004	Bomb explodes in U.S. military tent at base in Mosul. At least 24 people die.
Jan. 4, 2005	Ali al-Haidari, governor of Baghdad Province, is assassinated by insurgents.
Jan. 12, 2005	The White House announces that the search for weapons of mass destruction in Iraq is officially over. No such weapons were found.
Jan. 30, 2005	Iraq's elections to select a 275-seat National Assembly went ahead as scheduled.
Feb. 22, 2005	The United Iraqi Alliance selects Ibrahim al-Jaafari to be the prime minister of Iraq.
Feb. 28, 2005	Suicide bomber blows up a car in Hilla, killing about 115 people who were seeking employment with the Iraqi police.

(c) Israeli-Palestinian conflict

July 2000	Israeli Prime Minister Barak, US President Clinton and Palestinian Chairman Yasser Arafat meet at Camp David in a failed attempt to hammer out a final settlement.
Sept. 28, 2000	Palestinians initiated riots after Israeli opposition leader Ariel Sharon visited the Temple Mount. Thereafter, Palestinians kill over 700 Israelis.
Feb 6, 2001	Likud leader Ariel Sharon elected Prime Minister in Israel replacing Ehud Barak.
June 1, 2001	Suicide bomb kills 20 in Tel Aviv. Islamic Jihad and Palestine Hizbulla both claim the bombing.
August 9, 2001	Suicide bombing in Jerusalem by Islamic Jihad movement kills 15, wounds 130.
Aug 27, 2001	Israel assassinates Abu Ali Mustafa, Secretary General of the Popular Front for the Liberation of Palestine (PFLP).
Oct 17, 01	PFLP assassinates Israeli tourism minister in retaliation for killing of Abu Ali Mustafa.
Mar-Apr 2002	In retaliation for a series of suicide bombings, Israel mounts operation "Defensive Wall" in the West Bank, imprisoning Arafat in the "Mukata" compound in Ramalah.
July 23, 2002	Israel assassinates Saleh Shehadeh, head of Hamas Izzeldin-El Kassam armed brigades.
Jan 5, 2003	Double suicide bombing in Tel Aviv kills 23.
Feb 2003	Israel initiates a series of incursions in the Gaza strip and Nablus with numerous civilian casualties.
Mar 5, 2003	Hamas suicide bombing of Haifa bus kills 17. Israeli reoccupation of parts of Gaza.
Apr 29, 2003	Abu Mazen (Mahmoud Abbas) appointed Palestinian Prime Minister. US releases updated road map
Jun 4, 2003	Abu Mazen and Ariel Sharon vow to stop violence, end occupation according to the road map.
Jun 10-11, 2003	Failed Israeli assassination attempt on Hamas leader Ahmed Rantissi and Hamas suicide attack that kills 15 in Jerusalem jeopardize the future of the road map.
Aug 20, 2003	Hamas suicide bombing in a Jerusalem bus claims 21 lives
Aug 21, 2003	Israel assassinates Hamas leader Ismail Abu Shanab.
Sept 6, 2003	Mahmud Abbas resigns; Failed Israeli assassination attempt on Hamas spiritual leader Ahmed Yassin.
Sept 10, 2003	Twin suicide bombings kill 15 in Israel; Israel moves against buildings surrounding Arafat's Mukata.
Oct 4, 2003	Palestinian Islamic Jihad Suicide bomber kills 20 in Arab-Jewish owned Haifa restaurant.
Oct 5, 2003	Israeli jets strike a camp in Syria allegedly used for training Palestinian terrorists.
Nov 24, 2003	Sharon announces Disengagement Plan for unilateral withdrawal of Israeli forces if the roadmap fails.
March 22, 2004	Israeli Defense Force (IDF) assassinates Hamas leader Ahmed Yassin.
April 17, 2004	IDF assassinates Hamas leader Abdel Aziz Rantissi.
July 9, 2004	Israeli security barrier is found to violate international law and must be torn down.
Aug 31, 2004	16 Israelis were killed in a suicide attack on a Beersheba bus.
Sept 26, 2004	Hamas leader Izz El-Deen Al-Sheikh Khalil is assassinated by Mossad agents. Hamas spokesmen announce they will consider attacking Israeli targets outside Israel.
Sept 29, 2004	Qassam rockets kill two children. Israel launches operation "Days of Repentance," occupying a large area in northern Gaza, demolishing houses and killing over 80 Palestinians by October 7.
Oct 7, 2004	Multiple suicide attacks in the Sinai desert against Egyptian tourist areas frequented by Israelis.
Oct 25-26, 2004	Israel Knesset approves disengagement plan.
Nov 11, 2004	Yasser Arafat dies.
Jan 9, 2005	Mahmoud Abbas elected President of the Palestinian National Authority.
Feb 8, 2005	Israel will release over 900 Palestinian prisoners and withdraw from Palestinian cities. Jordan and Egypt will return ambassadors to Israel. The Intifada is deemed to be over.

Source: http://en.wikipedia.org, www.infoplease.com/spot/iraqtimeline1.html, www.mideastweb.org.

Table 3 Breakpoints in volatility of stock returns in local currency detected by the ICSS algorithm

	Raw data		Filtered data	
	April 2000-2001	2002-March 2005	Apr 2000-2001	2002-Mar 2005
(a) Selected Middle Eastern, African, and Asian country indices				
Israel	17-Apr-01	--	--	24-Jul-02
Turkey	16-Nov-00; 23-Feb-01; 18-Jul-01	31-Oct-02; 11-Apr-03; 25-Sep-03;18-Feb-04	--	14-Mar-03
Morocco	28-Apr-00; 10-May-00 28-Jun-00; 30-Jun-00 28-Aug-00; 15-Nov-00 3-Jan-01; 17-Jan-01 23-Feb-01; 22-May-01 3-Aug-01; 31-Oct-01	3-Jan-02; 27-Jun-02; 7-Aug-02 26-Sep-03; 21-Sep-04; 14-Dec-04	28-Dec-01	--
Egypt	22-Nov-00	17-Jan-02; 9-Jul-02; 31-Jul-02; 10-Oct-02 2-Jan-03; 27-Jan-03; 5-Feb-03 21-May-03; 23-Feb-04; 20-Jan-05	--	--
Jordan	9-Aug-01; 13-Sep-01; 1-Oct-01; 9-Nov-01	14-Oct-02; 27-Nov-03; 12-Mar-04 30-Sep-04	7-Aug-01; 27-Sep-01	--
Pakistan	31-May-00; 16-Nov-00; 10-Sep-01	15-Feb-02; 15-May-02; 7-Jun-02; 28-Oct-02; 24-Dec-02; 28-Mar-03; 29-Jul-03; 4-Nov-03; 12-Dec-03; 23-Feb-04; 19-Apr-04; 25-Jun-04 6-Jan-05; 4-Mar-05	--	--
Indonesia	--	11-Sep-02; 4-Nov-02; 24-Jan-03; 16-Apr-04 18-May-04; 7-Jul-04	--	14-Jan-03
(b) Selected developed country indices				
United Kingdom	1-Jun-00; 7-Mar-01; 9-Apr-01; 4-Sep-01; 25-Oct-01	26-Jun-02; 16-Oct-02; 20-Jun-03 23-Jul-03; 16-Jan-04; 26-May-04	--	--
Germany	--	25-Jun-02; 4-Apr-03; 8-May-03; 16-May-03	--	--
Spain	12-Nov-01	12-Jun-02; 14-Oct-02; 4-Apr-03; 19-May-04	--	--
Japan	--	4-Jun-04	--	--
United States	1-Jun-00; 9-Oct-00 7-Mar-01; 24-Apr-01	16-Oct-02; 1-Apr-03; 24-Jul-03; 30-Sep-03	--	--
(c) Selected international indices				
Europe &Middle East	14-Apr-00; 7-Jun-00 7-Sep-00; 16-Nov-00; 18-Apr-01	2-Aug-02; 16-Oct-02	--	--
Latin America	4-Jan-01	16-Oct-02; 29-Oct-02; 1-Jan-04; 8-Jun-04	--	14-Oct-02
The World	7-Mar-01	13-Jun-02; 16-May-03; 18-May-04; 11-Jun-04	--	--
Emerging Markets	3-Jan-01	28-Apr-03; 26-Apr-04; 11-Jun-04	--	--

Note: Return series are filtered by univariate GARCH(1,1) models.

Table 4 Breakpoints in volatility of stock returns in U.S. dollars detected by the ICSS algorithm

	Raw data		Filtered data	
	April 2000-2001	2002-March 2005	Apr 2000-2001	2002-Mar 2005
(a) Selected Middle Eastern, African, and Asian country indices				
Israel	9-Apr-01	7-Feb-02; 7-Jul-03; 5-Aug-03	--	4-Jul-03
Turkey	16-Nov-00; 7-Dec-00 15-Feb-01; 28-Feb-01 18-Jul-01	25-Mar-03; 11-Apr-03; 28-Nov-03 11-Jun-04; 10-Mar-05	--	17-Mar-03
Morocco	31-Aug-00; 14-Nov-00 3-Jan-01; 26-Feb-01	3-Jan-02; 24-Jun-02; 5-Aug-02 21-Sep-04; 7-Jan-05	2-Aug-01	--
Egypt	22-Nov-00	15-Feb-02; 13-Dec-02; 2-Jan-03; 27-Jan-03; 5-Feb-03; 23-Feb-04; 30-Dec-04	--	--
Jordan	9-Aug-01; 13-Sep-01 1-Oct-01	11-Jul-02; 14-Oct-02; 2-Jan-03; 27-Nov-03; 1-Dec-03; 12-Mar-04; 30-Sep-04	8-Aug-01; 28-Sep-01	--
Pakistan	21-Jun-00; 8-Nov-00 12-Jan-01; 10-Sep-01	15-Feb-02; 15-May-02; 7-Jun-02; 24-Dec-02; 28-Mar-03; 29-Jul-03; 4-Dec-03; 6-Jan-05; 4-Mar-05	--	--
Indonesia	9-Nov-01	26-Sep-02; 15-Oct-02; 11-Nov-02; 16-Apr-04; 5-Jul-04	--	25-Sep-02; 9-Oct-02
(b) Selected developed country indices				
United Kingdom	4-Sep-01	10-Jun-02; 23-Jan-03; 7-Apr-03; 30-May-03; 11-Jul-03; 28-Nov-03; 19-May-04	--	--
Germany	28-Aug-01; 12-Nov-01	24-Jun-02; 4-Apr-03; 31-Oct-03; 10-Aug-04; 29-Oct-04	--	--
Spain	--	20-Jun-02; 14-Oct-02; 1-Nov-02; 26-Nov-02; 23-Jul-03; 14-Jan-04; 8-Jun-04	--	--
Japan	8-Mar-01	16-Dec-03; 20-May-04; 4-Jun-04; 13-Dec-04		
(c) Selected international indices				
Europe &Middle East	--	2-Aug-02	--	25-Jul-02
Latin America	5-Jun-00; 11-Oct-01	4-Jun-02; 30-Oct-02; 26-Nov-02	--	20-Nov-02
The World	7-Mar-01; 18-Apr-01	25-Jun-02; 1-Apr-03; 25-Apr-03 20-Jun-03	--	--
Emerging Markets	19-Apr-01	17-Jun-02; 1-Nov-02; 26-Apr-04 11-Jun-04	--	--

Note: Return series are filtered by univariate GARCH(1,1) models.

Table 5 Stock indices in local currency: Raw data

(a) Selected Middle Eastern, African, and Asian country indices

		Whole sample				April 2000-2001				2002-March 2005			
	Scale	D	10%	5%	1%	D	10%	5%	1%	D	10%	5%	1%
Israel	d5	0.281	T	T	T	0.369	T	T	T	0.226	T	T	T
	d4	0.127	T	T	T	0.273	T	T	T	0.176	T	T	T
	d3	0.100	T	T	T	0.273	F	F	T	0.138	T	T	T
	d2	0.135	F	F	F	0.211	F	F	T	0.107	T	T	T
	d1	0.096	F	F	F	0.093	T	T	T	0.074	T	T	T
Turkey	d5	0.254	T	T	T	0.188	T	T	T	0.423	F	F	T
	d4	0.242	F	F	T	0.325	T	T	T	0.283	F	F	T
	d3	0.267	F	F	F	0.214	T	T	T	0.146	T	T	T
	d2	0.248	F	F	F	0.193	F	F	T	0.256	F	F	F
	d1	0.227	F	F	F	0.165	F	F	F	0.220	F	F	F
Morocco	d5	0.252	T	T	T	0.361	T	T	T	0.316	T	T	T
	d4	0.176	T	T	T	0.142	T	T	T	0.184	T	T	T
	d3	0.128	T	T	T	0.148	T	T	T	0.166	T	T	T
	d2	0.134	F	F	F	0.143	T	T	T	0.184	F	F	F
	d1	0.199	F	F	F	0.246	F	F	F	0.178	F	F	F
Egypt	d5	0.262	T	T	T	0.565	F	T	T	0.232	T	T	T
	d4	0.123	T	T	T	0.218	T	T	T	0.134	T	T	T
	d3	0.164	F	F	T	0.335	F	F	F	0.224	F	F	T
	d2	0.132	F	F	F	0.131	T	T	T	0.176	F	F	F
	d1	0.150	F	F	F	0.220	F	F	F	0.195	F	F	F
Jordan	d5	0.145	T	T	T	0.274	T	T	T	0.273	T	T	T
	d4	0.187	T	T	T	0.425	F	F	T	0.180	T	T	T
	d3	0.177	F	F	T	0.468	F	F	F	0.114	T	T	T
	d2	0.156	F	F	F	0.346	F	F	F	0.200	F	F	F
	d1	0.181	F	F	F	0.503	F	F	F	0.196	F	F	F
Pakistan	d5	0.349	F	F	T	0.625	F	F	T	0.570	F	F	F
	d4	0.226	F	F	T	0.246	T	T	T	0.207	T	T	T
	d3	0.242	F	F	F	0.265	F	F	T	0.383	F	F	F
	d2	0.150	F	F	F	0.201	F	F	T	0.221	F	F	F
	d1	0.144	F	F	F	0.208	F	F	F	0.207	F	F	F
Indonesia	d5	0.159	T	T	T	0.372	T	T	T	0.216	T	T	T
	d4	0.152	T	T	T	0.204	T	T	T	0.319	F	F	T
	d3	0.156	F	F	T	0.178	T	T	T	0.244	F	F	F
	d2	0.152	F	F	F	0.108	T	T	T	0.169	F	F	F
	d1	0.145	F	F	F	0.133	F	F	T	0.194	F	F	F

(b) Selected developed country and international indices

		Whole sample				April 2000-2001				2002-March 2005			
	Scale	D	10%	5%	1%	D	10%	5%	1%	D	10%	5%	1%
United Kingdom	d5	0.273	T	T	T	0.237	T	T	T	0.391	F	T	T
	d4	0.183	T	T	T	0.242	T	T	T	0.442	F	F	F
	d3	0.252	F	F	F	0.186	T	T	T	0.263	F	F	F
	d2	0.183	F	F	F	0.221	F	F	F	0.346	F	F	F
	d1	0.235	F	F	F	0.202	F	F	F	0.349	F	F	F
Germany	d5	0.362	F	F	T	0.388	T	T	T	0.404	F	F	T
	d4	0.167	T	T	T	0.252	T	T	T	0.363	F	F	F
	d3	0.238	F	F	F	0.169	T	T	T	0.358	F	F	F
	d2	0.234	F	F	F	0.194	F	F	T	0.368	F	F	F
	d1	0.231	F	F	F	0.148	F	F	T	0.363	F	F	F
Spain	d5	0.292	F	T	T	0.361	T	T	T	0.226	T	T	T
	d4	0.136	T	T	T	0.282	T	T	T	0.237	F	F	T
	d3	0.108	T	T	T	0.286	F	F	T	0.210	F	F	T
	d2	0.150	F	F	F	0.208	F	F	T	0.139	F	F	F
	d1	0.110	F	F	F	0.095	T	T	T	0.131	T	T	T
Japan	d5	0.242	T	T	T	0.279	T	T	T	0.281	T	T	T
	d4	0.093	T	T	T	0.274	T	T	T	0.195	T	T	T
	d3	0.128	T	T	T	0.068	T	T	T	0.087	T	T	T
	d2	0.076	T	T	T	0.193	F	F	T	0.122	F	T	T
	d1	0.104	F	F	F	0.216	F	F	F	0.138	F	F	F
United States	d5	0.367	F	F	T	0.281	T	T	T	0.478	F	F	T
	d4	0.220	F	F	T	0.324	T	T	T	0.482	F	F	F
	d3	0.287	F	F	F	0.120	T	T	T	0.371	F	F	F
	d2	0.204	F	F	F	0.108	T	T	T	0.316	F	F	F
	d1	0.257	F	F	F	0.132	F	F	T	0.374	F	F	F
Europe & Middle East	d5	0.218	T	T	T	0.197	T	T	T	0.280	T	T	T
	d4	0.149	T	T	T	0.272	T	T	T	0.132	T	T	T
	d3	0.306	F	F	F	0.271	F	F	T	0.106	T	T	T
	d2	0.156	F	F	F	0.186	F	F	T	0.170	F	F	F
	d1	0.187	F	F	F	0.149	F	F	T	0.132	F	F	F
Latin America	d5	0.230	T	T	T	0.468	T	T	T	0.301	T	T	T
	d4	0.220	F	F	T	0.151	T	T	T	0.193	T	T	T
	d3	0.160	F	F	T	0.207	T	T	T	0.120	T	T	T
	d2	0.080	T	T	T	0.212	F	F	T	0.111	T	T	T
	d1	0.188	F	F	F	0.154	F	F	F	0.170	F	F	F
The World	d5	0.348	F	F	T	0.299	T	T	T	0.460	F	F	T
	d4	0.174	T	T	T	0.291	T	T	T	0.462	F	F	F
	d3	0.269	F	F	F	0.121	T	T	T	0.343	F	F	F
	d2	0.206	F	F	F	0.120	T	T	T	0.346	F	F	F
	d1	0.262	F	F	F	0.124	F	T	T	0.389	F	F	F
Emerging Markets	d5	0.203	T	T	T	0.521	T	T	T	0.365	F	T	T
	d4	0.159	T	T	T	0.142	T	T	T	0.189	T	T	T
	d3	0.155	F	F	T	0.151	T	T	T	0.096	T	T	T
	d2	0.108	F	F	T	0.100	T	T	T	0.178	F	F	F
	d1	0.149	F	F	F	0.140	F	F	T	0.150	F	F	F

Note: "T" indicates that the null hypothesis of variance homogeneity cannot be rejected, and "F" otherwise.

Table 6 Stock indices in local currency: Filtered data

(a) Selected Middle Eastern, African, and Asian country indices

		Whole sample				April 2000-2001				2002-March 2005			
	Scale	D	10%	5%	1%	D	10%	5%	1%	D	10%	5%	1%
Israel	d5	0.271	T	T	T	0.374	T	T	T	0.217	T	T	T
	d4	0.116	T	T	T	0.311	T	T	T	0.168	T	T	T
	d3	0.062	T	T	T	0.195	T	T	T	0.129	T	T	T
	d2	0.114	F	F	T	0.180	F	T	T	0.096	T	T	T
	d1	0.073	F	T	T	0.076	T	T	T	0.063	T	T	T
Turkey	d5	0.207	T	T	T	0.280	T	T	T	0.371	F	T	T
	d4	0.114	T	T	T	0.301	T	T	T	0.243	F	T	T
	d3	0.099	T	T	T	0.162	T	T	T	0.101	T	T	T
	d2	0.088	T	T	T	0.095	T	T	T	0.139	F	F	T
	d1	0.085	F	F	T	0.121	F	T	T	0.106	F	F	T
Morocco	d5	0.209	T	T	T	0.363	T	T	T	0.350	T	T	T
	d4	0.103	T	T	T	0.252	T	T	T	0.132	T	T	T
	d3	0.108	T	T	T	0.179	T	T	T	0.089	T	T	T
	d2	0.123	F	F	T	0.163	F	T	T	0.152	F	F	T
	d1	0.097	F	F	F	0.076	T	T	T	0.064	T	T	T
Egypt	d5	0.198	T	T	T	0.395	T	T	T	0.209	T	T	T
	d4	0.067	T	T	T	0.203	T	T	T	0.109	T	T	T
	d3	0.070	T	T	T	0.204	T	T	T	0.165	T	T	T
	d2	0.124	F	F	T	0.117	T	T	T	0.130	F	T	T
	d1	0.074	F	T	T	0.123	F	T	T	0.142	F	F	F
Jordan	d5	0.136	T	T	T	0.262	T	T	T	0.268	T	T	T
	d4	0.117	T	T	T	0.300	T	T	T	0.134	T	T	T
	d3	0.134	T	T	T	0.347	F	F	F	0.092	T	T	T
	d2	0.093	T	T	T	0.151	T	T	T	0.142	F	F	T
	d1	0.116	F	F	F	0.186	F	F	F	0.126	F	F	F
Pakistan	d5	0.194	T	T	T	0.549	T	T	T	0.471	F	F	T
	d4	0.160	T	T	T	0.253	T	T	T	0.097	T	T	T
	d3	0.135	T	T	T	0.111	T	T	T	0.229	F	F	F
	d2	0.073	T	T	T	0.121	T	T	T	0.101	T	T	T
	d1	0.061	T	T	T	0.129	F	F	T	0.088	F	T	T
Indonesia	d5	0.151	T	T	T	0.388	T	T	T	0.197	T	T	T
	d4	0.141	T	T	T	0.177	T	T	T	0.290	F	F	T
	d3	0.106	T	T	T	0.165	T	T	T	0.114	T	T	T
	d2	0.096	T	T	T	0.111	T	T	T	0.116	T	T	T
	d1	0.106	F	F	F	0.085	T	T	T	0.102	F	F	T

(b) Selected developed-country and international indices

		Whole sample				April 2000-2001				2002-March 2005			
	Scale	D	10%	5%	1%	D	10%	5%	1%	D	10%	5%	1%
United Kingdom	d5	0.215	T	T	T	0.290	T	T	T	0.144	T	T	T
	d4	0.146	T	T	T	0.338	T	T	T	0.176	T	T	T
	d3	0.105	T	T	T	0.176	T	T	T	0.071	T	T	T
	d2	0.077	T	T	T	0.145	T	T	T	0.102	T	T	T
	d1	0.076	F	F	T	0.071	T	T	T	0.073	T	T	T
Germany	d5	0.285	F	T	T	0.439	T	T	T	0.145	T	T	T
	d4	0.171	T	T	T	0.295	T	T	T	0.156	T	T	T
	d3	0.092	T	T	T	0.142	T	T	T	0.075	T	T	T
	d2	0.049	T	T	T	0.112	T	T	T	0.142	F	F	T
	d1	0.060	T	T	T	0.083	T	T	T	0.070	T	T	T
Spain	d5	0.290	F	T	T	0.367	T	T	T	0.274	T	T	T
	d4	0.116	T	T	T	0.345	T	T	T	0.188	T	T	T
	d3	0.069	T	T	T	0.189	T	T	T	0.164	T	T	T
	d2	0.112	F	F	T	0.161	T	T	T	0.100	T	T	T
	d1	0.074	F	T	T	0.076	T	T	T	0.075	T	T	T
Japan	d5	0.206	T	T	T	0.310	T	T	T	0.344	T	T	T
	d4	0.085	T	T	T	0.280	T	T	T	0.171	T	T	T
	d3	0.097	T	T	T	0.078	T	T	T	0.085	T	T	T
	d2	0.046	T	T	T	0.093	T	T	T	0.081	T	T	T
	d1	0.074	F	T	T	0.145	F	F	T	0.095	F	F	T
United States	d5	0.192	T	T	T	0.354	T	T	T	0.300	T	T	T
	d4	0.076	T	T	T	0.241	T	T	T	0.206	T	T	T
	d3	0.138	T	T	T	0.135	T	T	T	0.054	T	T	T
	d2	0.057	T	T	T	0.102	T	T	T	0.102	T	T	T
	d1	0.075	F	T	T	0.088	T	T	T	0.091	F	T	T
Europe & Middle East	d5	0.151	T	T	T	0.244	T	T	T	0.256	T	T	T
	d4	0.092	T	T	T	0.307	T	T	T	0.152	T	T	T
	d3	0.152	F	T	T	0.140	T	T	T	0.150	T	T	T
	d2	0.042	T	T	T	0.149	T	T	T	0.070	T	T	T
	d1	0.079	F	F	T	0.097	T	T	T	0.081	T	T	T
Latin America	d5	0.223	T	T	T	0.405	T	T	T	0.274	T	T	T
	d4	0.193	F	T	T	0.114	T	T	T	0.193	T	T	T
	d3	0.078	T	T	T	0.159	T	T	T	0.125	T	T	T
	d2	0.060	T	T	T	0.099	T	T	T	0.078	T	T	T
	d1	0.104	F	F	F	0.113	T	T	T	0.089	F	T	T
The World	d5	0.153	T	T	T	0.372	T	T	T	0.307	T	T	T
	d4	0.131	T	T	T	0.115	T	T	T	0.204	T	T	T
	d3	0.076	T	T	T	0.135	T	T	T	0.082	T	T	T
	d2	0.065	T	T	T	0.074	T	T	T	0.087	T	T	T
	d1	0.085	F	F	T	0.065	T	T	T	0.104	F	F	T
Emerging Markets	d5	0.210	T	T	T	0.478	T	T	T	0.214	T	T	T
	d4	0.080	T	T	T	0.103	T	T	T	0.200	T	T	T
	d3	0.094	T	T	T	0.102	T	T	T	0.134	T	T	T
	d2	0.065	T	T	T	0.070	T	T	T	0.111	T	T	T
	d1	0.081	F	F	T	0.076	T	T	T	0.093	F	T	T

Note: "T" indicates that the null hypothesis of variance homogeneity cannot be rejected, and "F" otherwise. Return series are filtered by univariate GARCH(1,1) models.

Table 7 Stock indices in US dollars: Raw data

(a) Selected Middle Eastern, African, and Asian country indices

		Whole sample				April 2000-2001				2002-March 2005			
	Scale	D	10%	5%	1%	D	10%	5%	1%	D	10%	5%	1%
Israel	d5	0.292	F	T	T	0.361	T	T	T	0.226	T	T	T
	d4	0.136	T	T	T	0.282	T	T	T	0.237	T	T	T
	d3	0.108	T	T	T	0.286	F	F	T	0.210	F	F	T
	d2	0.15	F	F	F	0.208	F	F	T	0.139	F	F	T
	d1	0.11	F	F	F	0.095	T	T	T	0.131	F	F	F
Turkey	d5	0.291	F	T	T	0.494	T	T	T	0.437	F	F	T
	d4	0.284	F	F	F	0.394	F	F	T	0.260	F	T	T
	d3	0.355	F	F	F	0.287	F	F	T	0.156	T	T	T
	d2	0.204	F	F	F	0.203	F	F	T	0.260	F	F	F
	d1	0.25	F	F	F	0.270	F	F	F	0.257	F	F	F
Morocco	d5	0.291	F	T	T	0.327	T	T	T	0.241	T	T	T
	d4	0.17	T	T	T	0.223	T	T	T	0.219	T	T	T
	d3	0.064	T	T	T	0.151	T	T	T	0.149	T	T	T
	d2	0.102	F	T	T	0.141	T	T	T	0.158	F	F	T
	d1	0.163	F	F	F	0.158	F	F	F	0.109	F	F	T
Egypt	d5	0.311	F	T	T	0.580	F	T	T	0.258	T	T	T
	d4	0.141	T	T	T	0.250	T	T	T	0.127	T	T	T
	d3	0.181	F	F	T	0.329	F	F	F	0.210	F	F	T
	d2	0.143	F	F	F	0.139	T	T	T	0.182	F	F	F
	d1	0.131	F	F	F	0.170	F	F	F	0.189	F	F	F
Jordan	d5	0.146	T	T	T	0.271	T	T	T	0.266	T	T	T
	d4	0.186	T	T	T	0.412	F	F	T	0.171	T	T	T
	d3	0.18	F	F	T	0.478	F	F	F	0.108	T	T	T
	d2	0.153	F	F	F	0.340	F	F	F	0.200	F	F	F
	d1	0.182	F	F	F	0.505	F	F	F	0.187	F	F	F
Pakistan	d5	0.356	F	F	T	0.632	F	F	T	0.574	F	F	F
	d4	0.215	F	F	T	0.287	T	T	T	0.183	T	T	T
	d3	0.238	F	F	F	0.252	F	T	T	0.375	F	F	F
	d2	0.146	F	F	F	0.197	F	F	T	0.217	F	F	F
	d1	0.143	F	F	F	0.186	F	F	F	0.202	F	F	F
Indonesia	d5	0.17	T	T	T	0.273	T	T	T	0.196	T	T	T
	d4	0.159	T	T	T	0.189	T	T	T	0.313	F	F	T
	d3	0.23	F	F	F	0.148	T	T	T	0.291	F	F	F
	d2	0.228	F	F	F	0.135	T	T	T	0.193	F	F	F
	d1	0.185	F	F	F	0.074	T	T	T	0.188	F	F	F

(b) Selected developed-country and international indices

		Whole sample				April 2000-2001				2002-March 2005			
	Scale	D	10%	5%	1%	D	10%	5%	1%	D	10%	5%	1%
United Kingdom	d5	0.275	T	T	T	0.363	T	T	T	0.545	F	F	F
	d4	0.218	F	F	T	0.272	T	T	T	0.484	F	F	F
	d3	0.304	F	F	F	0.136	T	T	T	0.376	F	F	F
	d2	0.267	F	F	F	0.214	F	F	T	0.446	F	F	F
	d1	0.259	F	F	F	0.208	F	F	F	0.394	F	F	F
Germany	d5	0.318	F	F	T	0.439	T	T	T	0.356	T	T	T
	d4	0.138	T	T	T	0.337	T	T	T	0.421	F	F	F
	d3	0.244	F	F	F	0.163	T	T	T	0.381	F	F	F
	d2	0.24	F	F	F	0.259	F	F	F	0.394	F	F	F
	d1	0.23	F	F	F	0.225	F	F	F	0.370	F	F	F
Spain	d5	0.291	F	T	T	0.267	T	T	T	0.438	F	F	T
	d4	0.223	F	F	T	0.364	F	T	T	0.282	F	F	T
	d3	0.25	F	F	F	0.200	T	T	T	0.271	F	F	F
	d2	0.239	F	F	F	0.172	F	T	T	0.353	F	F	F
	d1	0.247	F	F	F	0.111	T	T	T	0.350	F	F	F
Japan	d5	0.267	T	T	T	0.445	T	T	T	0.252	T	T	T
	d4	0.364	T	T	T	0.234	T	T	T	0.236	T	T	T
	d3	0.200	F	F	T	0.130	T	T	T	0.161	T	T	T
	d2	0.172	F	F	T	0.160	T	T	T	0.156	F	F	T
	d1	0.111	F	F	F	0.204	F	F	F	0.187	F	F	F
Europe & Middle East	d5	0.249	T	T	T	0.216	T	T	T	0.261	T	T	T
	d4	0.184	T	T	T	0.227	T	T	T	0.125	T	T	T
	d3	0.3	F	F	F	0.263	F	F	T	0.109	T	T	T
	d2	0.132	F	F	F	0.167	F	T	T	0.137	F	F	T
	d1	0.191	F	F	F	0.169	F	F	F	0.126	F	F	F
Latin America	d5	0.183	T	T	T	0.335	T	T	T	0.399	F	T	T
	d4	0.076	T	T	T	0.108	T	T	T	0.304	F	F	T
	d3	0.16	F	F	T	0.195	T	T	T	0.089	T	T	T
	d2	0.094	T	T	T	0.191	F	F	T	0.133	F	T	T
	d1	0.161	F	F	F	0.106	T	T	T	0.173	F	F	F
The World	d5	0.369	F	F	T	0.265	T	T	T	0.449	F	F	T
	d4	0.153	T	T	T	0.189	T	T	T	0.432	F	F	F
	d3	0.252	F	F	F	0.129	T	T	T	0.308	F	F	F
	d2	0.19	F	F	F	0.142	T	T	T	0.327	F	F	F
	d1	0.251	F	F	F	0.118	F	T	T	0.371	F	F	F
Emerging Markets	d5	0.224	T	T	T	0.429	T	T	T	0.422	F	F	T
	d4	0.139	T	T	T	0.132	T	T	T	0.158	T	T	T
	d3	0.16	F	F	T	0.148	T	T	T	0.126	T	T	T
	d2	0.09	T	T	T	0.106	T	T	T	0.164	F	F	F
	d1	0.15	F	F	F	0.125	F	T	T	0.136	F	F	F

Note: "T" indicates that the null hypothesis of variance homogeneity cannot be rejected, and "F" otherwise.

Table 8 Stock indices in US dollars: Filtered data

(a) Selected Middle Eastern, African, and Asian country indices

		Whole sample				April 2000-2001				2002-March 2005			
	Scale	D	10%	5%	1%	D	10%	5%	1%	D	10%	5%	1%
Israel	d5	0.29	F	T	T	0.367	T	T	T	0.274	T	T	T
	d4	0.116	T	T	T	0.345	T	T	T	0.188	T	T	T
	d3	0.069	T	T	T	0.189	T	T	T	0.164	T	T	T
	d2	0.112	F	F	T	0.161	T	T	T	0.100	T	T	T
	d1	0.074	F	T	T	0.076	T	T	T	0.075	T	T	T
Turkey	d5	0.176	T	T	T	0.353	T	T	T	0.396	F	T	T
	d4	0.114	T	T	T	0.343	T	T	T	0.203	T	T	T
	d3	0.087	T	T	T	0.178	T	T	T	0.098	T	T	T
	d2	0.07	T	T	T	0.096	T	T	T	0.152	F	F	T
	d1	0.106	F	F	F	0.184	F	F	F	0.133	F	F	F
Morocco	d5	0.264	T	T	T	0.394	T	T	T	0.261	T	T	T
	d4	0.162	T	T	T	0.160	T	T	T	0.231	T	T	T
	d3	0.062	T	T	T	0.148	T	T	T	0.084	T	T	T
	d2	0.074	T	T	T	0.127	T	T	T	0.102	T	T	T
	d1	0.075	F	T	T	0.084	T	T	T	0.083	T	T	T
Egypt	d5	0.232	T	T	T	0.468	T	T	T	0.247	T	T	T
	d4	0.06	T	T	T	0.166	T	T	T	0.084	T	T	T
	d3	0.078	T	T	T	0.235	F	T	T	0.148	T	T	T
	d2	0.126	F	F	T	0.094	T	T	T	0.134	F	F	T
	d1	0.065	T	T	T	0.101	T	T	T	0.125	F	F	F
Jordan	d5	0.136	T	T	T	0.257	T	T	T	0.241	T	T	T
	d4	0.12	T	T	T	0.280	T	T	T	0.127	T	T	T
	d3	0.137	T	T	T	0.353	F	F	F	0.098	T	T	T
	d2	0.089	T	T	T	0.148	T	T	T	0.143	F	F	T
	d1	0.116	F	F	F	0.187	F	F	F	0.121	F	F	F
Pakistan	d5	0.186	T	T	T	0.557	F	T	T	0.489	F	F	F
	d4	0.148	T	T	T	0.357	F	T	T	0.125	T	T	T
	d3	0.133	T	T	T	0.110	T	T	T	0.224	F	F	T
	d2	0.075	T	T	T	0.108	T	T	T	0.103	T	T	T
	d1	0.064	T	T	T	0.122	F	T	T	0.090	F	T	T
Indonesia	d5	0.179	T	T	T	0.271	T	T	T	0.196	T	T	T
	d4	0.133	T	T	T	0.175	T	T	T	0.287	F	F	T
	d3	0.167	F	F	T	0.145	T	T	T	0.175	F	T	T
	d2	0.162	F	F	F	0.130	T	T	T	0.123	F	T	T
	d1	0.119	F	F	F	0.062	T	T	T	0.113	F	F	F

(b) Selected developed-country and international indices

		Whole sample				April 2000-2001				2002-March 2005			
	Scale	D	10%	5%	1%	D	10%	5%	1%	D	10%	5%	1%
United Kingdom	d5	0.176	T	T	T	0.454	T	T	T	0.242	T	T	T
	d4	0.109	T	T	T	0.217	T	T	T	0.158	T	T	T
	d3	0.107	T	T	T	0.132	T	T	T	0.085	T	T	T
	d2	0.072	T	T	T	0.122	T	T	T	0.119	T	T	T
	d1	0.05	T	T	T	0.069	T	T	T	0.050	T	T	T
Germany	d5	0.157	T	T	T	0.482	T	T	T	0.210	T	T	T
	d4	0.095	T	T	T	0.175	T	T	T	0.179	T	T	T
	d3	0.069	T	T	T	0.147	T	T	T	0.096	T	T	T
	d2	0.046	T	T	T	0.107	T	T	T	0.124	F	T	T
	d1	0.048	T	T	T	0.066	T	T	T	0.053	T	T	T
Spain	d5	0.226	T	T	T	0.275	T	T	T	0.215	T	T	T
	d4	0.167	T	T	T	0.357	F	T	T	0.088	T	T	T
	d3	0.074	T	T	T	0.205	T	T	T	0.071	T	T	T
	d2	0.049	T	T	T	0.135	T	T	T	0.092	T	T	T
	d1	0.07	F	T	T	0.084	T	T	T	0.095	F	F	T
Japan	d5	0.182	T	T	T	0.403	T	T	T	0.330	T	T	T
	d4	0.058	T	T	T	0.245	T	T	T	0.136	T	T	T
	d3	0.111	T	T	T	0.117	T	T	T	0.084	T	T	T
	d2	0.05	T	T	T	0.085	T	T	T	0.077	T	T	T
	d1	0.058	T	T	T	0.131	F	F	T	0.070	T	T	T
Europe & Middle East	d5	0.176	T	T	T	0.259	T	T	T	0.230	T	T	T
	d4	0.081	T	T	T	0.213	T	T	T	0.178	T	T	T
	d3	0.165	F	F	T	0.185	T	T	T	0.152	T	T	T
	d2	0.05	T	T	T	0.163	F	T	T	0.062	T	T	T
	d1	0.095	F	F	F	0.101	T	T	T	0.096	F	F	T
Latin America	d5	0.163	T	T	T	0.363	T	T	T	0.327	T	T	T
	d4	0.097	T	T	T	0.122	T	T	T	0.199	T	T	T
	d3	0.106	T	T	T	0.172	T	T	T	0.096	T	T	T
	d2	0.044	T	T	T	0.113	T	T	T	0.089	T	T	T
	d1	0.098	F	F	F	0.088	T	T	T	0.079	T	T	T
The World	d5	0.237	T	T	T	0.308	T	T	T	0.275	T	T	T
	d4	0.097	T	T	T	0.162	T	T	T	0.185	T	T	T
	d3	0.074	T	T	T	0.124	T	T	T	0.064	T	T	T
	d2	0.047	T	T	T	0.094	T	T	T	0.091	T	T	T
	d1	0.091	F	F	F	0.064	T	T	T	0.104	F	F	T
Emerging Markets	d5	0.25	T	T	T	0.405	T	T	T	0.272	T	T	T
	d4	0.074	T	T	T	0.115	T	T	T	0.174	T	T	T
	d3	0.107	T	T	T	0.117	T	T	T	0.135	T	T	T
	d2	0.056	T	T	T	0.085	T	T	T	0.104	T	T	T
	d1	0.080	F	F	T	0.083	T	T	T	0.092	F	T	T

Note: "T" indicates that the null hypothesis of variance homogeneity cannot be rejected, and "F" otherwise. Return series are filtered by univariate GARCH(1,1) models.

Table 9 Wavelet-based volatility estimates of filtered returns

Filtered data in local currency

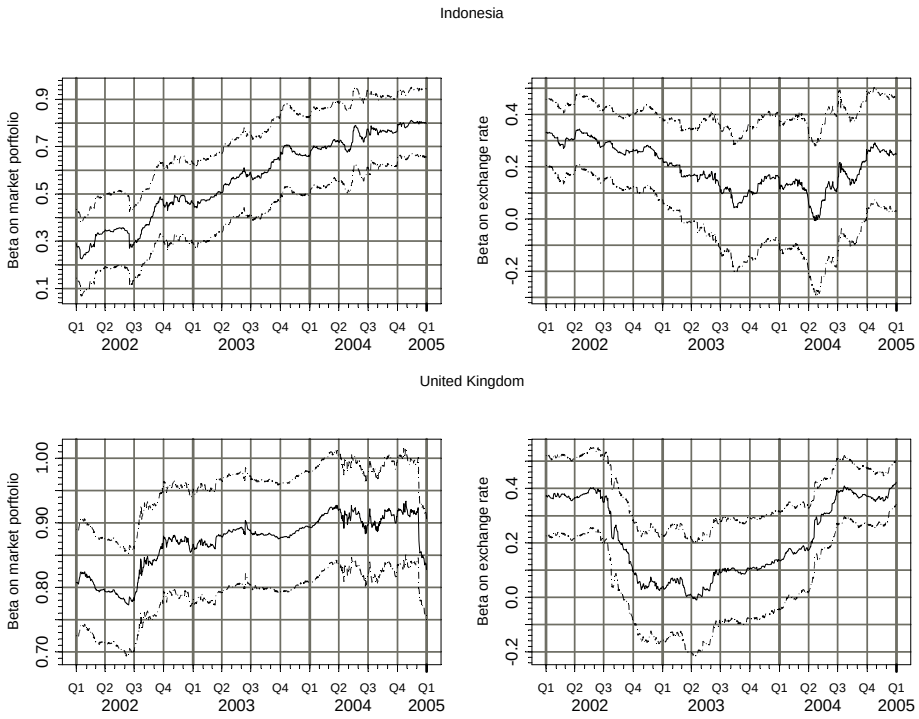
	U.K.		Spain		Middle East	
	Apr 00-01	02-Mar 05	Apr 00-01	02-Mar 05	Apr 00-01	02-Mar 05
Scale 1	0.714	0.693	0.709	0.698	0.707	0.709
Scale 2	0.521	0.530	0.511	0.505	0.495	0.496
Scale 3	0.337	0.368	0.338	0.365	0.352	0.342
Scale 4	0.250	0.214	0.283	0.249	0.242	0.242
Scale 5	0.135	0.168	0.126	0.202	0.160	0.194

Filtered data in US dollars

	Israel		Morocco		Latin America	
	Apr 00-01	02-Mar 05	Apr 00-01	02-Mar 05	Apr 00-01	02-Mar 05
Scale 1	0.693	0.701	0.693	0.700	0.713	0.696
Scale 2	0.500	0.504	0.490	0.500	0.497	0.503
Scale 3	0.361	0.399	0.373	0.364	0.343	0.347
Scale 4	0.228	0.217	0.237	0.282	0.255	0.245
Scale 5	0.221	0.145	0.225	0.188	0.138	0.180

Note: Wavelet-based variances are calculated for standardized residuals from univariate GARCH(1,1) models

Figure 1 Rolling estimates of market and currency risks for selected countries: 2002- March 2005



Note: Dashed lines represent a 95-percent confidence band. The data is daily.