McAleer, Michael; Shareef, Riaz; da Veiga, Bernardo

Working Paper
Risk Management of Daily Tourist Tax Revenues for the Maldives

Nota di Lavoro, Fondazione Eni Enrico Mattei, No. 137.2005

Provided in Cooperation with:
Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: McAleer, Michael; Shareef, Riaz; da Veiga, Bernardo (2005) : Risk Management of Daily Tourist Tax Revenues for the Maldives, Nota di Lavoro, Fondazione Eni Enrico Mattei, No. 137.2005

This Version is available at:
http://hdl.handle.net/10419/74130

Terms of use:
Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.
Risk Management of Daily Tourist Tax Revenues for the Maldives
Michael McAleer, Riaz Shareef and Bernardo da Veiga

NOTA DI LAVORO 137.2005

NOVEMBER 2005
NRM – Natural Resources Management

Michael McAleer, Riaz Shareef and Bernardo da Veiga,
School of Economics and Commerce
University of Western Australia

This paper can be downloaded without charge at:
The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm
Social Science Research Network Electronic Paper Collection:
http://ssrn.com/abstract=855924

The opinions expressed in this paper do not necessarily reflect the position of Fondazione Eni Enrico Mattei
Corso Magenta, 63, 20123 Milano (I), web site: www.feem.it, e-mail: working.papers@feem.it
Risk Management of Daily Tourist Tax Revenues for the Maldives

Summary
International tourism is the principal economic activity for Small Island Tourism Economies (SITEs). There is a strongly predictable component of international tourism, specifically the government revenue received from taxes on international tourists, but it is difficult to predict the number of international tourist arrivals which, in turn, determines the magnitude of tax revenue receipts. A framework is presented for risk management of daily tourist tax revenues for the Maldives, which is a unique SITE because it relies entirely on tourism for its economic and social development. As these receipts from international tourism are significant financial assets to the economies of SITEs, the time-varying volatility of international tourist arrivals and their growth rate is analogous to the volatility (or dynamic risk) in financial returns. In this paper, the volatility in the levels and growth rates of daily international tourist arrivals is investigated.

Keywords: Small Island Tourism Economies (SITEs), International tourist arrivals, Tourism tax, Volatility, Risk, Value-at-Risk (VaR), Sustainable Tourism-@-Risk (ST@R)

JEL Classification: G18, C32, L83, D81

The first author is most grateful for the financial support of the Australian Research Council, the second author wishes to acknowledge a UWA Research Fellowship, and the third author is most grateful for the financial support of an International Postgraduate Research Scholarship and University Postgraduate Award at UWA.

This paper was presented at the Second International Conference on "Tourism and Sustainable Economic Development - Macro and Micro Economic Issues" jointly organised by CRENoS (Università di Cagliari and Sassari, Italy) and Fondazione Eni Enrico Mattei, Italy, and supported by the World Bank, Chia, Italy, 16-17 September 2005.

Address for correspondence:

Michael McAleer
School of Economics and Commerce (M251)
University of Western Australia
35 Stirling Highway
WA 6009 Crawley
Australia
Phone: +61 0 8 6488 3400
Fax: +61 0 8 6488 1016
E-mail: Michael.McAleer@uwa.edu.au
Risk Management of Daily Tourist Tax Revenues for the Maldives

Michael McAleer, Riaz Shareef and Bernardo da Veiga

School of Economics and Commerce
University of Western Australia

June 2005

Corresponding author:

Michael McAleer
School of Economics and Commerce (M251)
University of Western Australia
35 Stirling Highway
Crawley
WA 6009
Australia

Tel: +61 (0)8 6488 3400
Fax: +61 (0)8 6488 1016
Email: Michael.McAleer@uwa.edu.au

Michael McAleer: Professor of Economics (Econometrics) at the University of Western Australia; Adjunct Professor, Department of Economics and Department of Mathematics and Statistics, University of Canterbury, New Zealand; and Adjunct Professor, Faculty of Science, Australian National University. He has published widely in theoretical and applied econometrics, theoretical and applied statistics, time series analysis, financial econometrics, empirical finance, methodology, integrated environmental modelling, intellectual property, and tourism research.

Riaz Shareef: Post-doctoral Research Fellow in the School of Economics and Commerce, University of Western Australia. His research interests are in applied econometrics, time series analysis, and tourism modelling, and he has published in Mathematics and Computers in Simulation and Tourism Economics. He is a member of the International Association for Mathematics and Computers in Simulation, Modelling and Simulation Society of Australia and New Zealand, and International Environmental Modelling and Software Society.

Bernardo da Veiga: PhD candidate in the School of Economics and Commerce, University of Western Australia. His research interests are in financial econometrics, risk management, and tourism research. He is a member of the International Association for Mathematics and Computers in Simulation, Modelling and Simulation Society of Australia and New Zealand, International Environmental Modelling and Software Society, Association for Investment Management and Research, and Professional Risk Managers' International Association.

*The first author is most grateful for the financial support of the Australian Research Council, the second author wishes to acknowledge a UWA Research Fellowship, and the third author is most grateful for the financial support of an International Postgraduate Research Scholarship and University Postgraduate Award at UWA.
1. Introduction

International tourism is widely regarded as the principal economic activity in Small Island Tourism Economies (SITEs) (see Shareef (2004) for a comprehensive discussion). Historically, SITEs have been dependent on international tourism for economic development, employment, and foreign exchange, among other economic indicators. A unique SITE is the Maldives, an archipelago of 1190 islands in the Indian Ocean, of which 202 are inhabited by the indigenous population of 261,000 and 89 islands are designated for self-contained tourist resorts. The Maldivian economy depends entirely on tourism, and accounts directly for nearly 38 per cent of real GDP. Employment in tourism accounts for 20 per cent of the working population and 65 per cent of foreign exchange earnings.

Any shock that would adversely affect international tourist arrivals to the Maldives would affect earnings from tourism dramatically, and have disastrous ramifications for the entire economy. An excellent example is the impact of the 2004 Boxing Day Tsunami, which sustained extensive damage to the tourism-based economy of the Maldives and reduced dramatically the number of tourist arrivals in the post-Tsunami period. Therefore, it is vital for the government of the Maldives, multilateral development agencies such as the World Bank and the Asian Development Bank who are assisting Maldives in the Tsunami recovery effort, and the industry stakeholders, namely the resort owners and tour operators, to obtain accurate estimates of international tourist arrivals and their variability. Such accurate estimates would provide vital information for government policy formulation, international development aid, profitability and marketing.

A significant proportion of research in the literature on empirical tourism demand has been based on annual data (see Shareef (2004)), but such analyses are useful only for long-term development planning. An early attempt to improve the short-term analysis of tourism was undertaken by Shareef and McAleer (2005), who modelled the volatility (or predictable uncertainty) in monthly international tourist arrivals to the Maldives. Univariate and multivariate time series models of conditional volatility were estimated and tested. The conditional correlations were estimated and examined to ascertain whether there was specialisation, diversification or segmentation in the international tourism demand shocks from the major tourism source countries to the Maldives. In a similar vein, Chan et al. (2005)
modelled the time-varying means, conditional variances and (constant) conditional correlations of the logarithms of the monthly arrival rate for the four leading tourism source countries to Australia.

In this paper, daily international arrivals to the Maldives and the number of tourist in residence are analysed for the period 1994-2003. The data are obtained from the Ministry of Tourism of the Maldives. In the literature, there does not seem to have been any empirical research using daily tourism arrivals data. One advantage of using daily data is that it avoids stochastic seasonality that is prevalent in monthly or quarterly time series data. In the absence of stochastic seasonality, we observe volatility clusterings in the number of international tourist arrivals and their associated growth rates. Therefore, it is useful to analyse daily tourism arrivals data, much like financial data, in terms of the time series patterns, since such an analysis would provide policy makers and the industry stakeholders with accurate indicators of their short-term objectives.

In virtually all SITEs, and particularly the Maldives, tourist arrivals or growth in tourist arrivals translates directly into a financial asset. In the Maldives, every international tourist is required to pay USD 10 for every tourist bed-night spent in the Maldives. This levy is called a ‘tourism tax’ and comprises over 60% of government revenue. Hence, tourism tax revenue is a principal determinant of development expenditure. As a significant financial asset to the economy of SITEs, and particularly so in the case of the Maldives, the volatility in tourist arrivals and their growth rate is identical conceptually to the volatility in financial returns, otherwise known as financial risk.

This paper models the volatilities in the number of tourist arrivals, tourist in residence and their growth rates. The purpose of this analysis of volatility is to present a framework for managing the risks inherent in the variability of total tourist arrivals, tourist in residence and hence government revenue through the modelling and forecasting of Value-at-Risk (VaR) thresholds for the number of tourist arrivals, tourist in residence and their growth rates. This paper provides the first application of the VaR portfolio approach to manage the risk associated with tourism revenues.

The structure of the paper is as follows. In Section 2, the economy of the Maldives is described. This is followed in Section 3 by an assessment of the impact of the 2004 Boxing
Day Tsunami on tourism in the Maldives. The concept of Value-at-Risk (VaR) is analysed in Section 4, the data are discussed in Section 5, the models of volatility are presented in Section 6, the empirical results are examined in Section 7, forecasting is undertaken in Section 8, and some concluding remarks are given in Section 9.

2. Study: The Tourism Economy of the Maldives

An archipelago in the Indian Ocean, the Maldives comprises 1,190 islands, of which 200 are inhabited. It was a former British protectorate, which became independent in 1965. The Exclusive Economic Zone of the Maldives is 859,000 square kilometres, and the aggregated land area is roughly 290 square kilometres. In the 2000 census, the total population was 270,101, and is estimated to have grown at 2.4 percent per annum over the period 1990-2000.

The Maldives has shown an impressive economic growth record, with an average growth rate of 7 per cent per annum over the last two decades. This record economic performance has been achieved largely due to the growing tourism demand to the Maldives. Furthermore, economic growth has enabled Maldivians to enjoy an estimated real per capita GDP of USD 2,261 in 2003, which is considerably above average for small island developing countries, with an average per capita GDP of USD 1,500. The engine of growth in the Maldives has been the tourism industry, accounting for 37 percent of GDP, more than one-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, and 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.

Tourism in the Maldives has a direct impact on fiscal policy, which determines development expenditure. More than one-fifth of government revenue arises from tourism-related levies. The most important tourism-related revenues are the tourism tax, the resort lease rents, resort land rents, and royalties. Except for the tourism tax, the other sources of tourism-related revenues are based on contractual agreements with the government of the Maldives. Tourism tax is levied on every occupied bed night from all tourist establishments, such as hotels,
tourist resorts, guest houses and safari yachts. Initially, this tax was levied at USD 3 in 1981, and was then doubled to USD 6 in 1988. After 16 years with no change in the tax rate, from 1 November 2004 the tax rate was increased to USD 10. This tax is regressive as it does not take into account the profitability of the tourist establishments. Furthermore, it fails to take account of inflation, such that the tax yield has eroded over time.

Tourism tax is collected by the tourist establishments and is deposited at the Inland Revenue Department at the end of every month. This current revenue is used directly to finance the government budget on a monthly basis. Since the tax is levied directly on the tourist, any uncertainty that surrounds international tourist arrivals will affect tax receipts, and hence fiscal policy. Any adverse affect on international tourist arrivals may also result in the suspension of planned development expenditures.

The nature of tourist resorts in the Maldives is distinctive as they are built on islands that have been set aside for tourism development. Tourism development is the greatest challenge in the history of Maldives, and has led to the creation of distinctive resort islands. Domroes (1985, 1989, 1993, 1999) asserts that these islands are deserted and uninhabited, but have been converted into ‘one-island-one-hotel’ schemes. The building of physical and social infrastructure of the resort islands has had to abide by strict standards to protect the flora, fauna and the marine environment of the islands, while basic facilities for sustainability of the resort have to be maintained. The architectural design of the resort islands in the Maldives varies profoundly in their character and individuality. Only twenty percent of the land area of any given island is allowed to be developed, which is imposed to restrict the capacity of tourists on every island. All tourist accommodation must face a beach front area of five metres. In most island resorts, bungalows are built as single or double units. Recently, there has been an extensive development of water bungalows on stilts along the reefs adjacent to the beaches. All the conveniences for tourists are available on each island, and are provided by the onshore staff.

3. Impact of the 2004 Boxing Day Tsunami on Tourism in the Maldives

As the biggest ever national disaster in the history of the Maldives, the 2004 Boxing Day Tsunami caused widespread damage to the infrastructure on almost all the islands. The World
Bank, jointly with the Asian Development Bank [World Bank (2005a)], declared that the total damage of the Tsunami disaster was USD 420 million, which is 62 per cent of the annual GDP. In the short run, the Maldives will need approximately USD 304 million to recover fully from the disaster to the pre-tsunami state.

A major part of the damage was to housing and tourism infrastructure, with education and fisheries sectors also severely affected. Moreover, the World Bank damage assessment highlighted that significant losses were sustained in water supply and sanitation, power, transportation and communications. Apart from tourism, the largest damage was sustained by the housing sector, with losses close to USD 65 million. Approximately, 1,700 houses were destroyed, another 3,000 were partially damaged, 15,000 inhabitants were fully displaced, and 19 of the 202 inhabited islands were declared uninhabitable.

The World Bank also stated that the tourism industry would remain a major engine of the economy, and that the recovery of this sector would be vital for the Maldives to return to higher rates of economic growth, full employment and stable government revenue. In the Asian Development Bank report, similar reactions were highlighted by stating that it would be vitally important to bring tourists back in full force, as tourism is the most significant contribution to GDP. In fact, tourism means everything to the Maldivian economy.

In the initial macroeconomic impact assessment undertaken by the World Bank, the focus was only on 2005. The real GDP growth rate was revised downward from 7 per cent to 1 per cent, consumer prices were expected to rise by 7 per cent, the current account balance was to double to 25 per cent of GDP, and the fiscal deficit was to widen to 11 per cent of GDP, which is unsustainable, unless the government were to implement prudent fiscal measures.

The 2004 Boxing Day Tsunami also caused widespread destruction and damage to countries such as Indonesia, India and Sri Lanka. Compared with the damage caused to the Maldives, the destruction which occurred in these other countries is substantially different in terms of its scale and nature. In India, widespread socioeconomic and environmental destruction was caused in the eastern coast affecting the states of Andhra Pradesh, Kerala and Tamil Nadu, and the Union Territory (UT) of Pondicherry. The Tsunami struck with 3- to 10-metre waves and penetrated as far as 3 kilometres inland, affecting 2,260 kilometres of coastline (World
Bank (2005b)). Nearly 11,000 people died in India. The tsunami also adversely affected the earning capacity of some 645,000 people whose principal economic activity is fisheries.

According to the damage assessment report published in World Bank (2005c), nearly 110,000 lives were lost in Indonesia, 700,000 people were displaced, and many children were orphaned. The total estimate of damages and losses from the catastrophe amounted to USD 4.45 billion, of which 66 per cent constituted damages, while 34 per cent constituted losses in terms of income flows to the economy. Furthermore, total damages and losses amounted to 97 per cent of Aceh’s GDP. Although Aceh’s GDP derives primarily from oil and gas, which were not affected, and most livelihoods rely primarily on fisheries and agriculture, this was still a catastrophic event.

In Sri Lanka, the human costs of the disaster were also phenomenal, with more than 31,000 people killed, nearly 100,000 homes destroyed, and 443,000 people remaining displaced. The economic cost amounted to USD 1.5 billion dollars, which is approximately 7 per cent of annual GDP (World Bank (2005d)). As in India, Indonesia and the Maldives, the tsunami affected the poorest Sri Lankans, who work in the fisheries industry, and some 200,000 people lost their employment in the tourism industry.

Compared with all the tsunami-stricken countries, the Maldives was affected entirely as a result of its geophysical nature. When the tsunami struck, the Maldives was, for a moment, wiped off the face of the earth.

4. Value-at-Risk and Tourism

Value-at-Risk (VaR) is a procedure designed to forecast the maximum expected negative return over a target horizon, given a (statistical) confidence limit, (see Jorion (2000) for a discussion). Put simply, VaR measures an extraordinary loss on an ordinary or typical day. VaR is used widely to manage the risk exposure of financial institutions and is a requirement of the Basel Capital Accord (see Basel Committee (1988, 1995, 1996)). The central idea underlying VaR is that, by forecasting the worst possible return for each day, institutions can be prepared for the worst case scenario. In the case of the banking industry, or authorized
deposit-taking institutions, more generally, such an insurance policy can help avoid bank runs, which can be devastating to the economy if they result in widespread bank failures.

In the case of SITEs such as the Maldives, where tourism revenue is a major source of income and foreign exchange reserves, it is important to understand the risks associated with this particular source of income, and to implement adequate risk management policies to ensure economic stability and sustained growth. Forecasted VaR figures can be used to estimate the level of reserves required to sustain desired long term government projects and foreign exchange reserves. Furthermore, an understanding of the variability of tourist arrivals, and hence tourism related revenue, is critical for any investor planning to invest in or lend funds to SITEs.

Formally, a VaR threshold is the lower bound of a confidence interval in terms of the mean. For example, suppose interest lies in modelling the random variable $Y_t$, which can be decomposed as:

$$Y_t = E(Y_t | F_{t-1}) + \varepsilon_t.$$  

This decomposition suggests that $Y_t$ is comprised of a predictable component, $E(Y_t | F_{t-1})$, which is the conditional mean, and a random component, $\varepsilon_t$. The variability of $Y_t$, and hence its distribution, is determined entirely by the variability of $\varepsilon_t$. If it is assumed that $\varepsilon_t$ follows a distribution such that:

$$\varepsilon_t : D(\mu_t, \sigma_t)$$

where $\mu_t$ and $\sigma_t$ are the unconditional mean and standard deviation of $\varepsilon_t$, respectively, these can be estimated using numerous parametric and/or non-parametric procedures. The procedure used in this paper is discussed in Section 6. Therefore, the VaR threshold for $Y_t$ can be calculated as:

$$VaR_t = \mu_t - \alpha \sigma_t$$
where $\alpha$ is the critical value from the distribution of $\varepsilon_i$ that gives the correct confidence level. Alternatively, $\sigma_i$ can be replaced by alternative estimates of the variance (see Section 6 below). For further details, see McAleer et al. (2005) for a formal development, specifically the Sustainable Tourism@Risk (or ST@R) model.

5. Data Issues

The data used in this paper are total daily international tourist arrivals from 1 January 1994 to 31 December 2003, and were obtained from the Ministry of Tourism of the Maldives. As can be seen in Table 1, there were over four million tourists during this period, with Italy being the largest tourist source country. Tourists from Western Europe accounted for more than 80 per cent of tourists to the Maldives, with Russia as the biggest emerging market.

A distinct advantage of using daily data is that it avoids stochastic seasonality that is prevalent in monthly or quarterly time series data. However, for weekly data, there is evidence of strong seasonality, where the peak tourist season corresponding to the European winter months and weaker seasonality evident in the European summer months. In the absence of stochastic seasonality, volatility clustering can be observed in the number of international tourist arrivals and their associated growth rates.

There exists a direct relationship between the daily total number of tourists in residence and the daily tourism tax revenue. Modelling the variability of daily arrivals can be problematic as institutional factors, such as predetermined weekly flight schedules, lead to excessive variability and significant day-of-the-week effects. This problem can be resolved in one of two ways. Weekly tourist arrivals could be examined, as this approach removes both the excess variability inherent in daily total arrivals and day-of-the-week effects. However, this approach is problematic as it leads to substantially fewer observations being available for estimation and forecasting. A second solution, and one that is adopted in this paper, is to calculate the daily tourists in residence. This daily total is of paramount importance to the Government of the Maldives as it has a direct effect on the tourism tax revenue received. The tourists in residence series are calculated as the seven-day rolling sum of the daily tourist...
arrivals series, which assumes that tourists stay in the Maldives for seven days, on average. This is a reasonable assumption as the typical tourist stays in the Maldives for approximately 7 days, according to the Ministry of Tourism of the Maldives.

The graphs for daily tourist arrivals, weekly tourist arrivals and tourists in residence are given in Figures 1-3, respectively. All three series display high degrees of variability and seasonality, as would be expected of tourist arrivals data. As would be expected, the highest levels of tourism arrivals in the Maldives occur during the European winters, while the lowest levels occur during the European summers. The descriptive statistics for each series are given in Table 2. The daily tourist arrivals series display the greatest variability, with a mean of 1,122 arrivals per day, a maximum of 4,118 arrivals per day, and a rather low minimum of 23 arrivals per day. Furthermore, the daily arrivals series have a coefficient of variation (CoV) of 0.559, which is nearly twice the CoV of the other two series. The weekly arrivals and tourists in residence series are remarkably similar, with virtually identical CoV values of 0.3 and 0.298, respectively.

As the focus of this paper is on managing the risk associated with the variability in tourist arrivals and tourist tax revenues, the paper focuses on modelling the growth rates, namely the returns in both total tourist arrivals and total tourists in residence. The graphs for the returns in total daily tourist arrivals, total weekly tourist arrivals and total daily tourists in residence are given in Figures 4-6, respectively. The descriptive statistics for the growth rates of the three series are given in Table 3. Daily tourist arrivals display the greatest variability, with a standard deviation of 81.19, a maximum of 368.23%, and a minimum of -412.57%. Each of the series is found to be non-normally distributed, based on the Jarque-Bera Lagrange multiplier statistic for normality.
6. Volatility Models

The primary inputs required for calculating a VaR threshold are the forecasted variance, which is typically given as a conditional volatility, and the critical value of the distribution for a given level of significance. Several models are available for measuring and forecasting the conditional volatility. In this paper, the symmetric Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model of Bollerslev (1986), and the asymmetric GJR model of Glosten, Jagannathan and Runkle (1992), which discriminates between positive and negative shocks to the tourist arrivals series, will be used to forecast the required conditional volatilities.

The GJR\((p,q)\) model is given as:

\[
Y_t = E(Y_t \mid F_{t-1}) + \epsilon_t \\
\epsilon_t = h_t^{1/2}\eta_t \\
h_t = \omega + \sum_{i=1}^p (\alpha_i \epsilon_{i,t-1}^2 + \gamma_i I(\eta_{t,i}) \epsilon_{i,t-1}^2) + \sum_{i=1}^q \beta_i h_{i,t-1} \\
I(\eta_{t,i}) = \begin{cases} 
1, & \epsilon_{i,t} \leq 0 \\
0, & \epsilon_{i,t} > 0
\end{cases}
\]

where \(F_t\) is the information set available to time \(t\), and \(\eta_t \sim iid(0,1)\). The four equations in the model state the following: (i) the growth in tourist arrivals depends on its own past values; (ii) the shock to tourist arrivals has a predictable conditional variance component, \(h_t\), and an unpredictable component, \(\eta_t\); (iii) the conditional variance depends on its own past values and the recent shocks to the growth in the tourist arrivals series; and (iv) the conditional variance is affected differently by positive and negative shocks to the growth in tourist arrivals.

In this paper, \(Y_t = E(Y_t \mid F_{t-1}) + \epsilon_t\) is modelled as a simple AR(1) process. For the case \(p = q = 1, \ \omega > 0, \ \alpha_i \geq 0, \ \alpha_i + \gamma_i \geq 0, \ \beta_i \geq 0\) are sufficient conditions to ensure a strictly
positive conditional variance, \( h_t > 0 \). The ARCH (or \( \alpha_t + \frac{1}{2} \gamma_t \)) effect captures the short run persistence of shocks (namely, an indication of the strength of the shocks in the short run), and the GARCH (or \( \beta_t \)) effect indicates the contribution of shocks to long run persistence \( (\alpha_t + \frac{1}{2} \gamma_t + \beta_t) \) (namely, an indication of the strength of the shocks in the long run). For the GJR(1,1) model, \( \alpha_t + \frac{1}{2} \gamma_t + \beta_t < 1 \) is a sufficient condition for the existence of the second moment, which is necessary for sensible empirical analysis. Restricting \( \gamma_t = 0 \) in the GJR(1,1) model leads to the GARCH(1,1) model of Bollerslev (1986). For the GARCH(1,1) model, the second moment condition is given by \( \alpha_t + \beta_t < 1 \).

In the GJR and GARCH models, the parameters are typically estimated using the maximum likelihood estimation (MLE) method. In the absence of normality of the standardized residuals, \( \eta_t \), the parameters are estimated by the Quasi-Maximum Likelihood Estimation (QMLE) method (for further details see, for example, Li, Ling and McAleer (2002) and McAleer (2005)). The second moment conditions are also sufficient for the consistency and asymptotic normality of the QMLE of the respective models.

7. Empirical Results

The variable of interest for the Maldivian Government is the number of tourists in residence at any given day as this figure is directly related to tourism revenue. In this section, the tourists in residence series are used to estimate the GARCH(1,1) and GJR(1,1) models described in Section 6. All estimation was conducted using the EViews 5 econometric software package, though similar results were obtained using the RATS package. The models are estimated using QMLE for the case \( p=q=1 \).

The estimated GJR(1,1) equation for the tourists in residence series for the full sample is given as follows:

\[
Y_t = 0.001 + 0.1561Y_{t-1}^{+}
\]

\[
(0.0541) \quad (0.0169)
\]
where the figures in parentheses are standard errors. All the parameters are estimated to be positive and significant, which indicates that the model provides an adequate fit to the data. As \( \gamma \) is estimated to be positive and significant, it appears that volatility is affected asymmetrically by positive and negative shocks, with previous negative shocks having a greater impact on volatility than previous positive shocks of a similar magnitude.

The estimated GARCH(1,1) equation for the tourists in residence series for the full sample is given as follows:

\[
h_t = 0.592 + 0.121 e_{t-1}^2 + 0.048 I e_{t-1}^2 + 0.803 h_{t-1},
\]

\[
Y_t = 0.001 + 0.156 Y_{t-1}
\]

Furthermore, as the respective estimates of the second moment conditions, \( \alpha + \frac{1}{2} \gamma + \beta < 1 \) for GJR(1,1) and \( \alpha + \beta < 1 \) for GARCH(1,1), are satisfied, the QMLE are consistent and asymptotically normal. This means that the estimates are statistically adequate and sensible for purposes of interpretation.

8. Forecasting

A rolling window is used to forecast the 1-day ahead conditional variances and VaR thresholds for the tourists in residence, with the sample ranging from 7 January 1994 to 31 December 2003. In order to strike a balance between efficiency in estimation and a viable number of rolling regressions, the rolling window size is set at 1,000, which leads to a forecasting period from 3 May 1997 to 31 December 2003. Using the notation developed in the previous sections, the VaR threshold forecast for the growth rate of tourists in residence at any given time \( t \) is given by:
\[ \text{VaR}_i = E(Y_i \mid F_{t-1}) - \alpha \sqrt{h_i}, \]

where \( E(Y_i \mid F_{t-1}) \) is the forecasted expected growth rate of total tourists in residence, and \( h_i \) is the forecasted conditional variance of the growth rate in total tourist arrivals.

Figures 7 and 8 give the forecasted variances for both models. As can be seen from the figures, the forecasts are quite similar, with a correlation coefficient of 0.98. The forecasted VaR thresholds are given in Figures 9 and 10, respectively. As discussed in Section 2, the forecasted VaR threshold represents the maximum expected negative growth rate that could be expected given a specific confidence level. As is standard in the finance literature, where many of these techniques were developed, this paper uses a 1% level to calculate the VaR. In other words, growth rates smaller than the forecasted VaR should only be observed in 1% of all forecasts, which is referred to as the correct “conditional coverage”. The results show that, in using the GJR (GARCH) model, we observe 32 (30) instances where the actual daily growth rate is smaller than the forecasted VaR threshold. Based on a Likelihood Ratio test, both models display the correct conditional coverage. In addition, Figures 11 and 12 give the second moment conditions for each rolling window of both models. As the condition is satisfied for every rolling window, this provides greater confidence in the statistical adequacy of the two estimated models. Finally, both models lead to the same average VaR at -6.59%, which means that, on average, the lowest possible daily growth rate in tourists in residence, and hence in tourist tax revenues, is -6.59%, given a 99% level of significance.

9. Conclusion

In the Maldives, tourist arrivals and the growth in tourist arrivals translate directly into a financial asset for the Government, as each international tourist is required to pay USD 10 for every tourist bed-night spent in the Maldives. This levy is called a ‘tourism tax’ and enters directly into government revenue, so that tourism tax revenue is a principal determinant of development expenditure. As a significant financial asset to the economy of SITEs, and particularly so in the case of the Maldives, the volatility in tourist arrivals and in their growth rates are conceptually equivalent to the volatility in financial returns, which is more commonly known as financial risk.
Daily international arrivals to the Maldives and their associated growth rates were analysed for the period 1994-2003. This seems to be the first analysis of daily tourism arrivals and growth rates data in the tourism research literature. The primary purpose for analysing volatility was to model and forecast the Value-at-Risk (VaR) thresholds for the number of tourist arrivals and their growth rates. This would also seem to be the first paper in the tourism research literature to have applied the VaR portfolio approach to manage the risks associated with tourism revenues.

The empirical results based on two widely-used conditional volatility models showed that volatility was affected asymmetrically by positive and negative shocks, with previous negative shocks to the growth in tourist arrivals having a greater impact on volatility than previous positive shocks of a similar magnitude. The forecasted VaR threshold represented the maximum expected negative growth rate that could be expected given a specific confidence level. Both conditional volatility models led to the same average VaR at -6.59%, which meant that, on average, the lowest possible growth rate in tourists in residence, and hence in tourist tax revenues, was -6.59%. This should be useful information for both private and public tourist providers in the Maldives.
References

Basel Committee on Banking Supervision

1995 An Internal Model-Based Approach to Market Risk Capital Requirements. BIS: Basel, Switzerland.


Bollerslev, T.

Chan, F., C. Lim and M. McAleer

Domroes, M.


Glosten, L.R., R. Jagannathan, and D.E. Runkle
Jorion, P.

Li, W.K., S. Ling and M. McAleer

McAleer, M.

McAleer, M., R. Shareef and B. da Veiga
2005 ST@R: A Model of Sustainable Tourism@Risk. Unpublished paper, School of Economics and Commerce, University of Western Australia.

Shareef, R.

Shareef, R. and M. McAleer
2005 Modelling the Uncertainty in International Tourist Arrivals to the Maldives. Under revision for Tourism Management.

World Bank
2005b Counting the Cost: Rebuilding Lives and Property in India after the Tsunami.
http://web.worldbank.org/WSBSITE/EXTERNAL/COUNTRIES/EXTTSUNAMI/0,,con
2005c Indonesia: Preliminary Damage and Loss Assessment, The 26 December 2004 Natural Disaster.

2005d Counting the Cost: A first look at what it will take to rebuild lives
Figure 4: Growth Rates in Daily Tourist Arrivals

Figure 5: Growth Rates in Weekly Tourist Arrivals

Figure 6: Growth Rates in Daily Tourist in Residence
Figure 7: GJR Variance Forecasts for Tourists in Residence

Figure 8: GARCH Variance Forecasts for Tourist in Residence

Figure 9: Growth Rates for Tourist in Residence and GJR VaR Thresholds
Figure 10: Growth Rates for Tourist in Residence and GARCH VaR Thresholds

Figure 11: Rolling Second Moment Condition for GJR

Figure 12: Rolling Second Moment Condition for GARCH
Table 1. Composition of Tourist Arrivals, 1994-2003

<table>
<thead>
<tr>
<th>Source Country</th>
<th>Head Count</th>
<th>% Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Italy</td>
<td>852,389</td>
<td>20.78</td>
</tr>
<tr>
<td>2. Germany</td>
<td>730,453</td>
<td>17.81</td>
</tr>
<tr>
<td>3. UK</td>
<td>603,501</td>
<td>14.72</td>
</tr>
<tr>
<td>4. Japan</td>
<td>381,374</td>
<td>9.30</td>
</tr>
<tr>
<td>5. France</td>
<td>238,638</td>
<td>5.82</td>
</tr>
<tr>
<td>6. Switzerland</td>
<td>237,245</td>
<td>5.79</td>
</tr>
<tr>
<td>7. Austria</td>
<td>118,324</td>
<td>2.89</td>
</tr>
<tr>
<td>8. The Netherlands</td>
<td>60,011</td>
<td>1.46</td>
</tr>
<tr>
<td>Total International Tourist Arrivals</td>
<td>4,101,028</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 2: Descriptive Statistics

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Daily Arrivals</th>
<th>Weekly Arrivals</th>
<th>Tourists in Residence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1,122</td>
<td>7,833</td>
<td>7,699</td>
</tr>
<tr>
<td>Median</td>
<td>1,007</td>
<td>7,510</td>
<td>7,430</td>
</tr>
<tr>
<td>Maximum</td>
<td>4,118</td>
<td>14,942</td>
<td>15,517</td>
</tr>
<tr>
<td>Minimum</td>
<td>23</td>
<td>3,316</td>
<td>3,145</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>627</td>
<td>2,351</td>
<td>2,293</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.087</td>
<td>0.535</td>
<td>0.593</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>4.436</td>
<td>2.784</td>
<td>2.981</td>
</tr>
<tr>
<td>CoV</td>
<td>0.559</td>
<td>0.300</td>
<td>0.298</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>1033</td>
<td>25.808</td>
<td>201.597</td>
</tr>
</tbody>
</table>
Table 3: Descriptive Statistics for Growth Rates

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Daily Arrivals</th>
<th>Weekly Arrivals</th>
<th>Tourists in Residence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.010</td>
<td>0.163</td>
<td>5.24e-12</td>
</tr>
<tr>
<td>Median</td>
<td>-7.66</td>
<td>-0.027</td>
<td>-0.039</td>
</tr>
<tr>
<td>Maximum</td>
<td>368.23</td>
<td>50.37</td>
<td>26.34</td>
</tr>
<tr>
<td>Minimum</td>
<td>-412.57</td>
<td>-38.45</td>
<td>-20.64</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>81.19</td>
<td>11.66</td>
<td>3.21</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.143</td>
<td>0.344</td>
<td>0.283</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.01</td>
<td>4.95</td>
<td>8.76</td>
</tr>
<tr>
<td>CoV</td>
<td>8,119</td>
<td>71.53</td>
<td>6.12e11</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>12.44</td>
<td>92.61</td>
<td>4,799.9</td>
</tr>
</tbody>
</table>
NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

Our Note di Lavoro are available on the Internet at the following addresses:
http://www.feem.it/Feem/Pub/Publications/WPapers/default.html
http://www.repec.org

NOTE DI LAVORO PUBLISHED IN 2004

IEM 1.2004 Anil MARKANDYA, Suzette PEDROSO and Alexander GOLUB: Empirical Analysis of National Income and So2 Emissions in Selected European Countries
ETA 2.2004 Masakisa FUJITA and Shlomo WEBER: Strategic Immigration Policies and Welfare in Heterogeneous Countries
PRA 3.2004 Adolfo Di CARLUCCIO, Giovanni FERRI, Cecilia FRALE and Ottavio RICCHI: Do Privatizations Boost Household Shareholding? Evidence from Italy
ETA 4.2004 Victor GINSBURGH and Shlomo WEBER: Languages Disenfranchisement in the European Union
PRA 7.2004 Sandro BRUSCO, Giuseppe LOPOMO and S. VISWANATHAN (lxv): Merger Mechanisms
PRA 8.2004 Wolfgang AUSSENNEGG, Pegaret PICHLER and Alex STOPMER (lxv): IPO Pricing with Bookbuilding, and a When-Issued Market
PRA 9.2004 Pegaret PICHLER and Alex STOPMER (lxv): Primary Market Design: Direct Mechanisms and Markets
PRA 11.2004 Bjarne BRENDSTRUP and Harry J. PAARSCH (lxv): Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders
PRA 12.2004 Ohad KADAN (lxv): Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values
PRA 13.2004 Maarten C.W. JANSSEN (lxv): Auctions as Coordination Devices
PRA 14.2004 Gadi FIBICH, Arieh GAVIOUS and Aner SELA (lxv): All-Pay Auctions with Weakly Risk-Averse Buyers
PRA 15.2004 Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (lxv): Competition and Cooperation in Divisible Good Auctions: An Experimental Examination
CCMP 16.2004 Marta STRYSZOWSKA (lxv): Late and Multiple Bidding in Competing Second Price Internet Auctions
NRM 17.2004 Slim Ben YOUSSEF: R&D in Cleaner Technology and International Trade
NRM 18.2004 Angela ANTOCI, Simone BORGHESI and Paolo RUSSU (lxvi): Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamics
NRM 20.2004 Jacqueline M. HAMILTON (lxvii): Climate and the Destination Choice of German Tourists
NRM 22.2004 Pius ODUNGA and Henk FOLMER (lxvii): Profiling Tourists for Balanced Utilization of Tourism-Based Resources in Kenya
NRM 23.2004 Jean-Jacques NOWAK, Mondher SAHLI and Pasquale M. SGRO (lxviii): Tourism, Trade and Domestic Welfare
NRM 25.2004 Juan Luis EUGENIO-MARTÍN, Noelia MARTÍN MORALES and Riccardo SCARPA (lxv): Tourism and Economic Growth in Latin American Countries: A Panel Data Approach
NRM 26.2004 Raúl Hernández MARTÍN (lxv): Assessing the Effectiveness of Tradable Landuse Rights for Biodiversity Conservation: An Application to Canada’s Boreal Mixedwood Forest
An Application to the Recreational Value of Forests

Gernot KLEPPER and Sonja PETERSON:

Andrea BIGANO and Stef PROOST:

Timo GOESCHL and Tun LIN

(lxvi): Biodiversity Conservation on Private Lands: Information Problems and

Signe ANTHON and Bo JELLESMARK THORSEN

(lxvi): Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits


Ekin BIROL, Ágnes GYOVAI and Melinda SMALE (lxvi): Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transition al Economy

Gernot KLEPPER and Sonja PETERSON: The EU Emissions Trading Scheme: Allowance Prices, Trade Flows, Competitiveness Effects

Scott BARRETT and Michael HOEL: Optimal Disease Eradication

Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG: Simple Priorities and Core Stability in Hedonic Games

Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON: Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?

Ingo BRÄUER and Rainer MARGGRAF: Regulatory Choices

Tom DEDEURWAERDERE (lxvi): Bioprospection: From the Economics of Contracts to Reflexive Governance

Koen SMEKENS and Bob VAN DER ZWAAN: The Amenity Value of Climate to German Households

Koen REHDANZ and David MADDISON: The Amenity Value of Climate to German Households

E.C.M. RUIJGROK and E.E.M. NILLESEN: The Socio-Economic Value of Natural Riverbanks in the Netherlands

E.C.M. RUIJGROK (lxvi): The Socio-Economic Value of Natural Riverbanks in the Netherlands


Giannis VARDAS and Anastasios XEPAPADEAS: Uncertainty Aversion, Robust Control and Asset Holdings

Anastasios XEPAPADEAS and Constadina PASSA: Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach

Michael FINUS: Modesty Pays: Sometimes!

Trond BJØRNDAL and Ana BRASÃO: The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications

Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT: On Coalition Formation with Heterogeneous Agents

Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA: Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants

Alessandro LANZA, Matteo MANERA and Michael MCALEER: Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns

Margherita GENIUS and Elisabetta STRAZZERA: The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests
Rob DELLINK and Ekko van IERLAND: Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment

Rosella LEVAGGI and Michele MORETTO: Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach

Salvador BARBERA and Matthew O. JACKSON (lxx): On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union

Alex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERÀ and Fernando VEGA-REDONDO (lxx): Optimal Information Transmission in Organizations: Search and Congestion

Francis BLOCH and Armando GOMES (lxx): Contracting with Externalities and Outside Options

Rabab AMIR, Efrosyni DIAMANTOUDI and Licun XUE (lxx): Merger Performance under Uncertain Efficiency Gains

Francis BLOCH and Matthew O. JACKSON (lxx): The Formation of Networks with Transfers among Players

Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO (lxx): Biocameralism and Government Formation

Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon RAPOPORT (lxx): Potential Maximization and Coalition Government Formation

Kfir ELIAZ, Debraj RAY and Ronny RAZIN (lxx): Group Decision-Making in the Shadow of Disagreement

Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ (lxx): Economics: An Emerging Small World?

Edward CARTWRIGHT (lxx): Learning to Play Approximate Nash Equilibria in Games with Many Players

Finn R. FØRSUND and Michael HOEL: Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power

Elissaios PAPYRakis and Reyner GERLAGH: Natural Resources, Investment and Long-Term Income

Marzio GALEOTTI and Claudia KEMFERT: Interactions between Climate and Trade Policies: A Survey

A. MARKANYA, S. PEDROSO and D. STREMIKIENĖ: Energy Efficiency in Transition Economies: Is There Convergence Towards the EU Average?

Rolf GOLOMbek and Michael HOEL: Climate Agreements and Technology Policy

Sergei IZMALKOV (lxx): Multi-Unit Open Ascending Price Efficient Auction

Gianmarco I.P. OTTAVIANO and Giovanni PERI: Cities and Cultures

Massimo DEL GAITTO: Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus devolution

Pierre-André JOUVET, Philippe MICHEL and Gilles ROTILLON: Equilibrium with a Market of Permits

Bob van der ZWAAN and Reyner GERLAGH: Climate Uncertainty and the Necessity to Transform Global Energy Supply

Francesco BÖSELLO, Marco LAZZARIN, Roberto ROSON and Richard S.J. TOL: Economy-Wide Estimates of the Implications of Climate Change: Sea Level Rise

Gustavo BERGANTINOS and Juan J. VIDAL-PUGA: Defining Rules in Cost Spanning Tree Problems Through the Canonical Form

Siddhartha BANDYOPADHYAY and Mandar OAK: Party Formation and Coalitional Bargaining in a Model of Proportional Representation

Hans-Peter WEIKARD, Michael FINUS and Juan-Carlos ALTAMIRANO-CABRERA: The Impact of Surplus Sharing on the Stability of International Climate Agreements

Chiara M. TRAVISI and Peter NIJKAMP: Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents

Chiara M. TRAVISI, Raymond J. G. M. FLORAX and Peter NIJKAMP: A Meta-Analysis of the Willingness to Pay for Reductions in Pesticide Risk Exposure

Valentina BOSETTI and David TOMBERLIN: Real Options Analysis of Fishing Fleet Dynamics: A Test

Alessandra GORIA e Gretel GAMBARELLI: Economic Evaluation of Climate Change Impacts and Adaptability in Italy

Massimo FLORIO and Mara GRASSEN: The Missing Shock: The Macroeconomic Impact of British Privatisation

John BENNETT, Saul ESTRIN, James MAW and Giovanni URGA: Privatisation Methods and Economic Growth in Transition Economies

Kira BÖRNER: The Political Economy of Privatization: Why Do Governments Want Reforms?

Pehr-Johan NORBACK and Lars PERSSON: Privatization and Restructuring in Concentrated Markets

Angela GRANZOTTO, Fabio PRANOVI, Simone LIBRALATO, Patrizia TORRICELLI and Danilo XUE: On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union

Chiara M. TRAVISI, Raymond J. G. M. FLORAX and Peter NIJKAMP: A Meta-Analysis of the Willingness to Pay for Reductions in Pesticide Risk Exposure

Angela GRANZOTTO, Fabio PRANOVI, Simone LIBRALATO, Patrizia TORRICELLI and Danilo XUE: On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union

Giuseppe DI VITA: Natural Resources Dynamics: Another Look

PRA 107.2004

Anna ALBERINI, Alistair HUNT and Anil MARKANDYA: Natural Resources, Investment and Long-Term Income

Gianmarco I.P. OTTAVIANO and Giovanni PERI: Cities and Cultures

Valeria COSTANTINI and Francesco GRACCEVA: Oil Security. Short- and Long-Term Policies
Valeria COSTANTINI and Francesco GRACCEVA: Social Costs of Energy Disruptions
Christian EGENHOFER, Kyriakos GIALOGLOU, Giacomo LUCIANI, Maroessa BOOTS, Martin SCHEEPERS,
Valeria COSTANTINI, Francesco GRACCEVA, Anil MARKANDYA and Giorgio VICINI: Market-Based Options
for Security of Energy Supply
David FISK: Transport Energy Security. The Unseen Risk?
Giacomo LUCIANI: Security of Supply for Natural Gas Markets. What is it and What is it not?
L.J. de VRIES and R.A. HAKVOORT: The Question of Generation Adequacy in Liberalised Electricity Markets
Alberto PETRUCCI: Asset Accumulation, Fertility Choice and Nondegenerate Dynamics in a Small Open
Economy
Carlo GIUPPONI, Jaroslav MYSIAK and Anita FASSIO: An Integrated Assessment Framework for Water
Resources Management: A DDS Tool and a Pilot Study Application
Margaretha BREIL, Anita FASSIO, Carlo GIUPPONI and Paolo ROSATO: Evaluation of Urban Improvement
on the Islands of the Venice Lagoon: A Spatially-Distributed Hedonic-Hierarchical Approach
Paul MENSINK: Instant Efficient Pollution Abatement Under Non-Linear Taxation and Asymmetric
Information: The Differential Tax Revisited
Mauro FABIANO, Gabriella CAMRAS, Rosanna DURSI, Roberta VALDI, Valentina MARIN and Francesca
PALMISANI: Integrated Environmental Study for Beach Management: A Methodological Approach
Irena GROSFELD and Iraj HASHI: The Emergence of Large Shareholders in Mass Privatized Firms: Evidence
from Poland and the Czech Republic
Maria BERRITELLA, Andrea BIGNANO, Roberto ROSON and Richard S.J. TOL: A General Equilibrium
Analysis of Climate Change Impacts on Tourism
Reyer GERLAGH: A Climate-Change Policy Induced Shift from Innovations in Energy Production to Energy
Savings
Elisatos PAPYRakis and Reyer GERLAGH: Natural Resources, Innovation, and Growth
Bernardo BORTOLOTTO and Mara FACCIO: Reluctant Privatization
Riccardo SCARPA and Mara THIENE: Destination Choice Models for Rock Climbing in the Northeast Alps: A
Latent-Class Approach Based on Intensity of Participation
Riccardo SCARPA Kenneth W. WILLIS and Melinda ACUTT: Comparing Individual-Specific Benefit Estimates
for Public Goods: Finite Versus Continuous Mixing in Logit Models
Santiago J. RUBIO: On Capturing Oil Rents with a National Excise Tax Revisited
Ascensión ANDINA DÍAZ: Political Competition when Media Create Candidates’ Charisma
Anna ALBERINI: Robustness of VSL Values from Contingent Valuation Surveys
Maria BERRITELLA, Andrea BIGNANO, Roberto ROSON and Richard S.J. TOL: A General Equilibrium
Analysis of Climate Change Impacts on Tourism
Herbert DAWID, Christophe DEISSENBERG and Pavel ŠEVČÍK: Cheap Talk, Gullibility, and Welfare in an
Environmental Taxation Game
ZhongXiang ZHANG: The World Bank’s Prototype Carbon Fund and China
Elisatos PAPYRakis and Reyer GERLAGH: Natural Resources, Innovation, and Growth
Chiara D’ALPAOS and Michele MORETTO: The Value of Flexibility in the Italian Water Service Sector: A
Real Option Analysis
Patrick BAJARI, Stephanie HOUTHON and Steven TADELIS (lxxi): Bidding for Incomplete Contracts
Susan ATHEY, Jonathan LEVIN and Enrique SEIRA (lxxi): Comparing Open and Sealed Bid Auctions: Theory
and Evidence from Timber Auctions
David GOLDREICH (lxxi): Behavioral Biases of Dealers in U.S. Treasury Auctions
Roberto BURGUEL (lxxi): Optimal Procurement Auction for a Buyer with Downward Sloping Demand: More
Simple Economics
Ali HORTACSU and Samita SAREEN (lxxi): Order Flow and the Formation of Dealer Bids: An Analysis of
Information and Strategic Behavior in the Government of Canada Securities Auctions
Victor GINSBURGH, Patrick LEGROS and Nicolas SAHUGUET (lxxi): How to Win Twice at an Auction. On
the Incidence of Commissions in Auction Markets
Claudio MEZZETTI, Aleksandar PEKEČ and Ilija TSETLIN (lxxi): Sequential vs. Single-Round Uniform-Price
Auctions
John ASKER and Estelle CANTILLON (lxxi): Equilibrium of Scoring Auctions
Philip A. HAILE, Han HONG and Matthew SHUM (lxxi): Nonparametric Tests for Common Values in First-
Price Sealed-Bid Auctions
François DEGEORGE, François DERRIEN and Kent L. WOMACK (lxxi): Quid Pro Quo in IPOs: Why
Bookbuilding is Dominating Auctions
Barbara BUCHNER and Silvia DALL’OLO: Russia: The Long Road to Ratification. Internal Institution and
Pressure Groups in the Kyoto Protocol’s Adoption Process
Carlo CARRARO and Marzio GALEOTTI: Does Endogenous Technical Change Make a Difference in Climate
Policy Analysis? A Robustness Exercise with the FEEM-RICE Model
Alejandro M. MANELLI and Daniel R. VINCENT (lxxi): Multidimensional Mechanism Design: Revenue
Maximization and the Multiple-Good Monopoly
Nicola ACOCELLA, Giovanni Di BARTOLOMEO and Wilfried PAUWELS: Is there any Scope for Corporatism
in Stabilization Policies?
Johan EYCKMANS and Michael FINUS: An Almost Ideal Sharing Scheme for Coalition Games with
Externalities
Cesare DOSI and Michele MORETTO: Environmental Innovation, War of Attrition and Investment Grants
Stéphane HALLEGATTE: Spatial Analysis: Development of Descriptive and Normative

Angelo ANTOCI

Alireza NAGHAVI, Barbara BUCHNER and Carlo CARRARO: Regional and Sub-Global Climatic Blocs. A Game Theoretic

Xavier LABANDEIRA, José M. LABEAGA and Miguel RODRÍGUEZ: Microsimulating the Effects of Household Energy Price Changes in Spain

NOTE DI LAVORO PUBLISHED IN 2005

CCMP 1.2005 Stéphane HALLEGATTE: Accounting for Extreme Events in the Economic Assessment of Climate Change

CCMP 2.2005 Qiang WU and Paulo Augusto NUNES: Application of Technological Control Measures on Vehicle Pollution: A Cost-Benefit Analysis in China

CCMP 3.2005 Andrea BIGANO, Jacqueline M. HAMILTON, Maren LAU, Richard S.J. TOL and Yuan ZHOU: A Global Database of Domestic and International Tourist Numbers at National and Subnational Level

CCMP 4.2005 Andrea BIGANO, Jacqueline M. HAMILTON and Richard S.J. TOL: The Impact of Climate on Holiday Destination Choice

ETA 5.2005 Hubert KEMPFF: Is Inequality Harmful for the Environment in a Growing Economy?


CCMP 9.2005 Angelo ANTOCI: Environmental Resources Depletion and Interplay Between Negative and Positive Externalities in a Growth Model

CTN 10.2005 Frédéric DEROIAN: Cost-Reducing Alliances and Local Spillovers

NRM 11.2005 Francesco SINDICO: The GMO Dispute before the WTO: Legal Implications for the Trade and Environment Debate


PRCG 14.2005 Clara GRAZIANO and Annalisa LUPORINI: Ownership Concentration, Monitoring and Optimal Board Structure

CSRIM 15.2005 Parashar KULKARNI: Use of Ecolabels in Promoting Exports from Developing Countries to Developed Countries: Lessons from the Indian LeatherFootwear Industry

KTHC 16.2005 Adriana DI LIBERTO, Roberto MURA and Francesco PIGLIARU: How to Measure the Unobservable: A Panel Technique for the Analysis of TFP Convergence

KTHC 17.2005 Alireza NAGHAVI: Asymmetric Labor Markets, Southern Wages, and the Location of Firms

KTHC 18.2005 Alireza NAGHAVI: Strategic Intellectual Property Rights Policy and North-South Technology Transfer

KTHC 19.2005 Mombert HOPPE: Technology Transfer Through Trade

PRCG 20.2005 Roberto ROSON: Platform Competition with Endogenous Multihoming

CCMP 21.2005 Barbara BUCHNER and Carlo CARRARO: Regional and Sub-Global Climate Blocs, A Game Theoretic Perspective on Bottom-up Climate Regimes


CTN 23.2005 Michael FINUS, Pierre v. MOUCHE and Bianca RUNDSHAGEN: Uniqueness of Coalitional Equilibria


NRM 27.2005 Massimiliano MAZZANTI and Anna MONTINI: The Determinants of Residential Water Demand Empirical Evidence for a Panel of Italian Municipalities

CCMP 28.2005 Laurent GILOTTE and Michel de LARA: Precautionary Effect and Variations of the Value of Information

NRM 29.2005 Paul SARFO-MENSAH: Exportation of Timber in Ghana: The Menace of Illegal Logging Operations

CCMP 30.2005 Andrea BIGANO, Alessandra GORIA, Jacqueline HAMILTON and Richard S.J. TOL: The Effect of Climate Change and Extreme Weather Events on Tourism

NRM 31.2005 Maria Angeles GARCIA-VALINAS: Desecentrization and Environment: An Application to Water Policies

NRM 32.2005 Chiara D’ALPAOS, Cesare DOSI and Michele MORETTO: Concession Length and Investment Timing Flexibility

CCMP 33.2005 Joseph HUBER: Key Environmental Innovations

CTN 34.2005 Antoni CALVÓ-ARMENGOL and Rahimi ILKILIÇ: Pairwise-Stability and Nash Equilibria in Network Formation

CTN 35.2005 Francesco FERI (lxxii): Network Formation with Endogenous Decay

CTN 36.2005 Frank H. PAGE, Jr. and Myrna H. WOODERS (lxxii): Strategic Basins of Attraction, the Farsighted Core, and Network Formation Games
Carlo CARRARO, Carmen MARCHIORI and Alessandra SGOBBI

Alessandra CASELLA and Nobuyuki HANAKI (lxii): Information Channels in Labor Markets, On the Resilience of Referral Hiring

Matthew O. JACKSON and Alison WATTS (lxii): Social Games: Matching and the Play of Finitely Repeated Games

Anna BOGOMOLNAIA, Michel LE BRETON, Alexei SAVVATEEV and Shlomo WEBER (lxii): The Egalitarian Sharing Rule in Provision of Public Projects

Francesco FERI: Stochastic Stability in Network with Decay

Aart de ZEEUW (lxii): Dynamic Effects on the Stability of International Environmental Agreements

C. Martijn van der HEIDE, Jeroen C.J.M. van den BERGH, Ekko C. v. IERLAND and Paolo A.L.D. NUNES: Measuring the Economic Value of Two Habitat Defragmentation Policy Scenarios for the Veluwe, The Netherlands

Carla VIEIRA and Ana Paula SERRA: Abnormal Returns in Privatization Public Offerings: The Case of Portuguese Firms

Anna ALBERINI, Valentina ZANATTA and Paolo ROSATO: Combining Actual and Contingent Behavior to Estimate the Value of Sports Fishing in the Lagoon of Venice

Michael FINUS and Bianca RUNDSHAGEN: Participation in International Environmental Agreements: The Role of Timing and Regulation

Lorenzo PELLEGRINI and Reyer GERLAGH: Are EU Environmental Policies Too Demanding for New Members States?

Matteo MANERA: Modeling Factor Demands with SEM and VAR: An Empirical Comparison

Olivier TERCIEUX and Vincent VANNEBELBOSCH (lxii): A Characterization of Stochastically Stable Networks

Ana MÁULEON, José SEMPERE-MONERRIS and Vincent J. VANNEBELBOSCH (lxii): R&D Networks Among Unionized Firms

Carlo CARRARO, Johan EYCKMANS and Michael FINUS: Optimal Transfers and Participation Decisions in International Environmental Agreements

Valeria GATTAF: From the Theory of the Firm to FDI and Internationalisation: A Survey

Alireza NAGHAVI: Multilateral Environmental Agreements and Trade Obligations: A Theoretical Analysis of the Doha Proposal

Margaretha BREIL, Gretel GAMBARELLI and Paulo A.L.D. NUNES: Economic Valuation of On Site Material Damages of High Water on Economic Activities based in the City of Venice: Results from a Dose-Response-Expert-Based Valuation Approach

Alessandra del BOCA, Marzio GALEOTTI, Charles P. HIMMELBERG and Paola ROTA: Investment and Time to Plan: A Comparison of Structures vs. Equipment in a Panel of Italian Firms

Gernot KLEPPER and Sonja PETERSON: Estimating and Combining Actual and Contingent Behavior to Estimate the Value of Sports Fishing in the Lagoon of Venice

Gero LOOSCHEL and Dirk T.G. RÜBBELKE: Impure Public Goods and Technological Interdependencies

Maia DAVID and Bernard SINCLAIR-DESGAGNÉ: Environmental Regulation and the Eco-Industry

Alain-Désiré NIMUBONA and Bernard SINCLAIR-DESGAGNÉ: The Pigouvian Tax Rule in the Presence of an Eco-Industry

Christoph A. SCHALTEGGER and Benno TORGLER: Trust and Fiscal Performance: A Panel Analysis with Swiss Data

Irene VALSECCHI: A Role for Instructions

Valentia BOSETTI and Gianni LOCATELLI: A Data Envelopment Analysis Approach to the Assessment of Natural Parks’ Economic Efficiency and Sustainability. The Case of Italian National Parks

Anna ALBERINI, Valentina ZANATTA and Paolo ROSATO: Responses in Attribute Based Valuation Surveys

Carlo CARRARO, Carmen MARCHIORI and Alessandra SGOBBI: Applications of Negotiation Theory to Water Issues

Carlo CARRARO, Carmen MARCHIORI and Alessandra SGOBBI: Advances in Negotiation Theory: Bargaining, Coalitions and Fairness

Sandra WALLMAN: Applications of Negotiation Theory to Water Issues

Asimina CHRISTOFOROU (lxiv): On the Determinants of Social Capital in Greece Compared to Countries of the European Union

Eric M. USLANER (lxiv): Varieties of Trust


Graziaella BERTOCCHI and Chiara STROZZI: A Data Envelopment Analysis Approach to the Assessment of Natural Parks’ Economic Efficiency and Sustainability. The Case of Italian National Parks

Anna MAULEON, José SEMPERE-MONERRIS and Vincent J. VanNEBELBOSCH (lxii): A Characterization of Stochastically Stable Networks

CTN 37.2005
CTN 38.2005
CTN 39.2005
CTN 40.2005
CTN 41.2005
NRM 42.2005
PRCG 43.2005
SIEV 44.2005
CTN 45.2005
CCMP 46.2005
IEM 47.2005
CTN 48.2005
CTN 49.2005
KTHC 50.2005
KTHC 51.2005
CCMP 52.2005
IE 53.2005
ETA 54.2005
CCMP 55.2005
ETA 56.2005
ETA 57.2005
NRM 58.2005
SIEV 59.2005
CCMP 60.2005
PRCG 61.2005
ETA 62.2005
NRM 63.2005
SIEV 64.2005
CTN 65.2005
CTN 66.2005
KTHC 67.2005
KTHC 68.2005
KTHC 69.2005
KTHC 70.2005
KTHC 71.2005
KTHC 72.2005
IEM 74.2005
Margherita GRASSO and Matteo MANERA: Asymmetric Error Correction Models for the Oil-Gasoline Price Relationship

Umberto CHERUBINI and Matteo MANERA: Hunting the Living Dead A “Peso Problem” in Corporate Liabilities Data

Hans-Peter WEIKARD: Cartel Stability under an Optimal Sharing Rule

Joëlle NOAILLY, Jeroen C.J.M. van den BERGH and Cees A. WITTHAGEN (lxxvi): Local and Global Interactions in an Evolutionary Resource Game

Joëlle NOAILLY, Cees A. WITTHAGEN and Jeroen C.J.M. van den BERGH (lxxvi): Spatial Evolution of Social Norms in a Common-Pool Resource Game

Maximiliano MAZZANTI and Roberto ZOBOLI: Economic Instruments and Induced Innovation: The Case of End-of-Life Vehicles European Policies

Anna LASUT: Creative Thinking and Modelling for the Decision Support in Water Management

Valentina BOSETTI and Barbara BUCHNER: Using Data Envelopment Analysis to Assess the Relative Efficiency of Different Climate Policy Portfolios

Ignazio MUSU: Intellectual Property Rights and Biotechnology: How to Improve the Present Patent System

Giulio CAINELLI, Susanna MANCI NELLI and Massimiliano MAZZANTI: Social Capital, R&D and Industrial Districts

Rosella LEVAGGI, Michele MORETTO and Vincenzo REBBA: Quality and Investment Decisions in Hospital Care when Physicians are Devoted Workers

Valentina BOSETTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?

Nicoleta FERRO: Value Through Diversity: Microfinance and Islamic Finance and Global Banking

A. MARKANDYA and S. PEDROSO: How Substitutable is Natural Capital?

Valentino BOSATTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?

A. MARKANDYA and S. PEDROSO: How Substitutable is Natural Capital?

Valentino BOSATTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?

Valentino BOSATTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?

Valentino BOSATTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?

Valentino BOSATTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?

Valentino BOSATTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?

Valentino BOSATTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?

Valentino BOSATTI and Laurent GILOTTE: Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?
Martin D. SMITH and Larry B. CROWDER (lxxvi): Valuing Ecosystem Services with Fishery Rents: A Lumped-Parameter Approach to Hypoxia in the Neuse River Estuary

Dan HOLLAND and Kurt SCHNIER (lxxvi): Protecting Marine Biodiversity: A Comparison of Individual Habitat Quotas (IHQs) and Marine Protected Areas

John NELLIS: The Evolution of Enterprise Reform in Africa: From State-owned Enterprises to Private Participation in Infrastructure — and Back?

Bernardo BORTOLOTTI: Italy’s Privatization Process and Its Implications for China

Anna ALBERINI, Marcella VERONESI and Joseph C. COOPER: Detecting Starting Point Bias in Dichotomous-Choice Contingent Valuation Surveys

Federico ECHENIQUE and Mehmet B. YENMEZ: A Solution to Matching with Preferences over Colleagues

Valeria GATTAI and Corrado MOLTENI: Dissipation of Knowledge and the Boundaries of the Multinational Enterprise

Valeria GATTAI: Firm’s Intangible Assets and Multinational Activity: Joint-Venture Versus FDI

Socrates KYPREOS: A MERGE Model with Endogenous Technological Change and the Cost of Carbon Stabilization

Fuminori SANO, Keigo AKIMOTO, Takashi HOMMA and Toshimasa TOMODA: Analysis of Technological Portfolios for CO2 stabilizations and Effects of Technological Changes

Fredrik HEDENUS, Christian AZAR and Kristian LINDGREN: Induced Technological Change in a Limited Foresight Optimization Model

Reyer GERLAGH: The Value of ITC under Climate Stabilization

John NELLIS: Privatization in Africa: What has happened? What is to be done?

Giovanni DI BARTOLOMEO, Nicola ACOCELLA and Andrew HUGHES HALLETT: Dynamic Controllability with Overlapping targets: A Generalization of the Tinbergen-Nash Theory of Economic Policy

Giovanni DI BARTOLOMEO and Nicola ACOCELLA: Tinbergen and Theil Meet Nash: Controllability in Policy Games

Adriana M. IGNACIUK and Rob B. DELLINK: Multi-Product Crops for Agricultural and Energy Production – an AGE Analysis for Poland

Raffaele MINIACI, Carlo SCARPA and Paola VALBONESI: Restructuring Italian Utility Markets: Household Distributional Effects

Valentina ZANATTA, Paolo ROSATO, Anna ALBERINI and Dimitrios REPPAS: The Impact of Speed Limits on Recreational Boating in the Lagoon of Venice

Chi-CHUR CHAO, Bharat R. HAZARI, Jean-Pierre LAFFARGUE, Pasquale M. SGRO, and Eden S. H. YU (lxxviii): Tourism, Jobs, Capital Accumulation and the Economy: A Dynamic Analysis

Michael MCALEER, Riaz SHAREEF and Bernardo da VEIGA (lxxviii): Risk Management of Daily Tourist Tax Revenues for the Maldives
<table>
<thead>
<tr>
<th>2004 SERIES</th>
<th>2005 SERIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CCMP</strong></td>
<td><strong>CCMP</strong></td>
</tr>
<tr>
<td>Climate Change Modelling and Policy (Editor: Marzio Galeotti)</td>
<td>Climate Change Modelling and Policy (Editor: Marzio Galeotti)</td>
</tr>
<tr>
<td><strong>GG</strong></td>
<td><strong>GG</strong></td>
</tr>
<tr>
<td>Global Governance (Editor: Carlo Carraro)</td>
<td>Global Governance (Editor: Carlo Carraro)</td>
</tr>
<tr>
<td><strong>SIEV</strong></td>
<td><strong>SIEV</strong></td>
</tr>
<tr>
<td>Sustainability Indicators and Environmental Valuation (Editor: Anna Alberini)</td>
<td>Sustainability Indicators and Environmental Valuation (Editor: Anna Alberini)</td>
</tr>
<tr>
<td><strong>NRM</strong></td>
<td><strong>NRM</strong></td>
</tr>
<tr>
<td>Natural Resources Management (Editor: Carlo Giupponi)</td>
<td>Natural Resources Management (Editor: Carlo Giupponi)</td>
</tr>
<tr>
<td><strong>KTHC</strong></td>
<td><strong>KTHC</strong></td>
</tr>
<tr>
<td>Knowledge, Technology, Human Capital (Editor: Gianmarco Ottaviano)</td>
<td>Knowledge, Technology, Human Capital (Editor: Gianmarco Ottaviano)</td>
</tr>
<tr>
<td><strong>IEM</strong></td>
<td><strong>IEM</strong></td>
</tr>
<tr>
<td><strong>CSRM</strong></td>
<td><strong>CSRM</strong></td>
</tr>
<tr>
<td>Corporate Social Responsibility and Sustainable Management (Editor: Sabina Ratti)</td>
<td>Corporate Social Responsibility and Sustainable Management (Editor: Sabina Ratti)</td>
</tr>
<tr>
<td><strong>PRA</strong></td>
<td><strong>PRA</strong></td>
</tr>
<tr>
<td>Privatisation, Regulation, Antitrust (Editor: Bernardo Bortolotti)</td>
<td>Privatisation, Regulation, Antitrust (Editor: Bernardo Bortolotti)</td>
</tr>
<tr>
<td><strong>ETA</strong></td>
<td><strong>ETA</strong></td>
</tr>
<tr>
<td>Economic Theory and Applications (Editor: Carlo Carraro)</td>
<td>Economic Theory and Applications (Editor: Carlo Carraro)</td>
</tr>
<tr>
<td><strong>CTN</strong></td>
<td><strong>CTN</strong></td>
</tr>
<tr>
<td>Coalition Theory Network</td>
<td>Coalition Theory Network</td>
</tr>
</tbody>
</table>