MODELLING THE VOLATILITY IN MONTHLY INTERNATIONAL TOURIST ARRIVALS TO THE MALDIVES

Riaz Shareef

School of Economics and Commerce
University of Western Australia
Crawley, WA 6009
Australia

Michael McAleer

School of Economics and Commerce
University of Western Australia
Crawley, WA 6009
Australia

ABSTRACT

Tourism is the principal industry in the Maldives, accounting for more than thirty per cent of real GDP and more than sixty per cent of foreign exchange earnings. As over fifty-five percent of government tax revenue arises from tourism-related taxes, and monthly government budget financing depends largely on international tourist arrivals, the monitoring of daily, weekly and monthly international tourist arrivals is essential for fiscal policy evaluation. Over 500,000 tourists visited the Maldives in 2003. This paper examines the time series properties of monthly international tourist arrivals to the Maldives from 8 major tourist source countries, namely Italy, Germany, UK, Japan, France, Switzerland, Austria and the Netherlands from 1 January 1994 to 31 December 2003. The data are collected by the Department of Immigration and Emigration and disseminated by the Ministry of Tourism in the Maldives. Monthly international tourist arrivals and the associated uncertainties are estimated for the 8 principal tourist source countries. Univariate and multivariate time series models of conditional volatility (or uncertainty) are estimated and tested. The conditional correlations are estimated and examined to ascertain whether there is specialization, diversification or segmentation in the international tourism demand shocks from the major tourism source countries to the Maldives.

1 INTRODUCTION

The purpose of this paper is to model the uncertainty in monthly international tourist arrivals from the eight major tourist source countries to the Maldives. Maldives relies entirely on tourism for the economic well-being of the nation. Tourism accounts a substantial proportion of foreign exchange earnings, which enables importation of consumer as well as capital goods for economic development, leads to a significant share of government revenue, is a key determinant of development expenditure, and provides employment for a considerable proportion of the workforce.

This paper gives estimates of univariate symmetric and asymmetric models and static conditional correlations of logarithm and log-difference of monthly international tourist arrivals from tourist source countries to the Maldives. This gives an indication of the relationship between shocks to the growth rate of monthly international tourist arrivals, as well as the direction of causality in the monthly international tourist arrivals across the 8 main international tourist sources to the Maldives. For the Maldives, it is crucial to obtain an accurate estimate of the uncertainty surrounding monthly international tourist arrivals based on historical data. In this paper, we examine the associated volatilities of monthly tourist arrivals from the 8 major tourist source countries for the period 1994-2003.

2 OVERVIEW OF THE MALDIVIAN ECONOMY

The Republic of Maldives was a former British protectorate, which became independent in 1965. It is an archipelago in the Indian Ocean, comprising 1,192 islands, of which 199 are inhabited. The Exclusive Economic Zone of the Maldives is 859,000 square kilometres, and the aggregated land area is roughly 290 square kilometres. The total population of the Maldives is 270,101 in the 2000 census, and is estimated to have grown at 2.4 percent per annum over the period 1990 to 2000.

In spite of the small size, limited natural resource base, small population and remoteness, the Maldives has shown an impressive economic growth record over the last 20 years, with an average growth rate of 7 percent per annum. This growth rate enabled the Maldives to attain an estimated real per capita GDP of USD 2,261 in 2003, which is considerably above average for a small island developing country, which has an average per capita GDP of USD 1,500. The engine of growth in the Maldives has been the tourism industry, which is regarded as the most impor-

tant industry in the economy, accounting for one-fifth of GDP, a third of fiscal revenue, and two-thirds of gross foreign exchange earnings in recent years. The fisheries sector remains the largest sector in terms of employment, accounting for about one-quarter of the labour force. It is still an important source of foreign exchange earnings. Due to the high salinity content in the soil, agriculture continues to play a minor role. The government, which employs about 20 percent of the labour force, plays a dominant role in the economy, both in the production process and through its regulation of the economy

3 TRENDS AND COMPOSITION OF MONTHLY INTERNATIONAL TOURIST ARRIVALS

This section explains the trends in international tourist arrivals to the Maldives over the period 1981 to 2004, in which international tourist arrivals have recorded a growth rate of 9.7 percent per annum. Table1 gives an overview of the numbers of tourist arrivals and their respective shares in total international arrivals.

Over the same period, tourists from Europe, particularly Western Europe, showed an annual growth rate of 10.1 percent, 8.5 percent from Asian tourists, 10.1 percent in African tourists, 7.6 percent from the Americas, and 11.9 percent from tourists from Oceania. There are over 200 different tourist source countries for which the Ministry of Tourism maintains international tourist arrivals data. Of these tourist source countries, 21 are from Western Europe, 35 are from Eastern Europe, 13 are from South and South-East Asia, 25 are from the Middle East, 52 from Africa, 36 from South America, and 10 from Oceania.

The single biggest tourist source is Western Europe, which accounts for more than four-fifths of international tourist arrivals to the Maldives. In 2003, Italy was the single largest source country, while there was one tourist from each of the Vatican City, Burundi, Cape Verde, Comoros, Gambia, Guinea Bissau, Mali, Ecuador, Guatemala, Guyana, Samoa, Marshall Islands, New Caledonia, Norfolk Island, Solomon Islands and Tonga. Although UK was ranked fourth among the highest tourist generating countries during the period 1994-2004, it is also considered the most important tourist-source country because, British tourist arrivals have shown a continuously increasing linear trend. The single biggest emerging market is Russia, with an annual growth rate of 35.2 percent per annum over the period 1991-2003.

The top eight tourist generating countries to the Maldives over the period 1994-2004 were Italy, Germany, UK, Japan, France, Switzerland, Austria and The Netherlands. Tourists from Italy increased steadily at an annual rate of 14.5 percent during the period 1981 to 1992, while accounting for just over 21 percent of the total international tourist arrivals. From the beginning of the European recession in 1992, the growth rate of Italian tourist arrivals to the Maldives fell dramatically to 2.4 percent per annum until 1997. Thereafter, the annual growth rate recorded an all-time high of 15 percent per annum from 1998 to 2003, accounting for just over 20 percent of the total share of total tourist arrivals. Currently, Italy generates the highest number of tourist arrivals, and has also been the single biggest source country for six consecutive years since 1998.

Germany is the single most prominent tourist source country in the history of tourism in the Maldives, maintaining its dominance in the composition of tourist arrivals for seventeen consecutive years since 1981, with an average share of 27.7 percent and an annual growth rate of 9.4 percent. From 1998, Germany lost its dominance to Italy, coinciding with an average share of 16.7 percent during the period 1998-2004, while recording an annual growth rate of -1.2 percent per annum. The main purpose of German tourists to the Maldives is scuba diving.

British tourists have been keen visitors to the Maldives, accounting for the third largest tourist source country over the period 1981-2004. An analysis of British tourist arrival figures illustrates an increasing linear trend, accounting for an annual average share of 10.3 percent of the total international tourist arrivals, and leads to 16.1 percent annual growth rate. During the period 1981-1990, British tourist arrivals grew at 14.2 percent per annum, and then plummeted to 15,500 tourists in 1992 compared with 22,684 in 1990. From 1992 onwards, the annual growth rate in British tourist arrivals returned to the pre-slump growth rate of 14 percent. This slump was due to the 1991 Gulf War. In 2003, British tourists accounted for the second-highest number of international tourists from a single source.

Japanese tourists are well known for overseas travel due to their economic prosperity, change in lifestyles caused by increased disposable income, and stronger Yen, all of which contributed to the higher demand for international travel. Japan is one of the principal source markets for inbound tourism to the Maldives, and was the third highest tourist generating country during the period 1981-1996. This is due to the significant role played by the Japanese government in promoting overseas travel in order to reduce their large trade surpluses. To this effect, the Japanese government unveiled a program called the Ten Million People Program and established the International Tourism Institute of Japan to promote travel abroad. There was also a relaxation of Japanese emigration policies by making international bilateral agreements with countries so that overseas travel would become easier. However, during the period 1994-2003, Japan dropped to fourth position in market share, which is attributable to the effect of emerging source countries. Nevertheless, Japanese tourists have been recording an annual growth rate of 15.6 percent over

the last 23 years, with the exception of the 1998-1999 Asian economic and financial crises.

French tourists have been visiting the Maldives since the inception of tourism in the Maldives in 1972. France has been the fifth largest tourist source market throughout the last 23 years, and recorded an annual growth rate of 8.3 percent over the period. Although French tourists have been increasing in numbers, the share of French tourists has been declining, most notably during the period 1981-1988. Nevertheless, the share in tourist arrivals increased after 1988, but was hampered by the European recession of 1992 and continued to decline after 1997. After 1997, French tourist arrivals have been increasing steadily, and in 2003 their share reached a record 7.7 percent.

There has been an increasing trend in visitor arrivals from Switzerland over the last 23 years, accounting for an annual growth rate of 9.2 percent. The share of Swiss tourists to the Maldives has been changing dramatically over time, averaging 5.7 and 5.9 percent during the periods 1981-1993 and 1994-2004, respectively. The reasons for the erratic behaviour of the Swiss tourist market over the last 23 years are not entirely clear. However, the explanation for the declining share of Swiss tourist arrivals in the period 1991-1993 is the European recession, and for the period 1996 to 2000 it was due to the depreciation of the Swiss Franc.

Austria is the seventh largest tourist source country, accounting for nearly three percent of total international tourists to the Maldives. Over the last 23 years, the Austrian tourist arrival rate has grown at an impressive 8.4 percent per annum. During these 23 years, in the period 1981-1993 Austrian tourists arrived at 13.2 percent per annum due to inauguration of direct flights from Vienna to the Maldives in the late 1980s. Furthermore, during the period 1994-2003, the arrival rate dropped to a modest 3.4. This drop is explained by the negative annual growth rate of 11.6 percent during 1998-2001, accounting for the depreciation of the Austrian Shilling against major hard currencies. The trend for Austrian tourists has been declining in both the growth rate and the share of total tourist arrivals. This could be due to the faster growth rate of tourist arrivals from emerging markets such as Russia and other Eastern European states.

As given in Table 1, inbound tourism from The Netherlands has always remained in eighth position among the 8 major tourist source countries to the Maldives. The number of Dutch tourist arrivals has increased steadily over the last 23 years at an annual rate of 10.3 percent. Their share in total tourist arrivals has been changing over the same period, peaking at 2.6 percent in 1997. Dutch tourist travel has been highly susceptible to exchange rate movements in the Guilder against the other major currencies. This is evident during the period 1994-1997, when the arrival rate was 35 percent per annum, and was largely attributable to the appreciation of the Guilder. However, the current trend for Dutch tourist arrivals to the Maldives is declining.

4 CHARACTERISTICS OF MONTHLY INTERNATIONAL TOURIST ARRIVALS

For the analysis here, we use logarithms and log-differences of monthly international tourist arrivals from the 8 major tourist sources countries to the Maldives for the period 1994-2003. The data series in logarithms, log-differences and their associated uncertainties are examined.

Of the 8 major tourist source countries, Italy, UK, Japan, France, and Switzerland exhibit upward trends in the numbers and logarithms of tourist arrivals. The 5 countries show clear seasonal and cyclical patterns in these two series. There is strong evidence to suggest that the associated uncertainties or volatilities in monthly international tourist arrivals have strong correlations with the seasonality in tourism in the Maldives. In the logarithmic series there is evidence to show that there is uncertainty at the beginning of the series. For the UK, in logs, there is little evidence of volatility, except they appear at the end of the series. Uncertainty appears throughout the series and is largely influenced by seasonal variations for Japanese tourist arrivals. The uncertainty associated with French tourist arrivals is very similar to that of Italy, with noticeable variations towards the latter half of the sample. The volatilities in tourist arrivals from Switzerland are increasing in magnitude, together with the growth in arrivals.

Surprisingly, during the same period, Germany, Austria and The Netherlands show no clear trend. Interestingly, they show very similar seasonal patterns, owing to the fact that they are from Western Europe, which is the principal source of tourism to the Maldives. German tourist arrivals grew steadily for the three subsequent years after 1994, stagnated from 1997 to 1999, declined thereafter, and then increased the growth rate during the last three years of the sample period. Their associated volatilities have been widespread in levels, with clustering around 1995, 1998 and 2002, while in logs the clusterings are only apparent in 1996 and 2002. For Austria, tourist arrivals as well as their log counterparts increased steadily from 1994 to 1999, and then showed a sudden decline thereafter until the end of the sample period. The associated uncertainty in logs the volatilities are widespread during the first half of the series. As for The Netherlands, arrivals increased from 1994-1996. From 1997, there was a sudden surge in Dutch tourist arrivals, which was maintained at a high level until 2000, and then declined to the pre-1997 trend until the end of the sample period. In this series, there is clear evidence of a structural break in tourist arrivals through the influence of the value of the Dutch Guilder. Furthermore, during the period 1997-1999, the associated volatilities in the series have been quite profound, while in the case of logs, the volatilities appear in 1994 and immediately thereafter.

Log differences in monthly international tourist arrivals denote the growth rate in monthly international tourist arrivals. The growth rates are somewhat similar and are clearly stationary, and the associated volatilities in all 8 series show evidence of volatility clustering. From the annual difference series, the effect of 11 September 2001 is quite profound in all the series except for Austria, so that this global shock has clearly increased uncertainty in tourist arrivals immediately after the event. Furthermore, in the case of the log difference series, the associated volatilities cluster around September 2001 for Germany, UK, Japan, Switzerland and The Netherlands. However, for the remaining countries, there is not much evidence of volatility clustering.

It may be argued that the preferred series to model monthly international tourism demand to the Maldives is one which has a distribution closest to a normal distribution. In order to examine the validity of the preferred series, we examine the descriptive statistics of the logarithms of monthly international tourist arrivals and its log-difference.

For the logarithm of monthly international tourist arrivals the standard deviations of the series have become smaller relative to their counterparts in levels, while all the series are shown to be positively skewed, and with a smaller magnitude. The kurtosis for the eight different series is somewhat variable, with Italy, UK and France showing values that are close to 3. The null hypothesis of normality for the Jarque-Bera test is rejected only for UK and Japan.

As regards to the log-difference series, the standard deviations are relatively small and are similar in magnitude to the series in logs. The log-difference of the time series is all positively skewed, with similar magnitudes. The Jarque-Bera statistic reveals that the null hypothesis of normality is rejected only for Germany.

The above examination of the descriptive statistics suggests that the transformed series in logs and log-differences are optimal as these two series for the 8 tourism source markets reveal that they are closest to the normal distribution.

Prior to estimating the mean of the univariate time series, it is sensible to test for unit roots in the series as there are adverse consequences for estimation and inference in the presence of unit roots. In the classical regression model, it is assumed that the variables are stationary and that the errors of the regression model are stationary, with zero mean and finite variance. In the case where the series are non-stationary, the judgment would be otherwise and leads to a spurious regression (see Granger and Newbold (1974)). In this paper, we model univariate time series data where lagged dependent variables are included to capture dynamics. Furthermore, we will also model the conditional variance of the data generating process. If the series are non-stationary, then the variance of the data generating process will become infinitely large, so that statistical inference will be affected. In this context, we conduct the Phillips-Perron (1990) (PP) test for stationarity, with truncated lags of order 5 for each of the eight series in logarithms and log-differences.

The results of the test for the null hypothesis that monthly international tourist arrivals have a unit root are conducted with the critical values for the rejection of the null hypothesis of a unit root are -3.486 and -2.886 at the 1% and 5% levels of significance, respectively. The log of monthly international tourist arrivals from the UK has a unit root at the 1% significance level, whereas the null hypothesis is rejected at the 5% significance level. In the Dutch tourist arrivals series to the Maldives, the test suggests they are non-stationary at both the 1% and 5% significance levels. However, there is strong evidence against the presence of unit roots for each of the countries in log-difference series.

5 THE MEAN MODEL

An important task is to model the conditional mean. In order to estimate the conditional variance h_t accurately, we need to obtain accurate estimates of the unconditional shocks ε_t. Univariate time series data on monthly international tourist arrivals show a considerable degree of habit persistence. The literature on univariate time series analysis of international tourism demand has shown that the Box and Jenkins (1970) Autoregressive Moving Average or (ARMA) specifications typically fit the data reasonably well.

Considering the analysis described above, ARMA (*p*,*q*) specifications of the following general form have been chosen:

$$LogTA_t = ARMA(p,q) + \sum_{i=1}^{12} \phi D_{it} + \sum_{1}^{12} \theta D_t t + \varepsilon_t \qquad (1)$$

$$Vol(\varepsilon_t) = \varepsilon_t^2$$

$$\Delta \log TA_t = ARMA(p,q) + \sum_{i=1}^{12} \phi D_{it} + \sum_{1}^{12} \theta D_t t + \varepsilon_t \qquad (2)$$

$$Vol(\varepsilon_t) = \varepsilon_t^2$$

where $\log TA_t$ and $\Delta \log TA_t$ are logarithm of monthly international tourist arrivals and the log-difference (growth rate) of monthly tourist arrivals at time *t*. D_{it} (=1, 2, … 12 and is equal to zero elsewhere) denotes seasonal dummies; t=1 to T, where T=120 for all eight series. $D_i t$ is the seasonal dummy multiplied by the deterministic time trend to capture the trend effect of the seasonal dummies, particularly for Italy and Austria.

Several models have been tested and fitted to determine the most appropriate ARMA process to describe monthly international tourist arrivals from the 8 major tourist source countries to the Maldives over the period 1994 to 2003. The choice of model that best explains monthly international tourists to the Maldives is chosen on the basis of the statistical significance (at the 5% level) of the AR and MA coefficients, of the seasonal dummy variables, and the absence of serial correlation in the unconditional shocks. Furthermore, the empirical models are chosen according to the Box-Jenkins (1971) model selection criteria of the lowest values of AIC and SBC.

6 EMPIRICAL EVALUATION

McAleer (2005) provides an extensive comparison of univariate and multivariate conditional volatility models, including a discussion of the regularity conditions required for sensible empirical practice.

Univariate GARCH and GJR models are estimated for monthly international tourist arrivals, log of monthly international tourist arrivals, annual differences of monthly international tourist arrivals, and log-differences (the growth rate) of monthly international tourist arrivals, from each of the 8 major tourist source countries to the Maldives. The univariate and multivariate empirical results from the estimated models enable validation of the regularity conditions underlying the model, highlight the importance of the uncertainty surrounding monthly international tourist arrivals from the 8 major tourist sources to the Maldives, and evaluate them for policy analysis. This paper provides, for the first time, estimates of static conditional correlations between monthly international tourist arrivals from a pair of tourist source countries to the Maldives. These results give an indication of the relationship between shocks to the number of monthly international tourist arrivals, log of monthly international tourist arrivals, annual difference of monthly international tourist arrivals, and the growth rate of monthly international tourist arrivals. Furthermore, the direction of causality in these measures of monthly international tourist demand across the 8 main international tourist source countries to the Maldives is evaluated. For the Maldives, it is vital to obtain an accurate estimate of the uncertainty surrounding monthly international tourist arrivals based on historical data.

The univariate ARMA(p,q)-GARCH(1,1) and ARMA(p,q)-GJR(1,1) models are used to estimate the log of monthly international tourist arrivals and the growth rate of monthly international tourist arrivals. Table 2 and 3 presents the empirical results for the conditional variances of log and log-difference of monthly international tourist arrivals.

All the estimates in this chapter are obtained using EViews 4.1. The Berndt, Hall, Hall, and Hausman (BHHH) (1974) algorithm has been used in most cases, but the Marquardt algorithm is used when the BHHH algorithm does not converge. Several different sets of initial values have been used in each case, but do not lead to substantial differences in the estimates. The asymptotic and robust t-ratios (see Bollerslev and Wooldridge (1992) for the derivation of the robust standard errors) for the QMLE are reported in Tables 1 and 2. There are 3 entries for each estimate, namely the coefficient (in bold), the Bollerlev-Wooldridge (1992) robust t-ratio, and the asymptotic t-ratio. In general, the robust t-ratios are smaller in absolute value than their asymptotic counterparts.

The estimates of the conditional mean for the ARMA(p,q)-GARCH(1,1) model for the log of monthly international tourist arrivals and the growth rate of monthly international tourist arrivals for the 8 main tourist source markets, are not presented due to reasons of brevity but are available on request.

The conditional mean estimations are obtained through the general-to-specific modelling procedure, in which insignificant variables are excluded until a parsimonious specification is achieved. It is evident from the results that there is a very strong degree of habit persistence in the monthly international tourist arrivals, with the AR(1) coefficients being very close to 1, and highly significant. This result is consistent with the findings in the literature. There is also strong evidence to suggest that tourism to the Maldives is highly seasonal, with tourist arrivals being significantly concentrated in the peak tourist season, which coincides with the European winter months. In the case of the Netherlands, there is strong evidence to suggest there is seasonality in the log and log-difference series. In the log-difference series, for Italy, Switzerland and Austria, the trended seasonal dummies are found to be more significant than non-trended ones.

For the GARCH(1,1) estimates of the conditional variance of the log of monthly international tourist arrivals, both the log-moment and the second moment conditions are satisfied, so that the consistency and asymptotic normality of the QMLE are guaranteed. Interesting, the results demonstrate that there is strong evidence of long-run persistence ($\alpha + \beta$) as the GARCH(1) coefficients are relatively large and highly significant. The short-run persistence, or the ARCH effect, is only significant for Japan, Switzerland, Austria and the Netherlands. The GJR(1,1) estimates for the log of monthly international tourist arrivals series show that both moment conditions are met only for Germany, Japan, France, Switzerland and the Netherlands. For Italy, the UK and Austria, only the log-moment condition is satisfied, so that the QMLE are consistent and asymptotically normal. The asymmetric effects are somewhat mixed in the case of the log of monthly international tourist arrivals for Italy, Germany, UK, Japan, France, and Austria. For Italy, Germany, Japan, and Austria, if there is

a shock to the log of international tourist arrivals, the uncertainty becomes greater, while it is lower for the UK and France. This interpretation is plausible for Germany, Austria and the UK, because Germany and Austria seem to show no clear trend or pattern, while the UK shows a more consistent pattern with a strong linear trend in the arrivals over the sample period.

For the log-difference, or the growth rate in monthly international tourist arrivals, the estimates for GARCH(1,1) and GJR (1,1) are displayed in Tables 2. Except for Germany and Austria, both the second moment and log-moment conditions are satisfied, guaranteeing that the QMLE are consistent and asymptotically normal. These estimates also show that there are significant and strong GARCH effects, while there is evidence of ARCH effects only in the case of Italy, Germany, Japan and Austria. These results are quite similar to what was found for the log-arrivals series. The estimates for GJR(1,1) are significant for all countries, except for the UK, where there is a negative coefficient estimate. These results show that, if there is a decline in the anticipated growth rate in monthly international tourist arrivals from the 8 major markets, apart from the UK, there is going to be significant uncertainty about the growth rate in the long run, while for the UK the reverse is true.

From the empirical results obtained for the ARMA(p,q)-GARCH(1,1) and ARMA(p,q)-GJR(1,1) models it can be observed from the conditional mean estimates that, on average, there is very strong habit persistence and seasonality in monthly tourist arrivals to the Maldives from the eight major tourist source countries. From the conditional variance estimates, it was observed that there is a very strong and significant GARCH effect and a relatively low ARCH effect. This implies that, in general, given any unanticipated shocks to monthly international tourist arrivals to the Maldives from the 8 main tourist source countries, the effect of that shock will last for a considerable period of time. It can also be noticed from the empirical results that, across the series modelled, asymmetric effects are not very profound, and hence no useful information can be obtained from the ARMA(p,q)-GJR(1,1) model. Among the preferred models is the ARMA(p,q)-GARCH(1,1) model, all of which are preferred, except for the annual differences series as the obtained results are relatively weak compared with the models estimated for the other three series. The empirical results for the log-series are the best, followed by the log-differenced series and finally the series in levels.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the financial support of the Australian Research Council. The first author also wishes to thank the C.A. Vargovic Memorial Fund at the University of Western Australia.

REFERENCES

Berndt, E.K., Hall, B.H., Hall, R.E. and Hausman, J. (1974), 'Estimation and Inference in Nonlinear Structural Models', *Annals of Economic and Social Measurement*, 3, 653-665.

Bollerslev, T. (1986), 'Generalised Autoregressive Conditional Heteroscedasticity', *Journal of Econometrics*, 31, 307-327.

Bollerslev, T., Chou, R.Y. and Kroner, K.F. (1992), 'ARCH Modelling in Finance: A Review of the Theory and Empirical Evidence', *Journal of Econometrics*, 52, 5-59.

Bollerslev, T., Engle, R.F. and Nelson, D.B. (1994), 'ARCH Models' in R.F Engle and D.L McFadden (eds.), *Handbook of Econometrics*, 4, (North Holland-Amsterdam), pp. 2961-3038.

Bollerslev, T. and Woodridge, J.M. (1992), 'Quasi-maximum Likelihood Estimation and Inference in Dynamic Models with Time-Varying Covariances', *Econometric Reviews*, 11, 143-173.

Engle, R.F. (1982), 'Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation', *Econometrica*, 50, 987-1007.

Glosten, L., Jagannathan, R. and Runkle, D. (1992), 'On the Relation Between the Expected Value and Volatility of Nominal Excess Return on Stocks', *Journal of Finance*, 46, 1779-1801.

Granger, C.W.J and Newbold, P (1974), 'Spurious Regressions in Econometrics', *Journal of Econometrics*, 2, 111-120.

Jeantheau, T. (1998), 'Strong Consistency of Estimators for Multivariate ARCH Models', *Econometric Theory*, 14, 70-86.

Li, W.K., Ling, S. and McAleer, M. (2002), 'Recent Theoretical Results for Time Series Models with GARCH Errors', *Journal of Economic Surveys*, 16, 245-269. Reprinted in M. McAleer and L. Oxley (eds.), *Contributions to Financial Econometrics: Theoretical and Practical Issues*, Blackwell, Oxford, 2002, 9-33.

Ling, S. and McAleer, M. (2002a), 'Necessary and Sufficient Moment Conditions for GARCH (r,s) and Asymmetric Power of GARCH(r,s) Models', *Econometric Theory*, 18, 722-729.

Ling, S. and McAleer, M. (2002b), 'Stationary and the Existence of Moments of a Family of GARCH Processes', *Journal of Econometrics*, 106, 109-117.

Ling, S. and McAleer, M. (2003), 'Asymptotic Theory for a Vector ARMA-GARCH Model', *Econometric Theory*, 19, 278-308.

McAleer, M (2005), 'Automated Inference and Leaning in Modeling Financial Volatility', *Econometric Theory*,21, 232-261.

McAleer, M., Chan, F. and Marinova, D. (2003), 'An Econometric Analysis of Asymmetric Volatility: Theory and Applications to Patents', to appear in *Journal of Econometrics.*

Nelson, D.B. (1991), 'Conditional Heteroscedasticity in Asset Returns: A New Approach', *Econometrica*, 59, 347-370.

Phillips, P.C.B and Perron, P (1988), 'Testing for a Unit Root in Time Series Regression', *Biometrica*, 75(2), 335-346.

Shephard, N. (1996), 'Statistical Aspects of ARCH and Stochastic Volatility', in O.E. Barndorff-Nielsen, D.R. Cox and D.V. Hinkley (eds.), *Statistical Models in Econometrics, Finance and Other Fields*, Chapman & Hall, London, pp. 1-67.

RIAZ SHAREEF is a PhD Candidate in the School of Economics and Commerce, University of Western Australia. His research interests are in tourism economics, tourism management, country risk, applied econometrics, and applied time series analysis.

MICHAEL MCALEER is Professor of Economics (Econometrics) in the School of Economics and Commerce, University of Western Australia. His research interests are in econometrics, financial econometrics, finance, statistics, time series analysis, intellectual property, integrated environmental systems, environmental risk, and tourism research.

Table 1: Tourist Arrivals and Shares, 1981-2003

1981-1993			**1994-2003**		
Source	**Head Count**	**% Share**	**Source**	**Head Count**	**% Share**
1. Germany	451,803	24.62	1. Italy	852,389	20.78
2. Italy	347,019	18.91	2. Germany	730,453	17.81
3. Japan	134,207	7.31	3. UK	603,501	14.72
4. UK	126,716	6.91	4. Japan	381,374	9.30
5. France	112,063	6.11	5. France	238,638	5.82
6. Switzerland	104,392	5.69	6. Switzerland	237,245	5.79
7. Austria	69,296	3.78	7. Austria	118,324	2.89
8. The Netherlands	23,251	1.27	8. The Netherlands	60,011	1.46
Total International Tourist Arrivals	1,835,037	100	Total International Tourist Arrivals	4,101,028	100

Table 2: Univariate GARCH (1,1) and GJR(1,1) Models of Logarithm of Tourist Arrivals

Country	GARCH(1,1)					GJR(1,1)						
				Moment							Moment	
	ω	α	β	Second	Log	ω	α	γ	β	α+γ/2	Second	Log
Italy	**-1.5E-04**	**0.069**	**0.918**	**-0.013**	**0.988**	**1.1E-03**	**-0.153**	**0.647**	**0.870**	**0.171**	**-0.097**	**1.041**
	-0.308	1.766	21.274			0.316	-1.301	2.321	22.274			
	-0.367	1.452	19.147			3.718	-2.565	3.455	17.136			
Germany	**2.1E-04**	**0.117**	**0.878**	**-0.018**	**0.995**	**1.1E-03**	**-0.240**	**0.334**	**0.948**	**-0.073**	**-0.234**	**0.875**
	0.452	1.494	9.091			1.953	-3.486	3.425	10.796			
	0.619	1.555	8.39			2.291	-2.208	2.902	16.651			
UK	**0.001**	**0.05**	**0.864**	**-0.092**	**0.915**	**1.8E-04**	**0.111**	**-0.233**	**1.008**	**-0.005**	**-0.016**	**1.003**
	0.65	1.57	8.477			0.430	1.408	-1.989	17.874			
	0.5	0.765	4.031			0.417	1.828	-2.050	11.892			
Japan	**0.001**	**0.266**	**0.697**	**-0.101**	**0.963**	**1.9E-03**	**-0.118**	**0.464**	**0.793**	**0.114**	**-0.177**	**0.907**
	0.897	1.851	4.911			2.593	-1.561	2.690	7.696			
	1.32	1.826	5.591			2.314	-2.144	1.970	9.047			
France	**0.001**	**0.068**	**0.895**	**-0.041**	**0.964**	**0.012**	**0.127**	**-0.282**	**0.380**	**-0.014**	**-1.055**	**0.365**
	0.46	0.798	5.77			1.103	0.903	-1.599	0.668			
	0.552	1.558	8.765			2.211	1.105	-2.123	1.155			
Switzerland	**0.001**	**0.072**	**0.883**	**-0.05**	**0.955**	**0.001**	**-0.048**	**0.208**	**0.919**	**0.056**	**-0.040**	**0.974**
	0.499	2.02	15.044			1.191	-0.959	1.707	14.861			
	0.739	1.24	8.734			0.473	-0.620	1.718	7.123			
Austria	**-0.001**	**0.047**	**0.949**	**-0.003**	**0.996**	**0.010**	**-0.207**	**0.940**	**0.789**	**0.264**	**-0.253**	**1.052**
	-4.165	7.33	4.249			3.602	-3.076	3.009	17.844			
	-4.188	1.1	3.437			2.473	-4.593	2.796	7.122			
Netherlands	**0.007**	**0.177**	**0.634**	**-0.244**	**0.811**	**0.006**	**0.139**	**0.088**	**0.663**	**0.183**	**-0.201**	**0.846**
	0.754	1.116	1.821			0.736	0.889	0.398	2.123			
	1.454	2.156	3.562			1.462	1.491	0.580	4.432			

Table 3: Univariate GARCH (1,1) and GJR(1,1) Models of Log-differences of Tourist Arrivals

Country	GARCH(1,1)					GJR(1,1)						
				Moment							Moment	
	ω	α	β	Second	Log	ω	α	γ	β	α+γ/2	Second	Log
Italy	**-3.3E-04**	**0.080**	**0.910**	**-0.011**	**0.990**	**-6.3E-05**	**-0.136**	**0.500**	**0.906**	**0.114**	**-0.040**	**1.020**
	-1.061	2.039	24.057			-0.515	-2.107	2.948	30.794			
	-1.717	1.387	18.701			-0.662	-3.833	3.352	24.701			
Germany	**3.3E-04**	**0.370**	**0.680**	**-0.040**	**1.050**	**-3.2E-05**	**-0.123**	**0.200**	**1.046**	**-0.023**	**0.243**	**1.345**
	0.488	1.899	4.397			-0.099	-2.372	4.350	16.493			
	1.239	1.622	4.532			-3.466	-2.574	3.366	27.037			
UK	**2.4E-04**	**0.050**	**0.927**	**-0.023**	**0.977**	**9.8E-04**	**0.076**	**-0.231**	**0.992**	**-0.040**	**-0.382**	**0.645**
	0.828	1.165	7.200			0.824	1.202	-0.933	7.371			
	0.498	1.106	16.497			1.701	1.333	-2.722	16.077			
Japan	**9.0E-04**	**0.208**	**0.762**	**-0.069**	**0.970**	**1.6E-03**	**-0.176**	**0.456**	**0.836**	**0.052**	**-0.150**	**0.888**
	1.118	2.082	9.182			2.629	-2.546	4.197	10.449			
	1.060	1.459	5.847			2.542	-2.616	2.667	15.518			
France	**1.6E-03**	**0.064**	**0.893**	**-0.044**	**0.957**	**3.1E-02**	**-0.143**	**0.850**	**0.285**	**0.283**	**-1.061**	**0.568**
	1.129	1.325	13.717			3.406	-2.555	2.931	1.765			
	0.658	1.468	10.916			2.850	-3.656	1.900	1.487			
Switzerland	**7.3E-04**	**0.078**	**0.884**	**-0.039**	**0.963**	**-3.7E-04**	**-0.114**	**0.244**	**1.014**	**0.008**	**0.019**	**1.022**
	0.860	1.511	13.718			-0.518	-6.561	5.309	12.997			
	0.714	1.497	10.566			-0.123	-0.681	1.595	3.270			
Austria	**-9.6E-04**	**0.079**	**0.922**	**-0.001**	**1.000**	**9.2E-03**	**-0.173**	**0.700**	**0.718**	**0.177**	**-0.271**	**0.895**
	-4.100	2.259	31.370			2.717	-1.171	2.750	3.109			
	-3.171	1.493	16.574			1.844	-2.966	2.027	3.598			
Netherlands	**1.5E-03**	**0.020**	**0.939**	**-0.040**	**0.959**	**-0.002**	**-0.026**	**0.088**	**1.026**	**0.018**	**0.038**	**1.044**
	0.378	0.409	6.685			-1.478	-7.255	2.290	38.902			
	0.436	0.591	9.165			-0.271	-0.282	0.735	4.941			