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Department of Banking & Financial Management
MSc Program in Banking & Financial Management

"FINANCIAL VOLATILITY, MACROECONOMIC VOLATILITY AND TOURISM DEVELOPMENT"

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January 2010

to my parents Michalis and Vassiliki

Acknowledgements

I would like to special thanks my Professor Dr. Christina Christou, under whose supervision I had decided to chose this topic. The present thesis would not have been possible done without her important help and advice. With her great efforts to explain things clearly and simply, she helped me to pursue the dissertation. All this period Dr Christina Christou provided encouragement, good teaching and she was always willing to answer any of my questions.

Also I have to mention that is a great honour for me to be present to my final presentation of this thesis Professor Nikolaos Apergis and Professor Aggelos Antzoulatos.

Finally, without the support of my family, my sister Eua, my fiancé Rania and my good friend and fellow student Alexandros Piladarinos it couldn't be possible to complete this dissertation.

ABSTRACT

This dissertation examines the causal relationship between financial performance and tourism development as well as economic performance and tourism development both in mean and variance for four countries. We use three different variables – share price index, industrial production and the number of total tourist arrivals for each country. We employ a model which detects the appropriates ARCH and GARCH models in order to apply the causality tests of Cheung & Ng and Hong. The empirical results indicate causality in mean from stock market to tourism. Also it is found that causality in mean between economic performance to tourism is bidirectional according to the Hong test. Furthermore it is noticed that volatility spillovers are detected fewer times than return spillovers and the main directions that are held are from stock market to tourism.

Keywords: causality, Hong test, Cheung & Ng test, tourism development, stock market, economic performance**.**

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INTRODUCTION

International tourism plays an important role in the economic development of many destination countries. It is a considerable source of business activities because is contributing to the economic development of many countries. In fact is the main source of income for many countries. During the second half of the twentieth century, tourism has become one of the most rapidly growing sectors in the world economy.

For these reasons many regions have realized that tourism is a dominant sector for their economies and have started to reclaim this sector. Although tourism is often referred as an industry, it is fundamentally different than conventional industries and these differences complicated the measurement of tourism. Academically, the most widely used variables that help us to measure the tourism demand are tourist arrivals and the tourist expenditures. In the literature there are many papers that have been written to show the impact of tourism in the economies of the countries. Furthermore most of these studies consider the effects of tourism on resource allocation, welfare and growth in a real economy. There are evidences which shows that except the significant role of the macroeconomic conditions to the tourism development, stock market fluctuations, exchange rates volatility and generally the financial conditions have a major impact in tourism development of a country. There are not many articles in the literature that examine the relationship between financial conditions and tourism development. The purpose of this dissertation is to examine the causality patterns of the financial volatility and macroeconomic volatility to the tourism development and vice versa. The structure of the dissertation is the following:

Chapter 1 is dealing with the literature review in the field of research regarding tourism as a important growth factor in the fields of Economy and Finance.

Chapter 2 introduces us to the definition of volatility as well as to its role to Finance and Economy. The main part of this chapter refers to the definition of Granger-causality and the Causality in Variance Tests, those of Cheung & Ng and Hong, giving a description of these methods.

In Chapter 3, we describe the methodology that the author of this dissertation uses and also we provide the empirical results from the implementation of the model that we are using.

Chapter 4 refers to the concluding remarks of this dissertation.

CHAPTER 1: LITERATURE REVIEW IN TOURISM DEVELOPMENT

Dritsakis (2004) investigates the relation among international tourism earnings, real exchange rate and economic growth for Greece. He uses quarterly data of the above variables with their sample spanning from 1960: I – 2000: IV regarding 1996 as a base year. The fundamental purpose of his research was to examine the tourism impact on the long-run economic growth of Greece by using Granger causality tests among real gross domestic product, real effective exchange rate and international tourism earnings. In this paper, the author uses a multivariate autoregressive VAR model with an error correction mechanism. The advantage of this model is that uses each variable as potentially endogenous and determines the relation of each variable to its own past values and with past values of the other variables. The introduced error correction model was used to examine the causal relation between the above three variables of the research. The concluding remarks of Dritsakis study is that there exists a strong causal relationship between international tourism earnings and real exchange rate, which it means that there is generated an important economic growth between these two variables, and also the study shows that economic growth and real exchange rate cause international tourism earnings with a simply causal relationship.

Balaguer and Cantavella-Jorda (2002) investigate the impact of tourism in the Spanish long-run economic growth. The paper uses Johansen's cointegration methodology and a p-dimensional VAR process of order K, where p is the number of variables. They use three variables with quarterly frequency data covering the period 1975 Q1 – 1997 Q1. These variables are the real gross domestic product, the international tourism earnings in real terms and the real effective exchange rate, which is a proxy of external competitivity. As we mentioned above, the purpose of this research is to examine the relation between the tourism development and the economic expansion of Spain. The final results demonstrate that exist a long-run stable relationship between economic development and tourism development. In other words there exists a causal relation tourism driven economic expansion for Spain. This result is different from other studies, such as **Chi-Ok Oh (2003).** Also the presence of external competitivity strengthens the causality between GDP and tourism earnings and is a fundamental variable for the long-run Spanish economic growth.

Eugenio-Martin, Morales and Scarpa (2004) examine the nature of relation between tourism and economy in the region of Latin America. More specifically, they study how relevant tourism sector is for the economic development and vice-versa. This paper uses a data panel approach and two different models. The first investigates the impact of tourist growth on the economic growth and the second one examines how the rate of growth per capita affects tourism growth. In the first case by using the Arellano-Bond dynamic panel data estimator, the authors showed that tourist's growth per capita exhibits an important economic development with their sample spanning from 1985 to 1998. But this is not a general result because they also found that the relation between tourism growth and economic development exists in low and medium income countries, but not in high income countries. In the second approach was used a generalized least squares AR(1) panel data model. For the entire dataset of countries, it demonstrates that tourist arrivals exhibit a positive correlation related with GDP per capita, international trade and life expectancy at birth. Furthermore, if we disintegrate our data set into three groups as before, low, medium and high income countries, it was showed that the tourist development depends on not only in the increase of the GDP per capita but it also depends on other factors, such as education enrolment, high expectancy of life and not so much in the price of goods and services.

Chi-Ok Oh (2003) examine the causal relationship between tourism growth and economic expansion for the Korean economy. This study uses time-series methods of causality tests for the hypotheses of tourism-led growth for the Korean economy. The author uses a VAR model and cointegration model. The data are in a quarterly frequency that covers the period 1975 1Q – 2001 1Q. The variables of the model are tourist receipts adjusted by the consumer price index as a proxy of tourism growth and real GDP for the examination of tourism growth. The variables are then converted through the use of natural logarithm to ease interpretation of coefficients. The purpose of this research is to examine the tourism impact in economy and vice-versa. Unlike the results of other studies, this paper concludes to the following remarks: the final results imply that there is no causal relation of tourism – led to economic growth. But there is one way causal realation of economic-driven tourism expansion. Also the cointegration test reveals that there is no long-run equilibrium relation between two series. This means that the economic expansion of Korea tend to attract more tourists only in the short run. So the widely believed that tourism has contributed positively to economic development of a country does not held for the case of Korea.

Kim, Chen and Jang (2006) study the causal relationship between tourism expansion and economic development in Taiwan and they expected to have similar results to **Oh's (2005)** because South Korea and Taiwan have similar economic structure. In this research have been used Granger causality tests following the cointegration approach. The data that were used by the authors were the GDP values of Korea in order to measure the economic development and the total tourist arrivals as a proxy of tourism development. Both datasets were obtained in a quarterly base covering the period 1956 to 2002. The results that were found showed that there exist a reciprocal relationship between tourism expansion and economic development in Taiwan. In other words, tourism and economic expansion in Taiwan reinforce each other. These results contradicted with **Oh (2005)** despite the fact that the two countries have similar economic structure. Some of the possible explanations for existing causality between tourism and economic growth are the level of openness of the country, the level of travel restrictions, the level of economic development and the size of the economy of the examined country.

Chen and Chiou-Wei (2009) examine the causality that may exist between tourism and economic expansion in Taiwan and South Korea. In order this relationship to be examined, it is used an EGARCH-M model in which the underlying volatility is due to the number of error lags and not their sign. The data used were real GDP, real exchange rates relative to the US dollar and tourism receipts as a proxy tourism growth in Taiwan and tourist arrivals as a proxy of tourism growth in South Korea, all in a quarterly base, covering the period from 1975 1Q to 2007 1Q. The reason that the authors take two different proxies for tourism growth for each of the two countries, is to be consistent with the specifications of other studies like **Kim et al (2006) and Oh (2005)** for comparison. Furthermore one of the reasons that EGARCH-M model is used is the need to accommodate the exchange rate and so the usual Granger causality test were expanded considering the characteristic and impact of uncertainty. The concluding remarks of this study contradict with that of **Kim et al (2006) and Oh (2005) for Taiwan and South Korea** respectively. More specific, the empirical results show that there is a reciprocal causal relationship between tourism and economic growth for South Korea while in the other hand there is a tourism-led economic growth relation for Taiwan. Furthermore, this research mentions the negative impact of economic uncertainty on tourism expansion and tourism uncertainty on economic expansion.

Dritsakis and Athanasiadis (2004) have introduced an econometric model of tourism demand in order to examine the impact of the foreign tourism on social and economic structure of Greece. For the purpose of this research was used the Ordinary Least Squares method (OLS). The data cover the period 1960-1993 in an annual base. The variables of the model are the following: a) number of tourist arrivals in Greece, b) population of country of origin, c) the disposable national income of country origin, d) the average total cost for a 10-day stay in Greece including travel expenses from country of origin, e) the average cost for a 10-day stay in other competitive Mediterranean countries including travel expenses from country of origin, f) the exchange rate of the country of origin vis-à-vis the Greek drachma each year, g) the gross investment in fixed assets in Greece, h) the advertising expenditures in the country of origin, i) a dummy variable which measures political stability in Greece. After the apply of the econometric method, the concluding remarks of the paper were the following: disposable income, average total cost along with travel cost and the exchange rate of the currency of the country if origin vis-à-vis the Greek drachma do not appear to have an important impact on tourism demand as one might expect since they appear in a few estimated equation. On the other hand, average stay cost in other competitive destinations, gross investment in fixed assets, advertising expenditures and political stability in Greece seems to play an important role on tourism demand since they appear in most of the estimated equations.

Eeckels, Filis and Leon (2005) have examined the transmission mechanism of the cyclical components of Greek GDP and international tourism income for Greece. This paper uses spectral analysis methodology and a VAR model. The variables of the model are the Greek gross domestic product (GDP) and the tourism income (TI) from foreign tourists. The data are in an annual frequency and their sample spanning from 1976 to 2004. The data were obtained from the IFS and the WTO. The final results show that tourism income is a countercyclical variable and acts as a leading indicator for GDP. Furthermore, in order to identify the transmission mechanism they use two different aspects of the method: a propagation mechanism which implies that converging path for GDP fluctuating and takes several years to converge while the multi-equation framework by means of a VAR model exhibits a monotonic path and eleven years to converge. To sum up, the research has shown that the impact of tourism on GDP is not important while the reverse situation, that is, the GDP has a major impact on tourism something that can be explained by the fact that higher GDP develops tourist infrastructure and attracts more tourism income.

Lee and Chien (2008) investigate the effects regime changes have on the long-run relationship between tourism development and real GDP in Taiwan. In order this relationship to be examined the authors examine the co-movements and the causal relations among real GDP, tourism development and the real exchange rate. The econometric model that is used is a multivariate model that is based on the **Balaguer and Cantavella-Jorda (2002) and Lee and Chang (2007)** papers. The variables of the model are the real GDP of Taiwan, the international tourism receipts and the international tourist arrivals and the real exchange rate. All the data used are annual observations of the variables, with their sample spanning from 1959 to 2003. The innovation of this study is the examination of how policy changes affect the relationship between tourism development and economic growth. The empirical results show that all the three variables have the phenomena of a breakpoint. Secondly, tourism development has a straightforward impact on economic expansion of Taiwan. In other words as economy grows, tourism will rise too and vice versa. Thirdly, the cointegration vector must be taken into account in the specification of tourism development and GDP. Finally, the economic and political relation between China and Taiwan affects the expansion of tourist industry.

Lee and Chang (2007) uses ah heterogeneous panel cointegration technique to examine the causal relationships between tourism development and economic growth for OECD and non OECD countries. They apply a multivariate model which includes the following variables: number of tourist arrivals per capita, tourism real receipts per capita, real effective exchange rate and real GDP per capita. The data of the variables are in an annual base and are applied from 1990 to 2002. The methodology involves the IPS unit root test, the Pedroni cointegration test and the two step procedure of **Engle and Granger (1987)** regarding the causality tests. The empirical investigation concludes to the following remarks: 1) the tourism expansion has higher effect on GDP in non OECD countries than in OECD countries and when we are using tourist receipts tourism activity has a great effect on Sub-Sahara's GDP, 2) as many other papers indicate real exchange rate has very important role on the economies of the paper's sample of countries and 3) the findings of the panel causality test that was applied shows that for OECD countries an unidirectional causality relation from tourism development to economic growth exists while in the other hand for non

OECD countries it was found that there is a reciprocal causality relationship between the above two variables.

Wang (2009) examines the impact of crisis events and also the influence of macroeconomic variables, such as foreign exchange rates, transportation costs, income and relative prices, on Taiwan's international inbound tourism demand. For this purpose is used an auto- regression distributed lag model which is being developed by **Pesaran, Smith and Shin (2001)** and is called ARDL model. This model has bound test with which can examine the existence of long-term relationships among the examined variables. The variables of the model are the total tourist arrivals in Taiwan as a proxy of inbound tourist demand and the level of income, price, exchange rate, oil price, past tourist arrivals and dummy variables for Asian financial crisis 1997-1998, September 11th attacks in 2001 and for the SARS crisis in 2003. The data are obtained in a quarterly base covering the period 1996 Q1 to 2006 Q2. The empirical evidence show that there is a long-term equilibrium among all variables which it shows that the number of inbound tourist arrivals can be affected by the macroeconomic variables, such as income and exchange rates which have a major impact in tourist arrivals. It is also found that number of Japanese tourists to Taiwan is affected by the number of inbound tourist arrivals, income, exchange rates, prices and transportation costs. Also exchange rates and relative prices play a crucial role in tourism stability and is something that policy makers have to protect. Finally this paper shows the major impact that disasters had on Taiwan's tourism.

Shareef and McAleer (2005) investigate the fluctuations and volatility in tourist arrivals to six Small Island Tourism Economies (SITEs), namely Fiji, Dominica, Cyprus, Maldives, Seychelles and Barbados. More specifically this paper focuses on the examination of the conditional volatility of the logarithm of international tourist arrivals in these countries since tourism earnings play a crucial role in SITEs. This paper uses ARMA(1, 1) in order to estimate the conditional means of the logarithm of monthly international tourist arrivals and GARCH(1,1) and GJR(1,1) to estimate the conditional volatility to tourism arrivals. The variables of the model are the tourist arrivals to these SITEs from eleven markets and their sample is spanning from 1980 to 2000 in a monthly base. The empirical results indicate that the test were used to examine the regularity conditions of the logarithm of monthly international tourist arrivals and their growth rates suggest that the univariated models of volatility and trends that were used are statistically adequate. The importance of this finding relies on the fact that these models can be used from private and public sector for the management of tourism.

Hoti, McAleer and Shareef (2005) examine the relationship between tourism growth and country risk returns and their associate volatilities for two SITEs, Malta and Cyprus. For this examination, they are using two multivariate models of conditional volatility: the no-spillover symmetric VARMA-GARCH model of Ling and McAleer (2003) and the asymmetric VARMA-AGARCH model of Hoti, Chan and McAleer (2002). These conditional volatility models are using monthly data for international tourist arrivals in the two countries as a proxy of tourism growth and monthly data of composite risk ratings as a proxy for country risk. The concluding remarks of this research indicate that both Cyprus and Malta's tourism growth are affected by their own previous short and long run shocks. Furthermore, in the case of the VARMA-AGARCH model volatility spillover effects are observed from tourism growth and risk returns for Cyprus to tourism growth for Malta. Also for both models the highest conditional correlation exists between the two tourism growth series, followed by the two country risk return series. This means that the two countries are close substitutes only in tourism growth.

Chen (2007) studies the relationship between GDP and stock prices of tourism firms in order to provide an indication of the interaction between tourism industries performances and economic development in Taiwan and China. For this purpose, Chen constructed a value-weighted tourism price index based on the stock prices of tourism firms. The data that Chen uses are the stock prices of six tourist firms for Taiwan and the stock prices of nine tourist firms from the Shanghai Stock Exchange and the Shenzhen Stock Exchange. All the observations for the stock prices are in a monthly base. In addition, as a proxy for business conditions is used both GDP and industrial production to carry out the empirical examination. The data for IP are monthly and for GDP quarterly. Chen also uses the vector auto regression (VAR)-based cointegration test of Johansen in order to examine the long run relation between business conditions and financial performance of tourist firms and Granger causality tests augmented with an appropriate error-correction term derived from the cointegrating relation between business conditions and financial performance of tourist firms to test the causality patterns that exist if the two time series variables are cointegrated. The results support a long-run equilibrium between the above two variables both in China and Taiwan and also that these two factors also reinforce each other.

Tang and Jang (2009) base their paper on Chen's (2007). The aim of the paper is to investigate the relationship between four tourism related industries (airlines, casinos, hotels and restaurants) and economic growth in the U.S. and also the interrelationships among the growth of tourism industries. The methodology that is used in the present paper includes cointegration tests and Granger causality tests. The data that is used are: a) quarterly industry sales revenues for measuring the industry performance and b) seasonally unadjusted quarterly GDP as a proxy for economic performance. The data cover the period from 1981 Q1 to 2005 Q4. The results indicate that there is no cointegration between industry performance and economic expansion. That is, ways to increase the revenue of tourism industries could potentially be successful in the long run. Also the Granger causality tests show a uni-directional causality from GDP to industry performance which may reflect the small proportion of the market that these industries have on the U.S. economy. In other words may show the small contribution of the U.S. economy to these industries in the short run. Also the temporal causal hierarchy that seems to exist among industry performance can provide to investors and managers a useful tool which can allow them to identify the best time to invest to these industries and also to prioritize the allocation of resources among industries in order to ensure a better tourism and economic performance.

Kim and Wong (2006). The aim of their paper is to apply the concepts and theories of conditional heteroscedastic volatility models and the new impact curve to the Korean inbound tourism market. For this purpose three volatility models is introduced: GARCH, EGARCH and TARCH. The data are used are the monthly arrivals in Korea in a monthly base and their sample spanning from January 1985 to November 2003. The main results of this research are the following: First, the arrivals of foreign tourists into Korea vary with monthly seasonality. Second, the GARCH model suggest that the effects of news shock on monthly tourist arrivals into Korea following a quadratic curve which means that the effect is quite persistent and because the news impact curve of the GARCH model follows a quadratic function centered on ε_{t-1}^2 , as this square spread increases the tourism demand become more volatile. Finally, using the EGARCH and TARCH model was found an asymmetric effect, which means that volatility of monthly inbound tourist demand in Korean depends on whether the news shock was good or bad.

Chen et al. (2009) find similar results as **Kim and Wong (2006)** have found. They examine the impact of volatility in forecasting of number of tourists in China. More accurately, they focus on whether the errors of the estimation of the inbound tourist numbers into China are heteroscedastic. The fundamental purpose of this research is to contribute to the development of better demand models of tourist demand forecast in China. For this purpose they are using three volatility models GARCH, EGARCH and GJR GARCH. These models are used in order to examine the conditional volatility of monthly tourist arrivals in China. The variables of the above models are monthly based data refer to inbound tourists into China and covering the period from January 1985 to November 2008. These time series data are processed with the use of the logarithmic transformation **(Lim, 1997).** The concluding remarks of this paper are two. Firstly, the volatility of inbound tourist demand has ARCH effects and for this reason volatility cannot be assumed as a constant as many studies take into account because volatility clustering occurs in tourist arrivals. Secondly, this study suggests the existence of asymmetrical effect and leverage effect in the number of inbound tourists into China. The importance of this paper relies on the fact that future studies should use the above models for modeling tourism demand which take volatility into account and so the governments and tourism industries can make the right decisions.

Chan, Lim and McAleer (2005) examine the volatility in tourism demand of Australia in order to investigate the interdependent and dependent effects of shocks in tourism demand models. For this purpose, this article uses the logarithm of the monthly tourist arrivals from four leading tourism source countries (USA, Japan, UK and New Zealand) to Australia with the fundamental purpose to be the modeling of the conditional mean and conditional variance of the above arrival rates. So the authors are using monthly data from 1975 to 2000 and three different multivariate GARCH models to examine the conditional volatility of the logarithm of the tourist arrivals rate and to test their interdependent relations. These models are the symmetric CCC-MGARCH model, the symmetric vector ARMA-GARCH model and the asymmetric vector ARMA-AGARCH model and their aim is to obtain the conditional correlation, to examine the interdependencies of volatilities of tourist arrivals among the above countries and to investigate the asymmetric impacts of the unconditional shocks on the conditional variances, respectively. The empirical results show that it exist evidence which support the presence of interdependent effects in the conditional variance between the four leading tourism source countries and the asymmetric impacts of shocks in two of the above countries, Japan and New Zealand. More accurately, a negative shock had a smaller effect on the conditional variance of New Zealand while on the other hand a negative shock had larger impact on the conditional variance of Japan.

Chao et al. (2005) study the effect that tourism has on welfare in a cash-in-advance economy. The results of this research provide evidence for the existence of a relation between tourism and domestic welfare and tourism and economic expansion. More specific, by introducing a monetary model where money is introduced as cash-in-advance and given that tourism is an endogenous variable of the model, since tourism is a demand shock that increases the prices of non-traded goods thus improves welfare via an improvement in the terms of trade. Whether the benefits from the terms-of-trade improvement are greater than the loss from the consumption perversion, the tourism generates a welfare-improving mechanism. Similar results have been founded when tourism is an exogenous variable.

CHAPTER 2: VOLATILITY AND CAUSALITY TESTS

2.1 INTRODUCTION TO VOLATILITY

It is useful to give a definition of volatility in order to explain of what volatility is. The term volatility refers to a statistical measure of the dispersion of returns of a given financial or macroeconomic security. More broadly, volatility refers to the degree of unpredictable change over time of a certain variable. It can either be measured by using the standard deviation or variance between the returns of the variable. A higher volatility means that a security's value can possibly be diffuse over a large range of values. This means that the price of the security can change dramatically over a short period of time in either direction. A lower volatility means that security's value may do not fluctuate enough and so the security can be described as safe. As such, volatility reflects the risk level faced by someone with exposure to that security.

Knowledge of volatility is of crucial importance in many areas, as macroeconomics and finance. For example, considerable macroeconomic work has been done in studying variability of inflation. For some decision makers, inflation may not be bad bout its volatility is not good because it makes financial planning very difficult. The same is true of importers, exporters and traders in foreign exchange markets, for volatility in the exchange rates means huge losses or gains. Investors in stock markets are interested in the volatility of stock prices in order to invest or allocate their portfolios according to the volatility that market show. In volatile markets it is risky and difficult for companies to raise capital in the capital markets.

Mandelbrot (1963) firstly referred to volatility clustering. As he notes large changes tend to be followed by large changes, of either sign, and small changes tend to be followed by small changes. Observations of this type in financial and macroeconomic time series have led to the use of models in order to compute and to quantify volatility. The most well known models that are used to calculate volatility are ARCH (**Engle, 1982**) and GARCH (**Bollerslev, 1986**). The aim of these models is to describe the phenomenon of volatility clustering.

The development of these models and the above reasons that have been cited, show the importance of the study of causality in variance. The study of causality in variance is of interest to both academics and practitioners because of its economic and statistical importance. First of all, volatility fluctuations reflect the arrival of information and the degree of which the markets evaluate the mew information. Furthermore the causality pattern in variance provide us with a better understanding about the dynamics of economic and financial prices and this is essential to construct better econometric models in order to describe more precisely the temporal dynamics of the time series.

The necessity of studying the causality in variance has driven many researchers to develop techniques in order to identify the causality patterns between financial and economic variables. The father of causality is said to be C.W.J. Granger who developed the Granger causality test and influenced many academics to improve and find new causality tests. Three of these were Cheung, Ng and Hong who have developed the Cheung and Ng test and the Hong test. In the next section the author provides the methodologies of these tests to which the present dissertation is based.

2.2 THE GRANGER CAUSALITY TEST

Granger-causality test was firstly proposed by C.W.J. Granger in 1969. Granger was mend to be one of the most influential econometricians in the field of causality and with his research helped to develop the causality tests. Granger defined causality as:

Let Y_n and X_n be two random variables, Ω_n the information set (or σ-algebra) involving the maximum available information regarding the history of these two random variables and A being the set that contains all the possible values that X can take. We say that Y_n causes X_{n+1} if $\Pr ob\left(X_{n+1} \in A \middle| \Omega_n\right) \neq \Pr ob\left(X_{n+1} \in A \middle| \Omega_n - Y_n\right)$ for some A. In other words, a causal relation with direction from Y to X will exist when Y_n contains some kind of information regarding the values that X_{n+1} can take. The fundamental theory behind this test is that the past and present may influence the future, but the future cannot influence the past.

The above definition of causality is too general to be practical and so it cannot be used with real data. For that reason we have provide an operational definition and so we have to modify the general relation above. We assume that we want to exam whether a vector stochastic process Y_t causes another vector X_t. Let J_n be an information set available at time n , which is combined by all the possible terms of vector Z_t, i.e. $J_n : Z_{n-j}, j \geq 0$. Z_t does not contain any of the terms of Y_t while includes all the possible terms of vector process X_t. We also define the information set $J_n^{'}$ for which

$J_n^{'} : Z_{n-j}, Y_{n-j},\ j \geq 0$ and let $F\left(X_{n+1} \middle| J_n\right)$ be the conditional distribution function of X_{n+1}. Regarding the above, we have the following definitions:

- Y_n **does not cause** X_{n+1} with respect to $J_n^{'}$ if $F\left(X_{n+1} \middle| J_n\right) = F\left(X_{n+1} \middle| J_n^{'}\right) \Leftrightarrow E\left(X_{n+1} \middle| J_n\right) = E\left(X_{n+1} \middle| J_n^{'}\right)$.

- If $J_n^{'} \equiv \Omega_n$ then we say that Y_n **cause** X_{n+1} if $F\left(X_{n+1} \middle| J_n\right) \neq F\left(X_{n+1} \middle| J_n^{'}\right) \Leftrightarrow E\left(X_{n+1} \middle| J_n\right) \neq E\left(X_{n+1} \middle| J_n^{'}\right)$.

- Y_n is a **prima facie cause** of X_{n+1} with respect to $J_n^{'}$ if $F\left(X_{n+1} \middle| J_n^{'}\right) \neq F\left(X_{n+1} \middle| J_n^{'}\right)$.

- Y_n **is not cause** X_{n+1} **in mean** with respect to $J_n^{'}$ if $\delta_{n+1}\left(J_n^{'}\right) = E\left(X_{n+1} \middle| J_n^{'}\right) - E\left(X_{n+1} \middle| J_n\right) = 0$.

- Y_n **causes** X_{n+1} **in mean** if $\delta_{n+1}\left(\Omega_n\right) \neq 0$.

When we are referring to causality in mean we should know that is a type of causality that is weaker than the general concept of causality because it does not involve the whole probability distribution of the random variable. Nevertheless, this type of causality is much more practical as it can be empirically tested using the least squares estimation methodology. When $\sigma^2\left(X \middle| J_n, Y\right) < \sigma^2\left(X \middle| J_n\right)$ will say that Y_n can help us to conduct more accurate forecasts regarding X_{n+1} and decreases the uncertainty of predictions.

Another causal relation that we have to mention is that of a feedback relation. When Y_n causes X_{n+1} and X_n causes Y_{n+1} then will exist bidirectional feedback causality.

In this point we have to refer to some drawbacks of the examination of causal relations. The first problem is detected is about the frequency of the empirical data that sometimes cannot be exclusively determined by the researcher and depends also on the availability and nature of this kind of data. This can lead to misleading results regarding the type of causality.

Another problem that we have to face is the omission of important exogenous explanatory variables from the econometric models used during the causality tests. This can lead us to biased results. Thus, the possibility of wrong results has to be kept in mind when interpreting results.

At last we have to mention the situation in which the time we measure a variable is not the same with the time period that an event that led this variable to take the measured value, has been realized.

2.3 THE CHEUNG & NG TEST

This test was proposed by **Cheung and Ng** (1996) for testing causality in variance of two time series and is based on the estimation of the residual cross-correlation function (CCF) and squared standardized residuals to detect causal relationships and to identify patterns of causation in the first and second moment. This method is an extension of the standard test of causation in mean. But the main advantage is that the CCF approach can analyze the causality not only in the mean but also in the variance.

This technique developed a two-stage procedure to test for causality in variance. In the first stage they estimate the univariate ARMA/GARCH models and obtain the squared residuals innovations while in the second stage, estimated standardized residuals and their squares are used to infer the causation pattern. Let’s now analyze this method by using mathematical tools.

Let us consider two ergodic and stationary time series $\mathbf{X_t}$ and $\mathbf{Y_t}$ and their two information sets $\boldsymbol{I_t} = \{X_{t-j}, j \geq 0\}$ and $\boldsymbol{J_t} = \{X_{t-j}, Y_{t-j}, j \geq 0\}$. We said that $\mathbf{Y}_t$ Granger-causes $\mathbf{X_{t+1}}$ in variance if $E\{(X_{t+1} - \mu_{x,t+1})^2 | I_t\} \neq E\{(X_{t+1} - \mu_{x,t+1})^2 | J_t\}$, where $\mu_{\chi,t+1}$ is the mean of $\mathbf{X_{t+1}}$ conditioned on $\boldsymbol{I_t}$. There will de a feedback in variance occurs if **X** Granger- causes **Y** and **Y** Granger-causes **X.** At last there is instantaneous causality in variance if

$$E\{(X_{t+1} - \mu_{x,t+1})^2 | J_t\} \neq E\{(X_{t+1} - \mu_{x,t+1})^2 | J_t + Y_{t+1}\}.$$

Because the above relations are too general, in order to empirically test these types of causal relations it is essential to input additional structure. We suppose that time series $\mathbf{X_t}$ and $\mathbf{Y_t}$ can be written as

$$X_t = \mu_{x,t} + h_{x,t}^{0.5} \varepsilon_t$$
$$Y_t = \mu_{y,t} + h_{x,t}^{0.5} \zeta_t,$$

where $\{\varepsilon_t\}$ and $\{\zeta_t\}$ are two independent white noise processes with zero mean and unit variance.

The conditional mean and variance are given by the following relations:

$$\mu_{z,t} = \sum_{i=1}^{\infty} \phi_{(z,i)}(\theta_{z,\mu}) \mathrm{Z}_{t-i} \rightarrow (1)$$
$$h_{z,t} = \phi_{z,0} + \sum_{i=1}^{\infty} \phi_{z,i}(\theta_{z,h}) \{(\mathrm{Z}_{t-i} - \mu_{z,t-i})^2 - \phi_{z,0}\} \rightarrow (2),$$

where $\theta_{z,w}$ is a $p_{z,w} \times 1$ parameter vector and W = μ,h , $\phi_{z,i}(\theta_{z,w})$, where W = μ,h, are uniquely defined functions of $\theta_{z,w}, W = \mu, h$ and Z = X,Y. Relations (1) and (2) include the time-series models such as ARMA models and (G)ARCH processes.

Now we can obtain the squared standardized innovations by simply estimating the above models. Let $\mathbf{U_t}$ and $\mathbf{V_t}$ be the squares of standardized innovations,

$$U_t = \left(\left(X_t - \mu_{x,t} \right)^2 / h_{x,t} \right) = \varepsilon_t^{\,2},$$
$$V_t = \left(\left(Y_t - \mu_{y,t} \right)^2 / h_{y,t} \right) = \zeta_t^{\,2}$$

These residuals will be used as inputs for the estimation of the CCF in the second step of the methodology. In order to calculate the CCF we have to define the sample cross-correlation function. Let $r_{u\upsilon}(\kappa)$ be the sample cross-correlation at lag ***k,***

$$r_{u\upsilon}(k) = c_{u\upsilon}(k)\left(c_{uu}(0)c_{\upsilon\upsilon}(0)\right)^{-1/2},$$ where

$c_{u\upsilon}(0)$ is the sample variance of U
$c_{\upsilon\upsilon}(0)$ is the sample variance of V
$c_{u\upsilon}(k)$ is the kth lag sample cross covariance, which is computed by
$c_{u\upsilon}(k) = T^{-1}\sum (U_t - \overline{U})(V_{t-k} - \overline{V}),\ k = 0, \pm 1, \pm 2......$

In combination with the hypothesis that the two residuals series $\{U_t\}$ and $\{V_t\}$ are independent and that the second moments of these series are exist and are finite we will have that :

$$\begin{pmatrix} \sqrt{T}\, r_{u\upsilon}(k) \\ \sqrt{T}\, r_{u\upsilon}(k') \end{pmatrix} \to AN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \right),\ \ k \neq k'$$

The above expression suggests that the CCF of squared standardized residuals can be used to detect causal relations and identify patterns of causation in the second moment.

The sample residual cross-correlation we have computed above help us to construct a proper causality in variance test. Because the $\mathbf{U_t}$ and $\mathbf{V_t}$ are not observable we need their estimators in order to test the hypothesis of no causality in variance. For this reason we will use the estimator of the sample cross-correlation coefficient $\hat{r}_{u\upsilon}(k)$.

Let $\theta_z^0 \equiv \left\{\theta_{z,\mu}^0, \theta_{z,h}^0, \varphi_{z,0}^0\right\}$ be the true parameter vector and $\hat{\theta}_z \equiv \left\{\hat{\theta}_{z,\mu}, \hat{\theta}_{z,h}, \hat{\varphi}_{z,0}\right\}$ its consistent estimator, where

$$Z = X, Y$$
$$\theta^0 = \left(\theta_x^0, \theta_y^0\right)$$
$$\hat{\theta} = \left(\hat{\theta}_x^0, \hat{\theta}_y^0\right)$$
$$\text{and } \theta = \left(\theta_x, \theta_y\right).$$

So $\hat{r}_{u\upsilon}(k)$ is defined as $\hat{r}_{u\upsilon}(k) = r_{u\upsilon}(k)\Big|_{\theta=\hat{\theta}}.$

Regarding the above results and the fact that the asymptotic behavior of the estimator of the sample cross-correlation coefficient $\hat{r}_{u\upsilon}(k)$ is given, we can construct the following test statistics to test the null hypothesis of noncausality:

1. $S = \sqrt{T}\,\hat{r}_{u\upsilon}(k) \sim N(0,1)$

The above test statistic is used to test for a causal relationship at a specified lag *k*. Another test we can use is the following:

2. $S = T\sum_{i=j}^{k} \hat{r}_{u\upsilon}(i)^2 \sim X^2(k-j+1)$

The above test statistic is used in order to test the hypothesis of no causality from lag j to lag k and this function follows a chi-square distribution with $(k-j+1)$ degrees of freedom. At this point we have to provide an important note. The choice of j and k depends on the specification of the alternative hypothesis. When we do not know the direction of causality it is preferable to set $-j = k = m.$ The parameter m should be large enough to include the largest nonzero lag that may appear in the causation pattern. In the opposite case, where the direction of causality is known ,for example if y causes x we set $j = 1$ and $k = m$.

When we have small size sample T, the second test statistic can be modified to

3. $S_M = T\sum \omega_i \hat{r}_{uv}(i)^2 \sim X^2(k-j+1)$, where $\omega_i = T/\left(T-|i|\right)$ or $\left(T+2\right)/\left(T-|i|\right)$

(Haugh, 1976; McLeod and Li, 1983). Note that S_M is always larger than S. The advantage of this test is that its distribution approaches better the chi-square density when we are using small samples.

Comparing the Cheung and Ng test with alternative methodologies that make use of multivariate GARCH models, we can see some advantages. Firstly, this methodology does not involve simultaneous modeling of both intra- and inter-series dynamics and because of that it is easy to use. Secondly, the Cheung and Ng methodology is robust to distributional assumptions. Furthermore it can also be used to study causal relations extending for longer time series and long lags in the causation patterns.

A disadvantage of this test is that it is not designed to detect the presence of nonlinear causation.

2.4 The Hong Test

The Hong test was proposed by Yongmiao Hong (2001). It constitutes a development of the Cheung and Ng test. Hong notes that the test statistic S that was produced by the Cheung and Ng methodology may not be fully efficient since it sets equal weighting to each lag. For this reason, Hong introduced a flexible weighting scheme which gives larger weights for lower order lags. More specifically, non-uniform weighting gives better power against the alternatives whose cross-correlations decay to zero as the lag order increases. This modifications produced a new test statistic, Q_1 , which is an appropriately standardized version of Cheung and Ng statistic. Now we can describe the Hong test.

We assume two strictly stationary time series:

$$\begin{matrix}\{Y_{1t}, t \in \Re^*\} \\ \{Y_{2t}, t \in \Re^*\}\end{matrix}, \text{ where } \Re^* = \Re \cup \{-\infty, +\infty\}$$

and their information sets $I_{it}, i = 1,2$ and let $I_t = (I_{1t}, I_{2t})$.

We shall now define what Granger-cause means. As defined in Granger (1980), Y_{2t} is said to Granger-cause Y_{1t} with respect to information set I_{t-1} if

$$\Pr(Y_{1t} | I_{1t-1}) \neq \Pr(Y_{1t} | I_{t-1}).$$

Because the above relationship is too general to be used, we have an alternative and more easily definition of Granger-cause, which is the following relation

$$E(Y_{1t} | I_{1t-1}) \neq E(Y_{1t} | I_{t-1}) \equiv \mu_{1t}^0.$$

The null hypothesis H_0 that we want to test is the noncausality in variance for two time series. The null and the alternative hypotheses are:

$$H_0 : E\{(Y_{1t} - \mu_{1t}^0)^2 | I_{1t-1}\} = E\{(Y_{1t} - \mu_{1t}^0)^2 | I_{t-1}\} \equiv Var(Y_{1t} | I_{t-1})$$
$$H_A : E\{(Y_{1t} - \mu_{1t}^0)^2 | I_{1t-1}\} \neq Var(Y_{1t} | I_{t-1})$$

We have three possible types of causal relations in variance:

1. If we accept H_0 then we say that Y_{2t} does not Granger-cause Y_{1t} in variance, while if we accept H_A we say that Y_{2t} Granger-cause Y_{1t} in variance.
2. We have a feedback in variance if Y_{1t} granger-causes Y_{2t} in variance and vice versa.
3. A simultaneous causality in variance occurs if

$$E\{(Y_{1t} - \mu_{1t}^0)^2 | I_{t-1}\} \neq E\{(Y_{1t} - \mu_{1t}^0)^2 | I_{1t-1}, I_{2t}\}.$$

At this point we have to note that even if no causality in mean and variance exists, that does not imply anything about the general causation, because it is possible to have causality in higher order moments.

The next step to the Hong methodology is to find a test for the null hypotheses H_0.
Consider the following disturbance processes:

$$\varepsilon_{it} = Y_{it} - \mu_{1t}^{0}, i = 1,2$$

where $\mu_{1t}^{0} = E(Y_{1t} | I_{t-1})$.

The underlying generating mechanism of residual is $\varepsilon_{it} = \xi_{it}(h_{it}^{0})^{1/2}$, where $h_{it}^{0} = E(\varepsilon_{it}^{2} | I_{it-1})$ is the conditional volatility and $\{\xi_{it}\}$ are the standardized residuals. By construction we have the following properties:

$$E(\xi_{it} | I_{it-1}) = 0$$
$$E(\xi_{it}^{2} | I_{it-1}) = 1$$
$$E(\varepsilon_{it} | I_{it-1}) = 0$$
$$E(\varepsilon_{it}^{2} | I_{it-1}) = 1$$

The H_0 and H_A can be written in terms of the squared residuals as:

$$H_0 : Var(\xi_{1\tau} | I_{1t-1}) = Var(\xi_{1t} | I_{t-1})$$

versus

$$H_A : Var(\xi_{1\tau} | I_{1t-1}) \neq Var(\xi_{1t} | I_{t-1}).$$

So we can check whether ξ_{2t} Granger-causes ξ_{1t} in variance. If H_0 holds, then ξ_{2t} does not Granger-causes ξ_{1t} and if H_A holds then ξ_{2t} Granger-causes ξ_{1t}.

Despite that squared innovations $\{\xi_{it}^{2}\}$ are not observable, they can be estimated squared residuals standardized b their conditional variance estimators.

Next, we provide the model specifications that will be used:

$\mu_{it}^{0} = \mu_{it}(b_{i}^{0}), i = 1,2$, where b_{i}^{0} are unknown parameter vector

$h_{it}^0 = \omega_i^0 + \sum_{j=1}^{q} a_{ij}^0 \varepsilon_{it-j}^2 + \sum_{j=1}^{p} \beta_{ij}^0 h_{it-j}^0$, which follows a GARCH(p,q) stochastic process

$\{Y_t\}_{t=1}^T$: Vector stochastic process

$Y_t = (Y_{1t}, Y_{2t})$

$\tilde{\theta}_i = \left(b_i^{0'}, \omega_t^0, a_i^{0'}, \beta_i^{0'}\right)'$ be any $\sqrt{T}-$consistent estimator for $\theta_i^0 = \left(b_i^{0'}, \omega_i^0, a_i^{0'}, \beta_i^{0'}\right)'$

$\alpha_i^0 = \left(a_{1i}^0, \ldots\ldots\ldots\ldots, a_{qi}^0\right)'$

$\beta_i^0 = \left(\beta_{1i}^0, \ldots\ldots\ldots\ldots, \beta_{pi}^0\right)'$

After the estimation of the above model we can obtain the centered squared standardized innovations as

- $\hat{u}_t \equiv u_t\left(\hat{\theta}_1\right) = \tilde{\varepsilon}_{1t}^{\,2} / \tilde{h}_{1t} - 1$
- $\hat{\upsilon}_t \equiv \upsilon_t\left(\hat{\theta}_2\right) = \tilde{\varepsilon}_{2t}^{\,2} / \tilde{h}_{2t} - 1$

where $\hat{\varepsilon}_{it} \equiv \varepsilon_{it}\left(\hat{\theta}_i\right)$, $\hat{h}_{it} \equiv h_{it}\left(\hat{\theta}_i\right)$, with

- $\varepsilon_{it} = \mathrm{Y}_{it} - \mu_{it}(b_i)$,
- $h_{it}(\theta_i) = \omega_i + \sum_{j=1}^{q} a_{ij} \varepsilon_{it-j}^2(\theta_i) + \sum_{j=1}^{p} \beta_{ij} h_{it-j}(\theta_i)$.

These residual will be used as inputs for the estimation of CCF. As we saw in the previous paragraph, Cheung and Ng (1996) was proposed a test for H_0 using the sample cross-correlation function, which is calculated by the following procedure:

$\tilde{\rho}_{u\upsilon}(j) = \left\{\tilde{C}_{uu}(0)\tilde{C}_{\upsilon\upsilon}(0)\right\}^{-1/2} \tilde{C}_{u\upsilon}(j)$, where the sample cross-correlation function is defined as:

$$\tilde{C}_{u\upsilon}(j) = \begin{cases} T^{-1} \sum_{t=j+1}^{T} \hat{u}_t \hat{\upsilon}_{t-j}, & j \geq 0, \\ T^{-1} \sum_{t=-j+1}^{T} \hat{u}_{t+j} \hat{\upsilon}_t, & j \geq 0, \end{cases}$$

and $\hat{C}_{uu}(0) = T^{-1}\sum_{t=1}^{T}\hat{u}_t^2$ and $\hat{C}_{\upsilon\upsilon}(0) = T^{-1}\sum_{t=1}^{T}\hat{\upsilon}_t^2$.

Hong has stated that the current volatility of the first variable is more affected by the recent volatility of the second variable than the remote past volatility of the second variable. Empirically speaking, cross-correlations between financial assets or markets generally decay to zero when the lag order j increases. For that reason, Hong suggested a new test statistic which was based on the kernel function. Kernel function is a weighting function that gives large weights in low lag cross-correlation coefficients. The most important kernels functions are the following:

1. Truncated: $k(z) = \begin{cases} 1, & |z| \le 1 \\ 0, & \text{otherwise} \end{cases}$

2. Bartlett: $k(z) = \begin{cases} 1-|z|, & |z| \le 1 \\ 0, & \text{otherwise,} \end{cases}$

3. Daniell: $k(z) = \sin(\pi z)/\pi z, \quad -\infty < z < \infty,$

4. Parzen: $k(z) = \begin{cases} 1-6z^2+6|z|^3, & |z| \le 0.5, \\ 2(1-|z|)^3, & 0.5 < |z| \le 1, \\ 0, & \text{otherwise,} \end{cases}$

5. QS: $k(z) = \dfrac{3}{\sqrt{5}(\pi z)^2}\{\sin(\pi z)/\pi z - \cos(\pi z)\}, \quad -\infty < z < \infty,$

6. Tukey-Hanning: $k(z) = \begin{cases} \frac{1}{2}(1+\cos(\pi z)), & |z| \le 1 \\ 0, & \text{otherwise.} \end{cases}$

The test statistic that is proposed is the following:

$$Q_1 = \left\{ T \sum_{j=1}^{T-1} k^2\left(\frac{j}{m}\right) \hat{\rho}_{uv}^2(j) - C_{1T}(k) \right\} \Big/ \left\{ 2D_{1T}(k) \right\}^{1/2},$$

where

$$C_{1T}(k) = \sum_{j=1}^{T-1}\left(1-\frac{j}{T}\right)k^2\left(\frac{j}{m}\right),$$

$$D_{1T}(k) = \sum_{j=1}^{T-1}\left(1-\frac{j}{T}\right)\left\{1-\frac{j+1}{T}\right\}k^4\left(\frac{j}{m}\right).$$

The factors $\left(1-\frac{j}{T}\right)$ and $\left(1-\frac{j}{T}\right)\left\{1-\frac{j+1}{T}\right\}$ are finite sample corrections.

The values obtained through he above test must be considered with upper tailed standard normal distribution critical values. Another test that we can consider, which is asymptotically equivalent with the above test, is:

$$Q_1^* = \left\{ T \sum_{j=1}^{T-1} \left(1-\frac{j}{T}\right)^{-1} k^2\left(\frac{j}{m}\right) \hat{\rho}_{uv}^2(j) - C_{1T}^*(k) \right\} \Big/ \left\{ 2D_{1T}^*(k) \right\}^{1/2},$$

where

$$C_{1T}^*(k) = \sum_{j=1}^{T-1} k^2\left(\frac{j}{m}\right),$$

$$D_{1T}^*(k) = \sum_{j=1}^{T-1}\left\{1-\left(T-j\right)^{-1}\right\}k^4\left(\frac{j}{m}\right).$$

Finally, another test statistic that we can use when we do not have any ex ante information in regard with the direction of causal relation is the following:

$$Q_2 = \left\{ T \sum_{j=1-T}^{T-1} k^2\left(\frac{j}{m}\right) \hat{\rho}_{uv}^2(j) - C_{2T}(k) \right\} \Big/ \left\{ 2D_{2T}(k) \right\}^{1/2},$$

where

$$C_{2T}(k) = \sum_{j=1-T}^{T-1}\left(1-\frac{|j|}{T}\right)k^2\left(\frac{j}{m}\right),$$

$$D_{2T}(k) = \sum_{j=1-T}^{T-1}\left(1-\frac{|j|}{T}\right)\left\{1-\frac{|j|+1}{T}\right\}k^4\left(\frac{j}{m}\right).$$

The values obtained using the above test statistic must once be compared with the critical values that correspond to the upper tail of a standard normal distribution.

2.5 LITERATURE REVIEW ON CAUSALITY

We will refer briefly to several studies that examined the concept of causality in the first and second moment. We will first introduce the studies from **Engle, Ito & Lin** (1990) and **Hamao, Masulis & Ng** (1990), who found that volatility in one market tends to continue after that market closes, producing volatility in markets opening several hours later even though these markets are geographically distant. **Engle, Ito and Lin** (1990) used four observations per day on the Japanese yen/U.S. dollar exchange rate and reported evidence in favour of a spillover effect in volatility between the different market locations, whereas **Hamao, Masulis and Ng** (1990) found a causal effect in the variance from the U.S. to the Japanese stock market only, and not conversely. Before referring to these studies, it is important to introduce the heat wave and the meteor shower hypothesis. According to the heat wave hypothesis, volatility has only country-specific autocorrelations, while on the other hand the meteor shower hypothesis allows volatility spillovers across markets.

Specifically: **Engle, Ito & Lin** (1990) attribute the Volatility Clustering pattern observed in economic and financial time series in two factors. On the one hand there exists the autocorrelation in the news arrival process which describes the flow of new information in the market that comes in clusters. On the other hand, the violation of the efficient market hypothesis which entails the existence of heterogeneous expectations and the use of inside information contribute negatively in a persistent turbulence in the market after a shock. An absence of Volatility transmission means that a market has local characteristics and influences only the domestic market. An existence of Volatility spillover can be attributed to competitive policies of the central banks, to the distribution of expectations or fears of a market in other markets and maybe to changes in common fundamental factors. Engle, Ito & Lin use daily data on the exchange rate Dollar/Yen exchange rate running from October 1985 till September 1986. Specifically, they decomposed the daily change in Exchange rate, in four individual changes in four important international foreign exchange markets, the markets of Pacific, Tokyo, London and New York. These markets are opened in non overlapping time periods. They founded volatility spillovers across these four markets.

Hamao, Masulis & Ng (1990) have studied the short-run interdependence of prices and price volatility across three major international stock markets of Tokyo, London and New York and examined the transmission mechanisms of the conditional first and second moment in common stock prices across these international stock markets. Specifically, they examined the daily and intraday stock-price activity over a three year period running from April 1985 to March 1988. They divided daily close-to close returns into their close-to-open and open-to-close components and analyzed separately the spillover effects of price volatility in foreign markets on the opening price in the domestic market and on prices after the opening of trading. They utilized the autoregressive conditionally heteroskedastic ARCH family of statistical models to explore these pricing relationships and found that daily stock returns measured from close-to-open and open-to-close to be approximated by a GARCH (1,1) in Mean model. They concluded that volatility spillovers could represent a causal phenomenon across markets that trade sequentially and could reflect global economic changes that can currently alter stock-return volatility across international stock markets. As far as the three international stock markets are concerned, they found that on the one hand there exist price volatility spillovers from New York to Tokyo, London to Tokyo, and New York to London, but on the other hand, however, they have not found any price volatility spillover effects in the reverse relation.

Lin et al (1991) use a signal extraction model with GARCH processes to study the interaction of the US and the Japanese stock markets. Their findings suggest that price and volatility spillovers are generally reciprocal, in the sense that the two markets influence each other.

Baillie & Bollerslev (1996) have examined four (4) foreign exchange spot rate series, recorded on an hourly basis for a six-month period (January 1986 till July 1986) in 1986, using a GARCH model specification with hourly dummy variables in order to model the volatility apparent in the percentage nominal return of each currency. The use of hourly data allows both currency specific and market specific factors to be clearly identified. For the conditional mean specification they have chose a moving average parameterization that is compatible with the efficient market hypothesis. They concluded that for each exchange rate, the volatility appears to be highly serially correlated. This is in accordance with the meteor shower hypothesis, where the news is transmitted through time and different market locations.

Ito, Engle & Lin (1992) have examined the intra-daily volatility of the yen/dollar exchange rate from 1979 to 1988 which correspond to different degrees of international policy coordination and have tested for heat wave vs. meteor shower effects. Precisely, they examined the volatility of the yen/dollar exchange rate during the period 1979-1988 in order to disentangle the causes of meteor showers and proposed a decomposition of volatility into components due to heat waves and to meteor showers, measuring separate contribution of heat wave and meteor shower characteristics in the volatility of financial markets. According to them the meteor shower phenomenon constitutes a failure of the market to fully make use of its information and may signal a violation of the market efficiency. They examined the role of the cooperative policies of central banks in the creation of meteor shower effects. They used a GARCH model specification and collected data concerning the intra-daily yen/dollar exchange rate from 1 February 1979 to 23 December 1988. The final conclusion of this study is that the volatility of the exchange rates has the characteristics of a meteor shower to its similarity to the pattern of meteor showers which are transmitted across the various markets as the globe turns. Despite the extensive investigation of the linkages and interactions of major stock markets, no attempt has been made to investigate the possibility that the quantity of news *(i.e.* the size of an innovation), as well as the quality *(i.e.* the sign of an innovation) may be important determinants of the degree of volatility spillovers across markets.

In terms of foreign stocks markets, **Koutmos** (1992) found a significant leverage effect in the stock returns of Canada, France and Japan stock markets. The evidence that volatility in the US and other stock markets is responding asymmetrically to own past innovations suggests that volatility spillovers themselves may be asymmetric, in the sense that negative innovations in a given market produce a higher volatility spill over in the next market to trade, than do positive innovations of an equal magnitude.

After three years, **Koutmos & Booth** (1995) have analyzed the transmission mechanism in the first and second moment of returns across the New York, Tokyo and London stock market. Using an extended multivariate Exponential Generalized Autoregressive Conditionally Heteroskedastic (EGARCH) model, they described the asymmetric impact of good and bad news on volatility. They collected daily open-to close returns for the basic index of each of the three markets, for the period from September 1986 until December 1993. They found evidence of price spillovers from New York to Tokyo and London, and from Tokyo to London. More extensive and reciprocal, however, were the second moment interactions. They documented significant volatility spillovers from New York to London and Tokyo, from London to New York and Tokyo and from Tokyo to London and New York. In all instances the volatility transmission mechanism is asymmetric. For example negative innovations in a given market increase volatility in the next market to trade considerably more than positive innovations. In other words, stock markets are sensitive to news originating in other markets, especially when the news has negative sign.

Booth, Martikainen & Tse (1997) have provided new evidence on the price and volatility spillovers among the four Scandinavian (Nordic) stock markets of Denmark, Norway, Sweden and Finland. They have applied the Exponential Generalized Autoregressive Conditionally Heteroskedastic (EGARCH) model and have collected data for the main index of each of the stock market for a six year period from May 1988 until June 1994. They found evidence for volatility transmission from Sweden to Finland with a weaker pattern observed in the reverse direction. These spillovers may reflect the longstanding economic and cultural ties between these two countries.

Hu, Chen, Fok & Huang (1997) have examined the transmission effects of volatility among the two developed markets and four emerging markets in the South China Growth Triangular using Cheung and Ng's causality in variance test. They analyzed index returns of equity markets for a 4 year period, from October 1992 through February 1996. The indices they used were from the stock market of Taiwan, Tokyo, New York, Hong Kong and Shanghai. They have provided evidence of the existence of volatility transmission from Tokyo to New York and a bidirectional causal relation in the second moment between the Hong Kong and US stock market. The information received from the Cheung and Ng's causality in variance test has contributed to the construction of econometric models. Including the effect of volatility transmission in the models, this has as a result the reduction of the degree of volatility persistence. In other words, foreign information is an important source of return volatility for emerging markets. Finally, geographic proximity and economic ties between two countries do not necessarily lead to a strong relationship in volatility across markets.

The results of the investigation of **Tse** (1998), that we will analyze now, are in contrast to **Hamao, Masulis & Ng** (1990) and **Engle, Ito & Lin** (1990) who found volatility spillovers between stock markets. Precisely, **Tse** (1998) has analyzed the information transmission mechanism between Japan and the US financial markets and tested the hypothesis that domestic market efficiently adjusts to foreign information. They collected data for 3-month interest rate futures contracts in Eurodollars and Euro Yen traded in Tokyo and Chicago, respectively, from the period June 1990 through July 1996. These two financial markets, according to Tse, they do not suffer from non- lead to spurious results as far as volatility spillovers are concerned. He used a two dimensional constant correlation EGARCH model in order to examine the Volatility linkages between the markets and the contemporaneous correlations for the investigation of the information transmission mechanism. He argued that the markets are informationally linked by some global events, the information transmission is rapid and that previous daytime foreign information, which is efficiently reflected in the open price of the domestic market, does not affect the volatility of the domestic market. To put it simply, Tse underlined that volatility clustering of changes thoroughly stems from domestic information.

Brooks & Henry (2000) have modelled the transmission of shocks between the US, Japanese and Australian equity markets. They have used parametric and nonparametric techniques, in order to test for the existence of linear and non-linear transmission of volatility across these markets. Precisely, they used the nonparametric test for non-linear Granger causality of Hiemstra and Jones (1994) in order to detect possible ties across the three markets. They collected weekly data from US, Japanese and Australian stock markets for the period from 1980 to 1998. They found evidence for the presence of causal relations from the U.S. and Japan to Australia However, little evidence is found regarding the reverse causality between the two markets. The asymmetry of the estimated variance - covariance matrix of returns implies that both the magnitude as well as the sign of the innovation in returns determines the spillover.

Kanas and Kouretas (2002) investigated the existence of causal relations in the first and second moments of the exchange rates among four (4) Latin American markets, the market of Argentina, Brazil, Mexico and Chile. They collected monthly data running from 1976 till 1993.They used the Cheung & Ng test for Causality in

Variance. Firstly, they used EGARCH models in order to capture the leverage effects of Volatility shocks as well as to investigate whether the presence of Causality in Variance can influence the existence of causal relations in the mean. They found that causality in variance can have a significant impact in causality in mean results in the case of a GARCH in mean (GARCH – M) or EGARCH in mean specification model. They generated data characterized from causality in variance and they used two specifications for the conditional mean model before studying for mean transmissions: 1. the GARCH term is included in the mean model and 2. The GARCH term is not included in the mean model. They concluded that there exist causal relations among the mean as well as the volatilities between the aforementioned markets inside each country and across the different markets. They proposed as a specification model for Volatility the Exponential GARCH (EGARCH) that has the possibility to model the asymmetric effects of shocks in Volatility.

Sola, Spagnolo & Spagnolo (2002) proposed an alternative way of detecting the transmission of high volatility periods from one economy to another. Using a parameterization of the Markov switching model which allows for four possible states of nature, they tested whether a country leads the other in and out of a period of high volatility. They underlined the fact that a crisis and as a result its transmission is better characterized as a sporadic event, rather than a structural relationship between stock markets as in a multivariate GARCH. They examined an empirical application of this procedure to three emerging markets recently affected by severe financial crises, the markets of Thailand, South Korea and Brazil for the period from January 1980 to January 2001, estimating two bivariate models. They have found that Thailand leads South Korea and therefore the volatility spillovers appear to be unidirectional following the onset of the crisis, running from the markets in turmoil (Thailand) to the other (South Korea). Only weak sign of evidence of volatility spillover was found between South Korea and Brazil.

Caporale, Pittis & Spagnolo (2002) investigated the causality relations among variances in four East Asian countries. They used daily data from the financial markets of Japan, Indonesia, South Korea and Thailand for the period from January 1987 to January 2000. They introduced a bivariate GARCH–BEKK specification for testing for the existence of a relationship between the variances among these financial markets. Hypothesis testing is performed on the models using the likelihood ratio test. They found evidence of volatility spillovers in all four countries. In the period before crisis, for Indonesia and Thailand, they found unidirectional positive spillovers in the second moment, from stock markets to foreign exchange markets. On the other hand, Japan and South Korea markets are in line with the portfolio approach. In the post-crisis period in the case of Korea and Japan we have the same approach as it was in the pre-crisis period; the variance appears to become bidirectional for Indonesia and Thailand. In addition, they have conducted Monte Carlo experiments to estimate the Type-I error probability of the likelihood ratio test, using artificial time series generated according to a multivariate model.

Pantelidis & Pittis (2004) investigated the effects of neglected causality in mean, on the finite sample properties of a variety tests regarding the causality in variance and focused on the interactions between causality in mean and causality in variance and more specifically on the effects of the former on testing for the latter. They made several critics in the field of tests concerning the causality in variance. Such tests are those of Cheung & Ng (1996) and Hong (2001). They stated that the above tests on the one hand are designed to detect the presence of causality in variance, but on the other hand do not account for any causality in mean, simultaneously. Using the Monte Carlo simulations they concluded that the tests for causality in variance suffer from size distortions when strong causality-in-mean effects do not have been taken into account. As a result, any conditional mean effects should be filtered out by a model that allows for the presence of causality in mean before any inferences on causality in variance are drawn.

Malik (2005) examined the relationship between the volatility of the British Pound and the volatility of the Euro, denominated in terms of Dollar, according to the exchange rates. According to his research, Malik found that Euro is more volatile than BP both at the hourly and daily frequencies. The higher volatility of euro than BP has important implications for many other financial markets.

Dijk, Osborn & Sensier (2005) examined the size properties of causality-in-variance tests in the presence of structural breaks in volatility. They made several critiques concerning the methods that are used from Cheung & Ng and Hong. They insisted of taking pre – tests for the series concerning the structural changes in volatility and recommended that causality-in-variance tests of Cheung & Ng and Hong should be applied only after such pre-testing for breaks in volatility. This is the reason why they conducted a Monte Carlo study in which they generated data that represent the above characteristics. They made several tests. First they ignored the structural breaks in volatility and found that this has only minor effects when just one of the series experiences a volatility change. On the other hand, simultaneous changes in volatility lead to substantially larger size distortions, with the distortion declining as the time interval between breaks increases.

Finally, **Inagaki** (2007) examined the volatility spillover between the British pound and the euro, denominated in terms of dollar. He made one step more from Malik who investigated the relationship of the volatility of British pound and Euro. Inagaki gave weight to causality in variance, which is directly related to volatility spillover and obtained the following empirical results, using the residual cross-correlation approach. Firstly, he found evidence of existence of strong simultaneous interaction between the British pound and the euro. Secondly, observed that the Euro Granger-causes the British pound in mean, whereas the British pound does not Granger-cause the euro in mean. Finally, he argued that the Euro Granger-causes the British pound in variance, whereas the British pound does not Granger-cause the euro in variance. In other words, the euro mean and volatility has a one-sided impact on the British pound volatility. From a theoretical viewpoint, the mostly strong explanation from the above findings is that volatility interaction corresponds to information transmission. With regard to this, British pound traders pay attention to information derived from the euro and that euro traders also pay attention to information derived from the British pound.

CHAPTER 3: METHODOLOGY AND RESULTS

3.1 DATA

In order to test the relation that maybe occurs between financial volatility, macroeconomic volatility and tourism development we will introduce the following variables:

- Regarding financial variables, we will use the *Share price index* of the countries we will examine. This index measures the performance of the stock market of the given nation. The share price index is an adjusted weighted average of the stocks of the stock market. This is a very useful tool for investors, because it provides a way the investors judge the overall state of the economy.

- In order to measure the economic activity we will use the *Industrial production (IP) of* the given nation. Industrial production is a popular measure for the economic performance (Estrella & Hardouvelis, 1991; Fama & French, 1989; Chen, 1991; Miffre, 2001; Chen 2005). Industrial production is an economic report that measures changes in output for the industrial sector of the economy like, manufacturing, mining, utilities and construction. Although these sectors contribute only a small portion of GDP, they are highly sensitive to interest rates and consumer demand. This makes Industrial production an important tool for examining the economic performance of a nation. Also, an additional advantage of using IP data is that is a monthly measure, which in turn can provide more observations. Finally industrial production is more sensitive to business cycles and that allowed us to observe fluctuations in the real economy.

- The third variable that we will use as a proxy to measure the tourism development is *tourist arrivals.* In literature, tourist arrivals are widely used in order to have a good understanding of tourist activity. *Tourist arrivals* are referred to the number of visitors who stay at least one night in a collective or private accommodation in the place/country visited. Visitor arrivals is the most popular measure in studies about tourism since 2000 (**Song & Li, 2008**)

All of our data are in a monthly base. *Share price index* and *Industrial Production* are available for the period of 1990-2009. They were obtained respectively from the DataStream and from the International Financial Statistics of the International Monetary Fund.

Regarding the *tourist arrivals*, they were obtained from Euro Stat and are available in a monthly frequency for the period 1990-2009 for most of the countries.

a/a	Country	Abbreviation
1	**AUSTRIA**	**AU**
2	**PORTUGAL**	**PO**
5	**FRANCE**	**FR**
6	**SPAIN**	**ESP**

3.2 Empirical Analysis of the Results

Our goal is on the one hand to detect any causality in mean and on the other hand any volatility spillover (causality in variance) that may be occurs among share prices and tourism and economic activity and tourism. In other words we detect the dynamic relationship in mean and volatility of 4 European countries, using the real stock prices, industrial production and total tourist arrivals of all these countries of our sample.

With the aid of the non – parametric causality tests that we analysed in Chapter 2, the Causality Test of Cheung & Ng and the Causality Test of Hong, we have the results. It is important to refer to the construction of the statistical tables. We took note to the biggest statistic which rejects the Null Hypothesis of the No Causality in Mean and in Variance. The tables of Cheung & Ng are two.

The **first table** presents the r statistic for 24 lags. The indicators of the r statistic show the direction of the one variable to the other at a specified lag *k* and the symbol m is referred to the mean and the symbol v is referred to volatility.

The **second table** provide us with S statistic. The indicators of the S statistic are used to test the hypothesis of no causality from lag 1 to lag 24 and are the same with the indicators of the r statistic. On the other hand, the tables of Hong are also two. The **first table** presents the statistics of six kernel functions (Quadratic-spectral, Bartlett, Daniell, Parzen, Tukey-Hanning and truncated) for the **causality in mean**. The **second table** presents the statistics of six kernel functions (Quadratic-spectral, Bartlett, Daniell, Parzen, Tukey-Hanning and truncated) for the **causality in variance**. The indicators of these kernel functions show the direction of the one country to the other. *For brevity reasons we did not put all the kernels but only three of them QS, Bartlett and Truncated*. The reason that we use only these three kernel functions is why they used widely in the literature for examine causality and because they are considered the most reliable kernels. Furthermore the Truncated kernel test is a normalised version of the S statistic test of the Cheung & Ng methodology. *These data are available from the author upon request.*

Our study is structured in a country level. In other words we examine each country alone. For each country we provide the statistical tables of the Cheung and Ng test and for the Hong test in order to examine possible causal relationships among the variables of our sample.

3.2.1 Financial volatility and tourism development

In this section we investigate the relationship between the stock market performance and tourism development. For this examination we will use two variables: the share price index and the total tourist arrivals of each country of our sample. The aim of this test is to detect any causality pattern in mean and variance for these two variables. The research will be in a country level and we will apply the Cheung and Ng test and the Hong test.

<u>AUSTRIA</u>

First we examine the causality in mean that share price index and tourist arrivals may exhibit. Table 1 show us the results of the Cheung and Ng rho test for the causality in mean. Table 2 indicates the S statistic of the Cheung and Ng test.

TABLE 1: Causality in Mean according to r statistic of Cheung & Ng Test

Lags	$Rho_{shar \rightarrow tour, m}$	$Rho_{tour \rightarrow shar, m}$
1	0,223	-1,344
2	1,717	-0,281
3	2,240**	-0,529
4	1,039	-0,268
5	1,716*	1,777*
6	1,042	0,135
7	0,234	2,120**
8	0,672	1,505
9	-0,657	1,324
10	0,958	1,714*
11	-0,640	-0,480
12	-0,006	0,266
13	0,769	-1,498
14	1,595	0,165
15	3,068***	-0,658
16	1,022	0,252
17	1,332	0,424
18	1,694	0,604
19	0,448	1,821*
20	1,342	1,486
21	-0,474	0,317
22	0,471	1,476
23	-0,411	-0,802
24	0,603	-0,217

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 2: Causality in Mean according to S statistic of Cheung & Ng Test

$S_{shar\_tour,m}$	303,952***
$S_{tour\_shar,m}$	141,507***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As we can see from the Table 1, according to the r statistic of the causality test of Cheung and Ng regarding causality in mean, share prices index and total tourist arrivals for Austria exhibit a unidirectional spillover return in the first lags in a 5% nominal size for the direction share prices index → tourist arrivals. That result indicates that there is a causal relationship at this direction. Also in the 15th lag there is a strong causal relationship in a 1% nominal size. From the results of the same table, we can detect causal relationship in the first lags in a 5% nominal size for the direction tourist arrivals → share prices index. So there is also a unidirectional spillover return for this direction.

Table 2 strengthens the evidence that Table 1 provide us by the S statistic test of Cheung and Ng test. As we can see there is a bidirectional return spillover between the two variables in a 1% nominal size.

Both stock market of Austria and tourism development which is measured by the total tourist arrivals are strongly influenced by each other.

Now we apply the second methodology, these of Hong, in order to test causality in mean. Table 3 provides the results of the above test.

TABLE 3: Causality in Mean according to Hong Test

Bandwidth	Quadratic$_{shar \rightarrow tour,m}$	Bartlett$_{shar \rightarrow tour,m}$	Truncated$_{shar \rightarrow tour,m}$	Quadratic$_{tour \rightarrow shar,m}$	Bartlett$_{tour \rightarrow shar,,m}$	Truncated$_{tour \rightarrow shar, m}$
1	-0,547	NaN	-0,673	0,531	NaN	0,578
2	-0,448	-0,673	0,509	0,465	0,578	-0,051
3	0,310	-0,316	2,081**	0,187	0,403	-0,334
4	0,995	0,240	1,841*	-0,045	0,212	-0,616
5	1,468	0,708	2,281**	-0,146	0,039	0,148
6	1,736*	1,055	2,120**	-0,130	-0,487	-0,145
7	1,880*	1,320	1,717*	-0,013	-0,080	0,826
8	1,934*	1,500	1,479	0,152	-0,063	1,106
9	1,909*	1,611	1,269	0,334	0,005	1,236
10	1,835*	1,673*	1,198	0,509	0,097	1,630
11	1,754*	1,703*	1,026	0,656	0,203	1,399
12	1,707*	1,711*	0,785	0,766	0,312	1,158
13	1,703*	1,702*	0,684	0,844	0,409	1,378
14	1,725*	1,679*	0,975	0,902	0,496	1,153
15	1,760*	1,652	2,551**	0,946	0,573	1,021
16	1,804*	1,639	2,496**	0,981	0,639	0,831
17	1,854*	1,647	2,579**	1,007	0,692	0,675
18	1,909*	1,670*	2,851**	1,027	0,734	0,560
19	1,966**	1,702*	2,659**	1,041	0,765	0,954
20	2,026**	1,742**	2,745**	1,050	0,790	1,147
21	2,088**	1,785*	2,574**	1,056	0,813	0,990
22	2,152**	1,830*	2,412**	1,058	0,835	1,172
23	2,218**	1,873*	2,250**	1,057	0,856	1,109
24	2,284**	1,913*	2,126**	1,053	0,875	0,958

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

From the implementation of the Hong test we can see a unidirectional return spillover in a 5% nominal size but only in one direction, share price index → total tourist arrivals. This result is not consistent with this from the Cheung & Ng test which denotes a bidirectional causal pattern in mean for the two variables.

TABLE 4: Causality in variance according to r statistic of the Cheung & Ng Test

Lags	$Rho_{shar \rightarrow tour, v}$	$Rho_{tour \rightarrow shar, v}$
1	-0,109	0,933
2	-0,059	-0,742
3	-0,475	-0,158
4	-0,602	-0,992
5	1,338	-0,361
6	3,373***	3,105***
7	-0,225	0,438
8	-0,398	-1,107
9	-0,943	-1,086
10	0,360	0,624
11	-0,375	-0,407
12	-0,284	-0,420
13	-0,030	0,323
14	0,875	-0,080
15	-0,173	-1,101
16	1,749*	-0,176
17	0,835	-0,758
18	-0,245	-0,195
19	-0,584	1,102
20	-0,501	-0,673
21	-0,108	0,327
22	0,142	-0,266
23	0,260	0,168
24	1,029	-0,922

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 5: Causality in variance according to S statistic of the Cheung & Ng Test

$S_{shar \rightarrow tour,v}$	71,440***
$S_{tour \rightarrow shar,v}$	-0,357

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

Let's now see what happens in the case of volatility spillover. At Table 4 we can see the results of the Cheung and Ng test according to the r statistic. As we can see in the first lags we have a causality pattern in a 1% nominal size in both directions, share price index → tourist arrivals and tourist arrivals → share price index. But as Table 5 notes, there is a strong volatility spillover only in the direction share price index→ tourist arrivals.

Now we will examine the above results with the Hong test, using the six kernel functions. In this part we have to mention the difference between the Cheung and Ng test and the Hong test. Cheung and Ng's test gives uniform weighting to each lag. In contrast the Hong test introduces a flexible weighting scheme for the sample cross-correlation at each lag. This happens in order to give better power against the alternatives whose cross-correlations decay to zero as the lag order increases. Also we have to mention that because truncated kernel gives equal weighting to each of the M sample cross correlations, Cheung and Ng's test can be viewed as a test based on the truncated kernel.

TABLE6: Causality in variance according to the Hong test

Bandwidth	$Quadratic_{shar \rightarrow tour,v}$	$Bartlett_{shar \rightarrow tour,v}$	$Truncated_{shar \rightarrow tour,v}$	$Quadratic_{tour \rightarrow shar,v}$	$Bartlett_{tour \rightarrow shar,,v}$	$Truncated_{tour \rightarrow shar, v}$
1	-0,745	NaN	-0,700	-0,113	NaN	-0,089
2	-0,791	-0,700	-0,995	-0,125	-0,089	-0,285
3	-0,941	-0,850	-1,130	-0,251	-0,162	-0,630
4	-1,115	-0,976	-1,201	-0,428	-0,277	-0,546
5	-1,035	-1,072	-0,815	-0,445	-0,371	-0,762
6	-0,655	-1,115	2,310**	-0,229	-0,448	1,850*
7	-0,212	-0,961	1,900*	0,069	-0,383	1,510
8	0,173	-0,675	1,570	0,346	-0,206	1,480
9	0,457	-0,397	1,470	0,565	-0,019	1,450
10	0,645	-0,156	1,209	0,717	0,153	1,250
11	0,758	0,041	0,977	0,812	0,301	1,023
12	0,824	0,197	0,756	0,863	0,421	0,820
13	0,861	0,317	0,537	0,887	0,514	0,620
14	0,875	0,407	0,486	0,888	0,583	0,417
15	0,873	0,472	0,299	0,865	0,631	0,457
16	0,857	0,517	0,683	0,826	0,663	0,278
17	0,831	0,552	0,624	0,778	0,684	0,209
18	0,798	0,579	0,458	0,730	0,694	0,050
19	0,758	0,601	0,350	0,686	0,696	0,099
20	0,714	0,616	0,232	0,643	0,692	0,022
21	0,668	0,626	0,082	0,599	0,684	-0,108
22	0,620	0,630	-0,060	0,553	0,671	-0,238
23	0,572	0,629	-0,188	0,503	0,655	-0,369
24	0,524	0,623	-0,158	0,451	0,636	-0,368

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As we can see from Table 6, the Hong test indicates a unidirectional causality pattern in volatility in a 5% nominal size for the direction share price index → tourist arrivals, while for the opposite direction there is a weak causal pattern in a 10% nominal size.

PORTUGAL

Now we will examine the relationship between share price index and tourism development in the case of Portugal. First we will study causality in mean with the implementation of r statistic and S statistic of the Cheung and Ng test. Table 7 bellow indicates the results from the r statistic test while Table 8shows the results from the S statistic test.

TABLE 7: Causality in Mean according to the r statistic of the Geung & Ng Test

Lags	$Rho_{shar \to tour, m}$	$Rho_{tour \to shar, m}$
1	-0,135	-2,155**
2	0,754	-1,212
3	1,680*	-1,822*
4	1,201	-0,317
5	1,841	-0,072
6	-0,262	1,251
7	1,504	0,452
8	0,132	1,076
9	-0,635	1,153
10	-0,594	0,566
11	-1,311	-0,480
12	0,035	-0,135
13	0,500	-2,206
14	0,542	-1,768
15	1,666	-0,719
16	0,658	-0,565
17	2,000**	0,001
18	1,440	0,671
19	0,239	1,317
20	0,161	0,211
21	0,148	1,242
22	-1,578	0,536
23	-1,176	-0,674
24	-0,043	-0,833

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level*

TABLE 8: Causality in Mean according to the
S statistic of the Geung & Ng Test

$S_{shar \rightarrow tour}$	133,499***
$S_{tour \rightarrow shar}$	-68,245

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As it is mentioned in Table 7 according to the r statistic of Cheung and Ng there is a bidirectional causal relationship between the variables, share price index and total tourist arrivals. More specifically, for the direction share price index→ tourist arrivals there is a causal pattern in a 5% nominal in the 17th lag. For the direction tourist arrivals→ share price index we can detect a causal relationship in a 5% nominal size in the first lags.

On the other hand, the S statistic test indicates only a share price index → tourist arrivals direction causal relationship. This is not consistent from the results of the r statistic which indicates a bidirectional return spillover between the two variables.
Now we will apply the Hong test to test the causality in mean. Table 9 denotes the results of the Hong test for causality in mean.

TABLE 9: Causality in Mean according to the Hong Test

Bandwidth	Quadratic$_{shar\rightarrow tour,m}$	Bartlett$_{shar\rightarrow tour,m}$	Truncated$_{shar\rightarrow tour,m}$	Quadratic$_{tour\rightarrow shar,m}$	Bartlett$_{tour\rightarrow shar,,m}$	Truncated$_{tour\rightarrow shar,\ m}$
1	-0,693	NaN	-0,696	2,630***	NaN	2,597***
2	-0,730	-0,696	-0,706	2,616***	2,597***	2,081**
3	-0,612	-0,748	0,180	2,641***	2,603***	2,666***
4	-0,323	-0,623	0,321	2,633***	2,668***	1,998**
5	-0,018	-0,441	1,062	2,500***	2,695***	1,479*
6	0,236	-0,238	0,705	2,323**	2,630***	1,526*
7	0,410	-0,525	1,007	2,170**	2,535***	1,208
8	0,525	0,993	0,702	2,014**	2,434***	1,181
9	0,587	0,221	0,528	1,869**	2,333**	1,205
10	0,604	0,308	0,364	1,748**	2,242**	1,000
11	0,594	0,367	0,516	1,657*	2,157**	0,797
12	0,578	0,407	0,296	1,602*	2,076**	0,569
13	0,564	0,435	0,144	1,568*	1,994**	1,342
14	0,555	0,450	0,013	1,543*	1,922**	1,724**
15	0,551	0,454	0,361	1,520*	1,871**	1,590*
16	0,552	0,454	0,258	1,499*	1,836**	1,430*
17	0,557	0,453	0,800	1,479*	1,810**	1,225
18	0,564	0,454	0,980	1,462*	1,788**	1,111
19	0,572	0,461	0,810	1,446*	1,767**	1,222
20	0,580	0,472	0,644	1,435*	1,748**	1,050
21	0,588	0,484	0,485	1,427*	1,729**	1,130
22	0,598	0,494	0,727	1,423*	1,711**	1,008
23	0,609	0,504	0,788	1,423*	1,693**	0,918
24	0,620	0,515	0,636	1,426*	1,676**	0,870

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

The results from the Hong test are not consistent with these of the Cheung and Ng test. According to this methodology, we have a strong causality pattern in mean for the direction tourist arrivals → share price index. This is an indication of the importance of tourism in Portuguese financial performance.

Now we will examine the case of the existence of volatility spillovers. We first apply the Cheung and Ng methodology to detect any unidirectional volatility spillover. Table 10 and Table 11 below indicate the results of the r statistic and S statistic test respectively.

TABLE 10: Causality in variance according to

r statistic of the Cheung & Ng Test

Lags	$Rho_{shar \rightarrow tour,\ v}$	$Rho_{tour \rightarrow shar,\ v}$
1	1,728*	0,765
2	0,093	1,548
3	1,385	-0,668
4	-1,140	0,502
5	1,462	-0,670
6	1,161	1,257
7	-0,893	0,218
8	-0,337	-0,795
9	-0,233	-1,030
10	0,017	4,450***
11	-0,834	-1,346
12	0,020	1,429
13	-1,386	-0,965
14	2,302**	-0,340
15	0,039	-0,442
16	-0,703	0,207
17	1,200	1,195
18	-0,871	-0,771
19	0,931	2,138**
20	-0,697	-0,465
21	1,304	0,307
22	0,094	0,666
23	0,251	0,236
24	-0,317	-1,125

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 11: Causality in variance according to

S statistic of the Cheung & Ng Test

$S_{shar \rightarrow tour,v}$	67,522***
$S_{tour \rightarrow share,v}$	93,040***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

Both the r statistic test and the S statistic test indicate a bidirectional volatility spillover for the two variables. More precisely, according to r statistic for the direction share price index → tourist arrivals we have a causality pattern in a 5% nominal size in the last lags, while for the opposite direction we have a strong causality pattern in a 1% nominal size. According to the S statistic test, we also have a bidirectional volatility spillover but this time in a 1% nominal size for both directions.

In order to have more accurate deductions we apply also the Hong test for causality in variance. The following Table show us the outputs of the test.

TABLE 12: Causality in variance according to
The Hong Test

Bandwidth	Quadratic$_{shar \to tour,v}$	Bartlett$_{shar \to tour,v}$	Truncated$_{shar \to tour,v}$	Quadratic$_{tour \to shar,v}$	Bartlett$_{tour \to shar,,v}$	Truncated$_{tour \to shar, v}$
1	1,382	NaN	1,418	-0,235	NaN	-0,292
2	1,298	1,418	0,509	-0,137	-0,292	0,503
3	1,038	1,206	0,801	0,137	-0,040	0,189
4	0,949	1,074	0,810	0,156	0,101	-0,098
5	0,967	1,026	1,099	0,153	0,122	-0,257
6	1,010	1,024	1,116	0,079	0,090	-0,056
7	1,041	1,047	0,989	-0,042	0,056	-0,303
8	1,018	1,070	0,710	-0,024	0,225	-0,369
9	0,954	1,078	0,452	0,174	-0,015	-0,324
10	0,879	1,068	0,211	0,482	-0,051	4,025***
11	0,812	1,039	0,146	0,830	0,002	4,036***
12	0,757	1,000	-0,059	1,173	0,163	4,105***
13	0,716	0,952	0,142	1,487*	0,374	3,951***
14	0,692	0,903	0,993	1,764*	0,602	3,655***
15	0,681	0,865	0,785	2,003**	0,825	3,400***
16	0,677	0,841	0,682	2,209**	1,033	3,137***
17	0,676	0,824	0,756	2,385**	1,222	3,141***
18	0,674	0,811	0,708	2,533**	1,390	3,003***
19	0,668	0,803	0,683	2,656***	1,540	3,553***
20	0,657	0,796	0,597	2,756***	1,677*	3,356***
21	0,640	0,791	0,714	2,836***	1,803*	3,151***
22	0,620	0,786	0,557	2,897***	1,918**	3,013***
23	0,597	0,783	0,416	2,940***	2,021**	2,823***
24	0,575	0,778	0,288	2,968***	2,113**	2,828***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As Table 12 indicates there is volatility spillover in a 1% nominal size only in the direction tourist arrivals → share price index. This is not in agreement with the findings of the Cheung and Ng methodology, which have shown bidirectional causality pattern in variance.

FRANCE

In this part we will examine the impact of financial volatility in tourism development for the case of France. Let's first start with the examination of stock market volatility with the tourism development. The first test we will apply is that of Cheung and Ng regarding r statistic and S statistic.

We provide Tables 13 and 14 which show us the results for the causality in mean first of the above two tests.

TABLE 13: Causality in Mean according to r statistic of the Cheung & Ng Test

Lags	$Rho_{share \rightarrow tour, m}$	$Rho_{tour \rightarrow share, m}$
1	0,448	-1,761*
2	0,339	-1,288
3	0,405	0,248
4	2,118**	1,901*
5	0,956	-0,162
6	0,246	-0,321
7	0,100	-0,677
8	3,399***	1,402
9	0,492	0,190
10	0,605	0,690
11	-1,048	-0,144
12	1,209	0,450
13	2,305**	-1,400
14	1,574	-1,239
15	1,084	-0,640
16	1,942*	1,055
17	1,218	0,776
18	0,899	-1,532
19	0,262	-0,861
20	3,163***	1,540
21	0,841	-0,311
22	0,322	-0,254
23	-0,196	0,272
24	1,134	0,411

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 14: Causality in Mean according to
S statistic of the Cheung & Ng Test

$S_{share \rightarrow tour,m}$	332,601***
$S_{tour \rightarrow share,m}$	-23,116

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As Table 13 indicates regarding the r statistic of the Cheung and Ng test, there is a unidirectional return spillover for the direction share price index→ tourism development in a 1% nominal size. Also for the direction tourism development → share price index we will find a week causal relationship in a 10% nominal size.
According to Table 14, which provide us with the outputs of the S statistic test for causality in mean, our sample exhibits a strong causal relationship in a 1% nominal size only for the direction share price index → tourism development. This is consistent with the same tests for Austria and Portugal.

Lets now apply the Hong test for testing causality in mean. For brevity reasons we use only three kernels os six, Bartlett, Quadratic-spectral and truncated. Table 15 shows us the results of the Hong test.

TABLE 15: Causality in Mean according to the Hong Test

Bandwidth	Quadratic$_{shar \rightarrow tour}$	Bartlett$_{shar \rightarrow tour}$	Truncated$_{share \rightarrow tour}$	Quadratic$_{tour \rightarrow share}$	Bartlett$_{tour \rightarrow share}$	Truncated$_{tour \rightarrow share}$
1	-0,600	NaN	-0,566	1,526	NaN	1,502
2	-0,628	-0,566	-0,843	1,573	1,502	1,403
3	-0,831	-0,701	-1,030	1,481	1,573	0,767
4	-0,699	-0,826	0,365	1,427	1,493	1,612
5	-0,487	-0,772	0,308	1,401	1,468	1,140
6	-0,323	-0,623	0,014	1,334	1,477	0,788
7	-0,076	-0,498	-0,248	1,258	1,452	0,593
8	0,197	-0,418	2,484**	1,171	1,402	0,815
9	0,473	-0,290	2,176**	1,082	1,348	0,548
10	0,736	-0,100	1,935*	0,987	1,298	0,412
11	0,980	0,932	1,884*	0,895	1,244	0,190
12	1,210	0,272	1,920*	0,819	1,187	0,027
13	1,427	0,432	2,742***	0,756	1,126	0,235
14	1,633*	0,586	2,955***	0,699	1,066	0,347
15	1,827*	0,739	2,910***	0,651	1,012	0,238
16	2,009**	0,888	3,354***	0,612	0,964	0,268
17	2,183**	1,033	3,365***	0,582	0,921	0,204
18	2,351**	1,175	3,262***	0,559	0,881	0,452
19	2,511**	1,310	3,040***	0,543	0,846	0,413
20	2,666***	1,436	4,497***	0,532	0,816	0,650
21	2,814***	1,559	4,370***	0,525	0,792	0,506
22	2,957***	1,684*	4,155***	0,520	0,771	0,364
23	3,093***	1,807*	3,942***	0,518	0,753	0,229
24	3,225***	1,925*	3,933***	0,517	0,736	0,116

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As we can see from the results of the Hong test, there is a causality pattern only in the direction share price index → tourist arrivals in a 1% nominal size as we can see from the above table in contrast to the indication of the r statistic of the Cheung and Ng test. We can remark that France stock market is the main factor that influences the tourist arrivals in France.

Now we will examine what happens in the case of volatility clustering. We first examine this case we the implement of the r statistic and the S statistic of the Cheung and Ng test. Table 16 and Table 17 Have the results of the above two tests.

TABLE 16: Causality in variance according to
r statistic of the Cheung & Ng Test

Lags	$Rho_{shar \rightarrow tour, v}$	$Rho_{tour \rightarrow shar, v}$
1	1,095	0,741
2	-1,087	0,292
3	0,035	0,129
4	-0,237	-0,184
5	-1,462	1,259
6	0,972	1,520
7	-0,384	-0,143
8	-1,991	-0,606
9	-0,390	1,772*
10	0,019	0,008
11	0,066	0,234
12	1,092	0,091
13	2,007**	-0,524
14	0,589	0,406
15	-1,341	-0,754
16	0,681	-0,205
17	-0,066	2,450**
18	-0,880	0,110
19	-0,174	1,316
20	-0,338	1,622
21	0,271	0,796
22	-0,524	-0,164
23	0,073	0,190
24	-0,655	0,358

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 17: Causality in variance according to
S statistic of the Cheung & Ng Test

$S_{shar \rightarrow tour,v}$	-35,505
$S_{tour \rightarrow share,v}$	144,538***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As Table 16 indicates, regarding the direction share price index → tourist arrivals and the r statistic test, there is a unidirectional volatility spillover in a 5% nominal size in the 13th lag. This means that the information from the stock market of France influence the total tourist arrivals, and hence the tourism development, after 13 months. On the other hand, regarding the direction tourist arrivals → share price index, there is a causal pattern relationship in the first lags in a 10% nominal size and at the last lags in a 5% nominal size. For the case of the S statistic test as Table 17 shows us, we can detect causal relationship in volatility between the two variables only in one direction, tourist arrivals → share price index. This is consistent with the findings from the r statistic test for the volatility clustering.

We further examine the volatility clustering with the use of the Hong test. Through this test we want to see if it is in agreement with the Cheung and Ng test. Table 18 Has the Hong test results.

TABLE 18: Causality in variance according to the Hong Test

Bandwidth	Quadratic$_{shar \rightarrow tour,v}$	Bartlett$_{shar \rightarrow tour,v}$	Truncated$_{shar \rightarrow tour,v}$	Quadratic$_{tour \rightarrow shar,v}$	Bartlett$_{tour \rightarrow shar,,v}$	Truncated$_{tour \rightarrow shar, v}$
1	0,144	NaN	0,145	-0,368	NaN	-0,318
2	0,158	0,145	0,200	-0,419	-0,318	-0,682
3	0,121	0,174	-0,243	-0,629	-0,465	-0,959
4	-0,038	0,117	-0,542	-0,843	-0,620	-1,172
5	-0,143	0,005	-0,111	-0,923	-0,762	-0,854
6	-0,185	-0,073	-0,108	-0,928	-0,856	-0,385
7	-0,164	-0,109	-0,323	-0,896	-0,882	-0,616
8	-0,134	-0,134	0,470	-0,838	-0,877	-0,729
9	-0,110	-0,136	0,250	-0,777	-0,870	-0,157
10	-0,087	-0,115	0,020	-0,740	-0,853	-0,368
11	-0,058	-0,094	-0,188	-0,729	-0,825	-0,547
12	-0,023	-0,081	-0,126	-0,734	-0,800	-0,722
13	0,012	-0,075	0,513	-0,743	-0,783	-0,829
14	0,043	-0,065	0,381	-0,747	-0,774	-0,951
15	0,072	-0,048	0,538	-0,741	-0,773	-0,988
16	0,094	-0,027	0,439	-0,724	-0,778	-1,121
17	0,107	-0,004	0,264	-0,701	-0,787	-0,169
18	0,111	0,018	0,235	-0,674	-0,794	-0,322
19	0,106	0,037	0,081	-0,648	-0,794	-0,170
20	0,095	0,053	-0,052	-0,625	-0,789	0,127
21	0,078	0,066	-0,184	-0,607	-0,778	0,082
22	0,563	0,074	-0,278	-0,593	-0,763	-0,057
23	0,029	0,078	-0,410	-0,584	-0,746	-0,188
24	-0,003	0,078	-0,470	-0,579	-0,728	-0,299

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

It is obvious from the above Table that we cannot reject the null hypothesis; hence there is no causality in volatility between share price index and tourist arrivals and vice versa. This is in contrast with the results from the Cheung and Ng test.

SPAIN

For the case of Spain we will apply the same tests with the other countries of our sample in order to investigate if any causality patterns between the stock market and the tourist arrivals occur. First we begin our examination with the implement of the r statistic and S statistic tests of the Cheung and Ng methodology regarding causality in mean. Table 19 and Table 20 show us the outputs from the implementation of the above two tests.

TABLE 19: Causality in Mean according to r statistic of the Cheung & Ng Test

Lags	$Rho_{shar \to tour, m}$	$Rho_{tour \to shar, m}$
1	-1,236	-1,733
2	1,241	0,073
3	2,407**	-1,083
4	1,224	0,043
5	0,318	-0,506
6	0,608	-0,134
7	0,569	0,304
8	0,594	2,315**
9	0,192	0,085
10	0,491	0,374
11	-1,318	0,194
12	0,707	-0,599
13	0,820	-1,548
14	1,577	-1,052
15	1,551	-0,884
16	2,117**	-0,489
17	0,717	0,237
18	1,228	-0,179
19	0,235	-0,165
20	0,701	0,579
21	0,616	0,669
22	-0,031	0,466
23	-0,860	-0,274
24	0,462	-0,487

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 20: Causality in Mean according to

S statistic of the Cheung & Ng Test

$S_{shar \rightarrow tour,m}$	226,886***
$S_{tour \rightarrow shar,m}$	-57,651

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

From the results of the tests we can presume the following: Regarding the r statistic test, we can detect a bidirectional return spillover between the two variables in a 5% nominal size. More accurately, for the share price index → tourist arrivals direction we can see a unidirectional return in a 5% nominal size in the 3rd and 16th lag, while in the opposite direction the causal pattern is detected at the first lags.

Regarding the S statistic test, we can see that the variables exhibit only a unidirectional return spillover in a 1% nominal size in the direction share price index → tourist arrivals.

Now we will examine the causality in mean concept with the implementation of the Hong test. Table 21 allow us to investigate the results of the test.

TABLE 21: Causality in Mean according to the Hong Test

Bandwidth	Quadratic$_{shar\rightarrow tour,m}$	Bartlett$_{shar\rightarrow tour,m}$	Truncated$_{shar\rightarrow tour,m}$	Quadratic$_{tour\rightarrow shar,m}$	Bartlett$_{tour\rightarrow shar,m}$	Truncated$_{tour\rightarrow shar,m}$
1	0,444	NaN	0,379	1,380	NaN	1,429
2	0,441	0,379	0,545	1,299	1,429	0,515
3	0,856	0,462	2,430**	0,977	1,217	0,498
4	1,446	0,848	2,294**	0,741	1,030	0,081
5	1,760*	1,258	1,775*	0,500	0,872	-0,159
6	1,855*	1,517	1,446	0,281	0,717	-0,427
7	1,829*	1,651	1,166	0,158	0,568	-0,635
8	1,742*	1,706*	0,936	0,094	0,424	0,528
9	1,622	1,711*	0,662	0,055	0,329	0,269
10	1,487	1,684*	0,465	0,031	0,281	0,068
11	1,365	1,635	0,616	0,018	0,251	-0,136
12	1,281	1,578	0,497	0,014	0,224	-0,254
13	1,232	1,520	0,424	0,009	0,196	0,049
14	1,202	1,463	0,712	-0,003	0,171	0,080
15	1,185	1,409	0,968	-0,021	0,152	0,049
16	1,176	1,365	1,593	-0,045	0,138	-0,080
17	1,174	1,335	1,475	-0,072	0,125	-0,233
18	1,176	1,319	1,538	-0,103	0,112	-0,382
19	1,181	1,311	1,354	-0,136	0,098	-0,524
20	1,188	1,309	1,253	-0,170	0,080	-0,608
21	1,197	1,310	1,139	-0,204	0,061	-0,669
22	1,207	1,311	0,972	-0,239	0,039	-0,765
23	1,221	1,311	0,928	-0,275	0,015	-0,878
24	1,237	1,310	0,806	-0,310	-0,010	-0,962

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

In contrast with the results of the Cheung and Ng test regarding the r statistic test, the Hong test reveals a unidirectional return spillover in a 5% nominal size in the first lags only in one direction, the share price index → tourist arrivals. Also in comparison of the S statistic test with the Hong test, the difference is in the level of significance, where in the S statistic we have a 1% nominal size while in the Hong test we have a 5% nominal size.

The next step is to examine the case of volatility clustering. First we use the Cheung and Ng methodology. Table 22 and Table 23 indicate the results from the r statistic and the S statistic tests respectively.

TABLE 22: Causality in variance according to r statistic of the Cheung & Ng Test

Lags	$Rho_{shar \rightarrow tour, v}$	$Rho_{tour \rightarrow shar, v}$
1	-1,343	0,945
2	-0,168	0,504
3	0,856	-1,112
4	0,440	-1,050
5	-0,285	2,303**
6	1,599	0,937
7	2,827***	-1,172
8	-0,781	-0,087
9	-0,470	-0,409
10	0,168	-0,288
11	0,556	0,002
12	0,453	0,444
13	-0,116	2,173**
14	-0,386	-0,678
15	0,368	-0,921
16	-0,835	-0,850
17	0,706	-0,707
18	-1,240	1,239
19	1,983**	-0,811
20	0,748	-0,671
21	-0,119	1,423
22	-0,356	-0,965
23	1,151	-0,706
24	-0,299	0,574

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 23: Causality in variance according to S statistic of the Cheung & Ng Test

$S_{shar \rightarrow tour}$	80,012***
$S_{tour \rightarrow shar}$	2,036

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As we can see from Table 22 regarding the r statistic test, there is a strong return spillover in a 1% nominal size in the first lags for the direction share price index → tourist arrivals, while for the opposite direction we can detect also in the first lags a unidirectional causality pattern in a 5% nominal size.

For the S statistic test of the Cheung and Ng methodology, the findings reveal single direction causality in variance for the direction share price index → tourist arrivals in a 1% nominal size.

In the next step we apply the Hong test to detect any causal relationship between the variables. Table 24 indicates the outputs of the Hong test.

TABLE 24: Causality in variance according to the Hong Test

Bandwidth	$Quadratic_{shar\rightarrow tour,m}$	$Bartlett_{shar\rightarrow tour,m}$	$Truncated_{shar\rightarrow tour,m}$	$Quadratic_{tour\rightarrow shar,m}$	$Bartlett_{tour\rightarrow shar,m}$	$Truncated_{tour\rightarrow shar,m}$
1	0,529	NaN	0,576	-0,098	NaN	-0,073
2	0,461	0,576	-0,078	-0,151	-0,073	-0,424
3	0,201	0,393	-0,168	-0,259	-0,198	-0,243
4	0,160	0,229	-0,428	-0,260	-0,260	-0,167
5	-0,182	0,094	-0,672	-0,054	-0,271	1,240
6	-0,167	-0,034	-0,148	0,212	-0,166	1,108
7	0,002	-0,121	1,780*	0,433	0,003	1,139
8	0,212	-0,090	1,578*	0,559	0,164	0,823
9	0,402	0,027	1,313	0,616	0,294	0,586
10	0,545	0,157	1,036	0,634	0,387	0,357
11	0,630	0,274	0,850	0,635	0,447	0,133
12	0,668	0,369	0,660	0,630	0,480	-0,030
13	0,679	0,442	0,447	0,624	0,492	0,740
14	0,679	0,496	0,278	0,618	0,499	0,622
15	0,672	0,531	0,118	0,612	0,509	0,586
16	0,658	0,552	0,072	0,604	0,519	0,532
17	0,639	0,561	-0,006	0,596	0,528	0,441
18	0,617	0,562	0,103	0,589	0,535	0,538
19	0,592	0,557	0,616	0,584	0,541	0,482
20	0,568	0,553	0,544	0,580	0,546	0,395
21	0,544	0,550	0,387	0,577	0,550	0,569
22	0,521	0,548	0,256	0,577	0,553	0,563
23	0,499	0,545	0,319	0,578	0,556	0,490
24	0,480	0,541	0,190	0,580	0,559	0,395

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As we can see from the Table above, in contrast with the Cheung and Ng test there is no evidence for a strong causal relationship in volatility between the two variables. The only evidence we have is a volatility spillover in a 10% nominal size for the direction share price index → tourist arrivals according to the Truncated kernel in the first lags.

3.2.2. Macroeconomic volatility and tourism development

In this part we examine the relationship between the real economic activity and tourism development of the countries of our sample. The aim of this section is to find evidence which relate the economic performance of the countries with the tourism development and vice versa. We use the industrial production as a proxy of the economic activity and total tourist arrivals as a proxy of tourism development. Also we use the same non- parametric models that we have used in the previous section, the Cheung and Ng test and the Hong test. At last, we mention that the research will be in a country level.

AUSTRIA

First we will examine the causality in mean between industrial production and tourism development with the help of the Cheung & Ng test. Table 25 and Table 26 indicate the outputs for the r statistic and the S statistic test of the Cheung & Ng methodology.

TABLE 25: Causality in Mean according to r statistic of the Cheung & Ng Test

Lags	$Rho_{ind \rightarrow tour, m}$	$Rho_{tour \rightarrow ind, m}$
1	-0,139	-1,237
2	-1,619	3,344***
3	5,740***	-0,498
4	-2,453	2,504**
5	0,525	-0,007
6	1,412	1,564
7	-0,102	-0,250
8	3,053***	-2,803
9	0,090	4,739***
10	4,059***	-2,084
11	-0,660	-0,297
12	-0,701	-2,259
13	0,426	-0,898
14	-0,978	2,813***
15	5,574***	-0,580
16	-2,344	1,726*
17	1,137	-0,190
18	1,800*	0,702
19	0,112	-0,436
20	3,219***	-3,165
21	-0,276	4,212***
22	3,930***	-1,995
23	-0,004	-0,536
24	-0,875	-2,128

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level..*

TABLE 26: Causality in Mean according to

S statistic of the Cheung & Ng Test

$S_{ind \rightarrow tour,m}$	318,010***
$S_{tour \rightarrow ind,m}$	34,086***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As we can see from the above results, the two variables exhibit strong causal relationship in mean.

More accurately, as long as the r statistic test we can see strong unidirectional return spillover for both directions, industrial production → tourist arrivals and tourist arrivals → industrial production, in a 1% nominal size.

Now we apply the second methodology, the Hong test. Table 27 provide us the results from the above test.

TABLE 27: Causality in Mean according to the Hong Test

Bandwidth	$Quadratic_{ind \to tour,m}$	$Bartlett_{ind \to tour,m}$	$Truncated_{ind \to tour,m}$	$Quadratic_{tour \to ind,m}$	$Bartlett_{tour \to ind,m}$	$Truncated_{tour \to ind,m}$
1	-0,324	NaN	-0,695	0,844	NaN	0,380
2	-0,437	-0,695	0,330	1,523	0,380	5,411***
3	2,256**	-0,393	13,461***	3,491***	2,129**	4,123***
4	6,477***	2,137**	13,487***	4,434***	3,227***	5,472***
5	9,231***	4,998***	11,864***	4,959***	3,888***	4,591***
6	10,608***	7,039***	11,154***	5,059***	4,331***	4,633***
7	11,364***	8,388***	10,087***	5,250***	4,600***	4,051***
8	11,880***	9,267***	11,592***	5,633***	4,757***	5,559***
9	12,234***	9,893***	10,723***	6,169***	4,885***	10,443***
10	12,496***	10,370***	13,757***	6,788***	5,140***	10,707***
11	12,734***	10,786***	13,033***	7,411***	5,529***	10,042***
12	12,997***	11,181***	12,409***	7,960***	5,952***	10,510***
13	13,296***	11,526***	11,795***	8,417***	6,368***	10,092***
14	13,614***	11,812***	11,394***	8,818***	6,762***	11,111***
15	13,946***	12,042***	16,743***	9,179***	7,132***	10,645***
16	14,287***	12,274***	17,087***	9,513***	7,480***	10,707***
17	14,631***	12,545***	16,679***	9,827***	7,801***	10,251***
18	14,972***	12,832***	16,649***	10,124***	8,091***	9,910***
19	15,306***	13,120***	16,087***	10,406***	8,350***	9,543***
20	15,632***	13,399***	17,283***	10,673***	8,577***	10,833***
21	15,948***	13,668***	16,769***	10,929***	8,783***	13,329***
22	16,256***	13,930***	18,732***	11,173***	8,987***	13,541***
23	16,554***	14,188***	18,221***	11,409***	9,197***	13,177***
24	16,843***	14,443***	17,858***	11,637***	9,409***	13,484***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

The Hong test results is in agreement with that of the Cheung & Ng test. As we see there is a strong bidirectional causality in mean between the two variables. To be more accurate, Table 27 reveals bidirectional return spillover in a 1% nominal size for the two variables.

Let's now see what happens for the case of volatility spillover. The contents of Table 28 and Table 29 are the outputs of the r statistic and S statistic test of the Cheung & Ng methodology.

TABLE 28: Causality in variance according to r statistic of the Cheung & Ng Test

Lags	$Rho_{ind \rightarrow tour,\ v}$	$Rho_{tour \rightarrow ind,\ v}$
1	2,367**	1,904**
2	1,036	-0,560
3	0,851	-0,784
4	-0,669	-0,803
5	0,271	-0,920
6	-0,398	-0,918
7	-1,097	0,577
8	-0,847	0,397
9	-0,685	-0,632
10	0,506	1,035
11	0,255	0,100
12	0,375	1,916*
13	-0,622	0,591
14	-0,780	-0,054
15	2,352**	0,507
16	-0,383	0,029
17	-1,239	0,134
18	-0,651	-0,668
19	0,640	-0,640
20	-0,043	-0,641
21	-0,576	-1,011
22	0,218	1,778*
23	-0,448	0,837
24	-1,077	0,264

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 29: Causality in variance according to S statistic of the Cheung & Ng Test

$S_{ind \rightarrow tour,v}$	-9,476
$S_{tour \rightarrow ind,v}$	35,939**

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

For the r statistic test in the direction industrial production → tourist arrivals we detect in the 1st and the 15th lag a causal pattern in a 5% nominal size, while for the direction tourist arrivals → industrial production we have an unidirectional return spillover in a 5% nominal size.

Regarding the S statistic test, we can see causality pattern in variance only in one direction, tourist arrivals → industrial production, in a 5% nominal size.

The next step is to compare the Cheung & Ng methodology with the Hong test. In the following Table we have the results for the Hong test.

TABLE 30: Causality in variance according to the Hong Test

Bandwidth	$Quadratic_{ind\to tour,v}$	$Bartlett_{ind\to tour,v}$	$Truncated_{ind\to tour,v}$	$Quadratic_{tour\to ind,v}$	$Bartlett_{tour\to ind,v}$	$Truncated_{tour\to ind,v}$
1	3,271***	NaN	3,280***	1,835*	NaN	1,873*
2	3,245***	3,280***	2,366**	1,775*	1,873*	0,986
3	2,932***	3,197***	1,828*	1,436	1,701*	0,654
4	2,554**	2,989***	1,396	1,134	1,483	0,447
5	2,187**	2,761***	0,961	0,916	1,296	0,358
6	1,864*	2,533**	0,640	0,760	1,143	0,290
7	1,614	2,313**	0,658	0,616	1,021	0,096
8	1,414	2,116**	0,554	0,477	0,915	-0,116
9	1,227	1,947**	0,405	0,361	0,816	-0,245
10	1,053	1,800**	0,225	0,275	0,721	-0,206
11	0,902	1,667*	0,207	0,213	0,633	-0,403
12	0,779	1,544*	-0,150	0,157	0,551	0,188
13	0,684	1,427	-0,256	0,102	0,483	0,061
14	0,611	1,316	-0,312	0,053	0,431	-0,124
15	0,558	1,211	0,572	0,004	0,387	-0,248
16	0,516	1,121	0,411	-0,456	0,347	-0,411
17	0,477	1,049	0,509	-0,094	0,308	-0,562
18	0,442	0,989	0,410	-0,138	0,269	-0,630
19	0,408	0,940	0,314	-0,174	0,229	-0,700
20	0,375	0,897	0,156	-0,204	0,189	-0,767
21	0,343	0,859	0,060	-0,230	0,149	-0,731
22	0,311	0,824	-0,077	-0,255	0,110	-0,355
23	0,278	0,789	-0,184	-0,281	0,074	-0,378
24	0,247	0,756	-0,139	-0,309	0,041	-0,497

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

From the study of Table 30 we can deduct useful conclusions for the existence of volatility spillovers. There is strong volatility spillover in 1% nominal size only for the direction industrial production → tourist arrivals, while in the opposite direction there is a weak existence of volatility transmission. That means that real economic activity is the factor that generates volatility fluctuations to tourism expansion.

PORTUGAL

The next country that we apply the two methodologies of Cheung & Ng and Hong test is Portugal. Just like to the other cases we first begin with the investigation of the causality in mean between the industrial production and total tourist arrivals for this country.

First we implement the Cheung & Ng test. Table 31 and Table 32 show the r statistic and the S statistic test respectively.

TABLE 31: Causality in Mean according to r statistic of the Cheung & Ng Test

Lags	$Rho_{ind \searrow tour, m}$	$Rho_{tour \searrow ind, m}$
1	2,936***	-2,720***
2	-1,536	2,941***
3	0,347	1,781*
4	1,933*	1,998**
5	3,383***	-5,399***
6	-1,862*	-2,030**
7	-4,779***	3,401***
8	1,822*	1,123
9	1,584	-0,149
10	3,805***	-1,950*
11	-3,605***	2,028**
12	-1,259	-1,421
13	2,474**	-3,190***
14	-0,838	2,565**
15	0,688	1,781*
16	1,634	1,652
17	4,101***	-6,011***
18	-2,351**	-2,220**
19	-4,737***	3,523***
20	1,575	0,009
21	1,632	0,051
22	3,056***	-1,580
23	-2,680***	1,279
24	-1,378	-0,870

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 32: Causality in Mean according to
S statistic of the Cheung & Ng Test

$S_{ind \rightarrow tour,m}$	90,556***
$S_{tour \rightarrow ind,m}$	-51,907

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

From the above results of r statistic test, we can clearly see that there is a bidirectional return spillover in a 1% nominal size for both variables. Also ,according to the S statistic test, there is a strong causality in mean in a 1% nominal size for the direction industrial production → tourist arrivals.

Lets now see what happens in causality in mean when we apply the Hong test for our sample.

TABLE 33: Causality in Mean according to the Hong Test

Bandwidth	$Quadratic_{ind \searrow tour,m}$	$Bartlett_{ind \searrow tour,m}$	$Truncated_{ind \searrow tour,m}$	$Quadratic_{tour \searrow ind,m}$	$Bartlett_{tour \searrow ind,m}$	$Truncated_{tour \searrow ind,m}$
1	5,500***	NaN	5,428***	4,953***	NaN	4,557***
2	5,539***	5,428***	4,537***	5,364***	4,557***	7,093***
3	5,294***	5,503***	3,355***	6,763***	5,745***	6,706***
4	5,038***	5,270***	3,898***	7,415***	6,508***	6,898***
5	5,227***	5,062***	6,855***	8,805***	6,938***	15,229***
6	5,993***	5,157***	7,004***	10,555***	7,807***	14,856***
7	6,965***	5,447***	12,459***	12,076***	8,976***	16,672***
8	8,069***	5,968***	12,281***	13,277***	10,121***	15,705***
9	9,231***	6,658***	11,977***	14,162***	11,147***	14,613***
10	10,338***	7,343***	14,491***	14,749***	11,982***	14,546***
11	11,305***	8,017***	16,489***	15,140***	12,646***	14,593***
12	12,124***	8,715***	15,956***	15,478***	13,182***	14,228***
13	12,857***	9,406***	16,413***	15,856***	13,618***	15,571***
14	13,543***	10,061***	15,804***	16,268***	13,989***	16,141***
15	14,191***	10,667***	15,215***	16,705***	14,328***	16,052***
16	14,805***	11,211***	15,084***	17,153***	14,638***	15,908***
17	15,389***	11,694***	17,507***	17,604***	14,919***	21,760***
18	15,948***	12,140***	17,853***	18,050***	15,214***	21,891***
19	16,487***	12,567***	21,070***	18,485***	15,546***	23,307***
20	17,006***	12,993***	20,842***	18,909***	15,906***	22,616***
21	17,507***	13,423***	20,670***	19,323***	16,281***	21,973***
22	17,992***	13,846***	21,581***	19,726***	16,652***	21,768***
23	18,462***	14,260***	22,132***	20,119***	17,012***	21,452***
24	18,917***	14,668***	21,868***	20,502***	17,356***	21,026***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

Table 33 presents us the results of the Hong test. It is obvious that there is a strong causal pattern in mean between the two variables. More precisely, there is a bidirectional return spillover in a 1% nominal size for our sample. This is in agreement regarding the Cheung & Ng test.

Now we will examine the existence of volatility spillovers. Like all the other cases we will apply first the Cheung & Ng test and then the Hong test.

We can obtain the results of the Cheung & Ng test from the Tables 34 and 35 .

TABLE 34: Causality in variance according to r statistic of the Cheung & Ng Test

Lags	$Rho_{ind \rightarrow tour, v}$	$Rho_{tour \rightarrow ind, v}$
1	0,495	0,916
2	-0,035	-0,904
3	0,726	0,071
4	-0,049	-0,359
5	1,086	1,461
6	-1,136	0,009
7	0,783	0,162
8	-0,334	-0,894
9	0,016	-0,343
10	0,069	0,540
11	-0,322	1,282
12	2,479**	-0,067
13	-0,577	0,760
14	-0,068	-1,180
15	-0,021	-0,017
16	-0,415	-0,985
17	0,357	1,423
18	-0,831	-1,319
19	-0,159	0,797
20	0,219	-0,989
21	-0,009	0,798
22	-1,311	1,956*
23	4,820***	1,444
24	-1,006	-0,653

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 35: Causality in variance according to
S statistic of the Cheung & Ng Test

$S_{ind \rightarrow tour,v}$	70,515***
$S_{tour \rightarrow ind,v}$	57,710***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level*

Let's examine the r statistic test. According to the results of Table 34, there is a strong causality in variance in the last lags in a 1% nominal size for the direction industrial production → tourist arrivals, while in the direction tourist arrivals → industrial production we can detect existence of volatility clustering in a 10% nominal size also in the last lags.

Regarding the S statistic test, it is suggested that there is a strong simultaneous interaction between the two variables in a 1% nominal size for the causality in variance.

Our next step is to investigate if the Hong test give us same examples as Cheung & Ng test does.

TABLE 36: Causality in variance according to the Hong Test

Bandwidth	$Quadratic_{ind \searrow tour,v}$	$Bartlett_{ind \searrow tour,v}$	$Truncated_{ind \searrow tour,v}$	$Quadratic_{tour \searrow ind,v}$	$Bartlett_{tour \searrow ind,v}$	$Truncated_{tour \searrow ind,v}$
1	-0,584	NaN	-0,534	-0,129	NaN	-0,111
2	-0,642	-0,534	-0,878	-0,136	-0,111	-0,166
3	-0,819	-0,689	-0,908	-0,228	-0,137	-0,541
4	-0,952	-0,804	-1,139	-0,390	-0,221	-0,775
5	-1,029	-0,899	-0,956	-0,477	-0,334	-0,323
6	-1,024	-0,968	-0,782	-0,531	-0,405	-0,581
7	-1,031	-1,000	-0,822	-0,588	-0,444	-0,796
8	-1,053	-1,012	-0,989	-0,645	-0,485	-0,788
9	-1,093	-1,021	-1,166	-0,700	-0,528	-0,948
10	-1,099	-1,036	-1,327	-0,752	-0,572	-1,054
11	-1,066	-1,059	-1,454	-0,798	-0,618	-0,855
12	-1,027	-1,090	-0,299	-0,839	-0,660	-1,019
13	-1,010	-1,108	-0,411	-0,875	-0,697	-1,055
14	-1,016	-1,107	-0,580	-0,903	-0,733	-0,929
15	-1,032	-1,097	-0,739	-0,924	-0,765	-1,077
16	-1,039	-1,086	-0,856	-0,935	-0,794	-1,037
17	-1,027	-1,075	-0,975	-0,936	-0,821	-0,810
18	-0,994	-1,068	-0,989	-0,928	-0,844	-0,646
19	-0,942	-1,063	-1,116	-0,912	-0,862	-0,677
20	-0,874	-1,061	-1,234	-0,889	-0,874	-0,650
21	-0,793	-1,063	-1,354	-0,861	-0,883	-0,679
22	-0,705	-1,067	-1,195	-0,830	-0,890	-0,198
23	-0,610	-1,074	2,321**	-0,797	-0,892	-0,008
24	-0,513	-1,068	2,296**	-0,762	-0,889	-0,079

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As Table 36 indicates, according to the Hong test there is no volatility clustering between the two variables. Also for the uniform weighting scheme, the Truncated kernel function, there is evidence for volatility clustering in the two last lags in a 5% nominal size.

FRANCE

The next country in which we will apply causality tests for mean and variance is France. Like the other countries we start with the implementation of the Cheung & Ng test and the Hong test in order to detect any causal pattern.

First we will start with the r statistic and the S statistic test from the Cheung & Ng methodology. Table 37 and Table 38 provide us the outputs of the above two tests.

TABLE 37: Causality in Mean according to r statistic of the Cheung & Ng Test

Lags	$Rho_{ind \searrow tour, m}$	$Rho_{tour \searrow ind, m}$
1	4,319***	-2,123**
2	0,548	-2,355**
3	2,564**	2,822***
4	0,140	1,868*
5	3,479***	-2,054**
6	0,400	0,284
7	0,311	3,193***
8	1,316	-0,993
9	3,301***	2,197**
10	-1,596	-0,271
11	-2,691**	2,292**
12	-2,944***	-3,672***
13	3,240***	-4,223***
14	1,366	-2,145**
15	1,999**	2,988***
16	0,288	-0,424
17	3,440***	-0,788
18	-0,306	-0,762
19	1,318	2,620**
20	0,513	-0,289
21	3,079***	0,972
22	-1,288	0,508
23	-2,842***	1,544
24	-2,838***	-3,910***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 38: Causality in Mean according to
S statistic of the Cheung & Ng Test

$S_{ind \rightarrow tour,m}$	239,053***
$S_{tour \rightarrow ind,m}$	-37,977

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

From Table 37, it is clearly that the two variables have a strong simultaneous interaction in a 1% nominal size regarding causality in mean.

Also from table 38, according to the S statistic test, there is a strong unidirectional interaction in mean between the two variables that we examine.

Now we apply the Hong test for investigate causality in mean.

TABLE 39: Causality in Mean according to the Hong Test

Bandwidth	$Quadratic_{ind \rightarrow tour,m}$	$Bartlett_{ind \rightarrow tour,m}$	$Truncated_{ind \rightarrow tour,m}$	$Quadratic_{tour \rightarrow ind,m}$	$Bartlett_{tour \rightarrow ind,m}$	$Truncated_{tour \rightarrow ind,m}$
1	12,588***	NaN	12,583***	2,776***	NaN	2,503***
2	12,361***	12,583***	8,572***	2,992***	2,503***	4,076***
3	11,513***	12,092***	9,328***	4,199***	3,216***	6,222***
4	10,858***	11,654***	7,755***	5,309***	4,093***	6,304***
5	10,706***	11,294***	10,539***	5,976***	4,842***	6,697***
6	10,656***	11,141***	9,407***	6,496***	5,406***	5,868***
7	10,577***	11,136***	8,494***	6,934***	5,796***	7,973***
8	10,532***	11,100***	8,165***	7,226***	6,128***	7,484***
9	10,571***	11,023***	10,130***	7,485***	6,444***	8,014***
10	10,716***	10,974***	10,004***	7,793***	6,728***	7,421***
11	10,968***	10,976***	10,953***	8,222***	6,972***	8,044***
12	11,278***	11,017***	12,150***	8,767***	7,183***	10,378***
13	11,591***	11,104***	13,654***	9,329***	7,405***	13,445***
14	11,899***	11,244***	13,377***	9,855***	7,685***	13,713***
15	12,203***	11,422***	13,544***	10,343***	8,021***	14,811***
16	12,502***	11,614***	12,994***	10,800***	8,391***	14,242***
17	12,796***	11,807***	14,608***	11,228***	8,775***	13,801***
18	13,081***	12,003***	14,091***	11,630***	9,149***	13,390***
19	13,356***	12,201***	13,895***	12,008***	9,503***	14,089***
20	13,622***	12,393***	13,473***	12,367***	9,836***	13,633***
21	13,878***	12,574***	14,591***	12,710***	10,150***	13,348***
22	14,124***	12,747***	14,418***	13,041***	10,441***	12,975***
23	14,363***	12,914***	15,271***	13,362***	10,707***	12,960***
24	14,593***	13,078***	16,099***	13,676***	10,950***	14,949***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

Table 39 confirms the evidence of strong causality in mean that we find in the Cheung & Ng test. The values of Table 39 are significant at any reasonable levels, suggesting very strong causality in mean in both directions.

Our next step is to examine if volatility spillovers occur. For this reason we first apply the Cheung & Ng test and then the Hong test in order to have a better power. Tables 40 and 41 report the results of the r statistic and the S statistic test respectively.

TABLE 40: Causality in variance according to r statistic of the Cheung & Ng Test

Lags	$Rho_{ind \rightarrow tour, v}$	$Rho_{tour \rightarrow ind, v}$
1	0,658	1,969**
2	-1,123	-0,582
3	0,882	-1,214
4	0,240	0,935
5	-0,478	-0,848
6	-0,506	0,120
7	0,437	0,956
8	0,020	-0,258
9	-0,438	2,252**
10	0,269	-0,981
11	0,051	0,277
12	0,027	0,996
13	-0,151	0,195
14	0,129	-0,693
15	-0,218	0,700
16	0,072	-0,653
17	-1,287	-0,076
18	0,290	0,748
19	1,231	-0,829
20	-1,000	0,056
21	-0,195	-0,318
22	0,996	-0,505
23	-0,689	0,796
24	-0,107	0,527

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 41: Causality in variance according to
S statistic of the Cheung & Ng Test

$S_{ind \rightarrow tour,v}$	-22,697
$S_{tour \rightarrow ind,v}$	36,050**

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

Both tests denotes a unidirectional volatility spillover in a 5% nominal size only for the direction tourist arrivals → industrial production.

Let's now see what the Hong test regarding causality in variance denotes.

TABLE 42: Causality in variance according to the Hong Test

Bandwidth	$Quadratic_{ind \rightarrow tour,v}$	$Bartlett_{ind \rightarrow tour,v}$	$Truncated_{ind \rightarrow tour,v}$	$Quadratic_{tour \rightarrow ind,v}$	$Bartlett_{tour \rightarrow ind,v}$	$Truncated_{tour \rightarrow ind,v}$
1	-0,400	NaN	-0,400	2,024**	NaN	2,054**
2	-0,375	-0,400	-0,146	1,957**	2,054**	1,128
3	-0,355	-0,341	-0,523	1,669*	1,881*	1,126
4	-0,469	-0,356	-0,785	1,469*	1,717*	0,941
5	-0,614	-0,431	-0,944	1,318	1,598*	0,762
6	-0,754	-0,522	-1,074	1,137	1,493	0,417
7	-0,886	-0,614	-1,208	0,992	1,386	0,374
8	-1,006	-0,703	-1,379	0,910	1,280	0,122
9	-1,120	-0,788	-1,488	0,869	1,178	1,117
10	-1,229	-0,872	-1,618	0,844	1,104	1,067
11	-1,333	-0,952	-1,754	0,820	1,067	0,829
12	-1,440	-1,030	-1,882	0,796	1,045	0,600
13	-1,542	-1,106	-1,999	0,767	1,027	0,396
14	-1,632	-1,180	-2,110	0,728	1,006	0,295
15	-1,708	-1,252	-2,211	0,678	0,981	0,204
16	-1,772	-1,323	-2,316	0,623	0,953	0,108
17	-1,827	-1,392	-2,117	0,565	0,923	-0,058
18	-1,876	-1,457	-2,208	0,507	0,890	-0,117
19	-1,922	-1,518	-2,048	0,451	0,855	-0,150
20	-1,966	-1,573	-1,983	0,397	0,819	-0,296
21	-2,007	-1,623	-2,080	0,344	0,782	-0,418
22	-2,045	-1,668	-2,020	0,293	0,743	-0,510
23	-2,079	-1,709	-2,045	0,242	0,703	-0,539
24	-2,108	-1,747	-2,140	0,193	0,663	-0,620

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

As we can see the values of the above Table indicates the same results with those of the Cheung & Ng test ; hence we can detect volatility clustering in a 5% nominal size only for the direction tourist arrivals → industrial production. This means that tourist arrivals Granger - causes industrial production.

SPAIN

The last country of our sample which examine both for causality in mean and variance is Spain.

Starting with the examination in mean that both industrial production and tourist arrivals may occur, we firstly apply the Cheung & Ng test. Tables 43 and 44 report the outputs of r statistic and S statistic respectively.

TABLE 43: Causality in Mean according to r statistic of the Cheung & Ng Test

Lags	$Rho_{ind \rightarrow tour, m}$	$Rho_{tour \rightarrow ind, m}$
1	5,183***	-1,290
2	-0,614	-3,605***
3	1,862*	3,798***
4	0,356	-1,386
5	4,296***	-1,736*
6	-4,139***	-4,858***
7	-0,375	4,641***
8	-1,176	-0,294
9	3,931***	1,381
10	-3,278***	-1,528
11	-0,996	5,136***
12	-0,349	-0,894
13	4,928***	-1,623
14	0,318	-3,648***
15	1,376	3,736***
16	0,550	-2,088**
17	4,248***	-1,326
18	-4,196***	-5,190***
19	0,175	4,346***
20	-1,328	-0,080
21	4,017***	0,065
22	-2,600**	-0,759
23	-1,207	4,080***
24	-0,360	-0,577

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 44: Causality in Mean according to S statistic of the Cheung & Ng Test

$S_{ind \rightarrow tour,m}$	161,432***
$S_{tour \rightarrow ind,m}$	-56,240

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

According to the r statistic test, there is a bidirectional return spillover for the two variables in a 1% nominal size.

When we examine causality in mean using the S statistic we find that exists causal relationship in mean only in the direction industrial production → tourist arrivals in a 1% nominal size.

Regarding the Hong test we have the following table.

TABLE 45: Causality in Mean according to the Hong Test

Bandwidth	$Quadratic_{ind\rightarrow tour,m}$	$Bartlett_{ind\rightarrow tour,m}$	$Truncated_{ind\rightarrow tour,m}$	$Quadratic_{tour\rightarrow ind,m}$	$Bartlett_{tour\rightarrow ind,m}$	$Truncated_{tour\rightarrow ind,m}$
1	18,401***	NaN	18,414***	1,152	NaN	0,477
2	18,154***	18,414***	12,739	1,824	0,477	6,393
3	16,631***	17,763***	11,447	5,274	2,535	10,778
4	14,987***	16,756***	9,629	7,742	4,856	9,691
5	14,655***	15,815***	14,244***	9,180	6,571	9,340
6	15,050***	15,349***	17,778***	10,842	7,649	15,192***
7	15,641***	15,473***	16,270***	12,465	8,656	19,703***
8	16,278***	15,824***	15,359***	13,917***	9,875	18,246***
9	16,919***	16,145***	18,011***	15,199***	11,111	17,469***
10	17,524***	16,469***	19,371***	16,298***	12,190	16,926***
11	18,079***	16,843***	18,518***	17,239***	13,090	21,751***
12	18,593***	17,227***	17,595***	18,092***	13,915***	20,840***
13	19,088***	17,571***	21,674***	18,927***	14,707***	20,409***
14	19,574***	17,913***	20,767***	19,743***	15,429***	22,132***
15	20,051***	18,273***	20,289***	20,530***	16,094***	23,896***
16	20,521***	18,617***	19,573***	21,288***	16,732***	23,820***
17	20,983***	18,933***	22,092***	22,013***	17,346***	23,309***
18	21,437***	19,233***	24,423***	22,705***	17,923***	27,234***
19	21,881***	19,545***	23,674***	23,365***	18,482***	29,620***
20	22,316***	19,868***	23,268***	23,994***	19,053***	28,784***
21	22,741***	20,185***	25,230***	24,595***	19,627***	28,007***
22	23,158***	20,499***	25,636***	25,169***	20,185***	27,372***
23	23,566***	20,816***	25,215***	25,719***	20,716***	29,283***
24	23,966***	21,129***	24,623***	26,247***	21,225***	28,645***

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

The values of Table 45 reveals the strong causality in mean that exhibits between the two variables in the two directions in a 1% nominal size. This is in contrast with the S statistic test for the same sample which denotes causal relationship in mean only in the direction industrial production → tourist arrivals.

Now we will examine if any volatility spillover between the two variables does occur. First we apply the Cheung & Ng test.

TABLE 46: Causality in variance according to

r statistic of the Cheung & Ng Test

Lags	$Rho_{ind \rightarrow tour, v}$	$Rho_{tour \rightarrow ind, v}$
1	1,599	-0,826
2	-0,134	0,278
3	-0,137	-0,483
4	-0,694	0,933
5	1,492	-1,276
6	-0,949	-0,907
7	-0,500	-0,322
8	-1,151	-0,131
9	1,621	-0,240
10	-1,001	-0,637
11	-0,875	-0,314
12	-0,724	-0,091
13	-0,925	-1,230
14	-0,918	2,299**
15	2,513**	-1,120
16	-0,342	-0,194
17	-0,277	-0,061
18	-1,293	0,163
19	-1,091	-0,664
20	1,084	-1,526
21	0,084	0,802
22	-0,123	-0,656
23	-1,011	0,586
24	-1,061	2,343**

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

TABLE 47: Causality in variance according to

S statistic of the Cheung & Ng Test

$S_{ind \rightarrow tour,v}$	-68,933
$S_{tour \rightarrow ind,v}$	-48,147

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

Regarding the r statistic test, as we can see in Table 46, there is a causal relationship in volatility only in the 15th lag in a 5% nominal size for the direction industrial production → tourist arrivals. For the opposite direction, we have a causal relationship only in 14th and 24th lag in a 5% nominal size.

The S statistic test reveals that does not exist any volatility spillover between the two variables.

Let's now examine the existence of volatility spillovers via the Hong test.

TABLE 48: Causality in variance according to the Hong Test

Bandwidth	$Quadratic_{ind \to tour,v}$	$Bartlett_{ind \to tour,v}$	$Truncated_{ind \to tour,v}$	$Quadratic_{tour \to ind,v}$	$Bartlett_{tour \to ind,v}$	$Truncated_{tour \to ind,v}$
1	1,057	NaN	1,112	-0,270	NaN	-0,223
2	0,987	1,112	0,288	-0,322	-0,223	-0,619
3	0,621	0,908	-0,164	-0,539	-0,374	-0,818
4	0,299	0,657	-0,322	-0,684	-0,520	-0,749
5	0,154	0,443	0,114	-0,710	-0,620	-0,462
6	0,074	0,313	0,083	-0,707	-0,662	-0,467
7	0,049	0,245	-0,119	-0,700	-0,669	-0,669
8	0,583	0,197	-0,019	-0,729	-0,673	-0,869
9	0,732	0,159	0,386	-0,793	-0,687	-1,039
10	0,090	0,141	0,378	-0,855	-0,712	-1,114
11	0,115	0,140	0,321	-0,897	-0,746	-1,252
12	0,148	0,147	0,219	-0,921	-0,784	-1,399
13	0,188	0,155	0,194	-0,932	-0,827	-1,231
14	0,238	0,163	0,169	-0,932	-0,869	-0,335
15	0,290	0,169	1,187	-0,924	-0,900	-0,263
16	0,344	0,182	1,002	-0,912	-0,913	-0,419
17	0,394	0,207	0,823	-0,898	-0,916	-0,572
18	0,439	0,235	0,934	-0,882	-0,915	-0,713
19	0,478	0,265	0,959	-0,864	-0,912	-0,776
20	0,510	0,296	0,981	-0,843	-0,910	-0,521
21	0,536	0,327	0,814	-0,819	-0,906	-0,552
22	0,555	0,357	0,656	-0,793	-0,902	-0,615
23	0,569	0,385	0,664	-0,763	-0,897	-0,689
24	0,577	0,409	0,687	-0,730	-0,892	0,030

Notes: *The null Hypotheses (H_0) denotes no causality in mean and variance. The alternative Hypotheses (H_1) denotes causality in mean and variance. The '*' shows significance at 10%, the '**' shows significance at the 5% and the '***' shows significance at the 1% level.*

It is obvious from the results of Table 48 , that no volatility clustering occurs between the two variables.

CHAPTER 4: CONCLUDING REMARKS

In Chapter 3 we have applied our econometric model in order to examine the causality patterns between financial performance and tourism development and economic activity and tourism development in the four countries of our sample. Let's now summarise the analysis of the previous empirical results in section 3.2.1 and 3.2.2 in a more general way. Our empirical research has two parts. The first part examines the dynamic relationship between the stock markets and the tourism development and the second examines the dynamic relationship between economic activity, which is measuring by the industrial production, and tourism development regarding causality in mean and volatility. This analysis is based on the statistical tables of the Cheung & Ng and Hong causality tests, using the GARCH model specifications. Finally we will refer to the empirical performance of these tests. Before we begin it is necessary to refer some characteristics of the countries we have selected.

The choice of these countries was made very carefully. Tourism in these countries forms an important part of their economies. We mention that tourism in Austria accounting the 9% of its GDP and tourism in Portugal accounting 6% of its GDP. Regarding France, tourism is a significant contributor to the French economy as it is the most visited country in the world with over 75 million visitors a year. For the case of Spain, the Spanish tourism industry has grown to become the second biggest in the world, worth about 40 billion Euros, about 5% of GDP, in 2006.

After this short presentation about the role that tourism plays in these countries, we can discuss the results we find in Chapter 3.

As we have mentioned in the introduction of this dissertation there are many studies in the literature that have been written in order to investigate the impact of tourism in the economic performance in many countries and vice versa. In our point of view, the literature in tourism development is not expanded in how the stock markets performance affects tourism and how tourism affects the financial performance.

Let's now begin first with the examination of financial performance, which measures with the share price index, and the tourism development.

For all the countries of our sample we can detect a strong causal relationship in mean in the first lags from the stock markets to tourist arrivals according to the Cheung & Ng test in a 1% nominal size. When we are using the Hong test for causality in mean we can see that there exists causal pattern in mean from stock market to tourist arrivals for the cases of Austria, France and Spain, while in the case of Portugal we can see a strong return spillover from tourist arrivals to stock market. A possible explanation for this result is because Portugal economy relies on tourism industry and this lead the tourism fluctuations to influence the financial performance of the firms of the country. Also we have to remark that Austria is the only of the four countries in which we can detect a bidirectional causal relationship between stock market and tourist arrivals in a 1% nominal size. This means that these two factors reinforce each other. Also we can detect volatility spillovers in the direction stock market to tourist arrivals, according to the Cheung & Ng test, in all countries except France where we have a causal relationship in variance from tourist arrivals to stock market. In addition, when we are applying the Hong test we detect no causality in variance for the cases in France and Spain, while in the case of Austria we have a bidirectional volatility spillover and for the case of Portugal we have evidence for volatility clustering only from tourist arrivals to stock market. The above findings indicates the role of financial performance in the tourism industry. A possible reason for that is the fact that many firms in these countries have invested in the tourism sector, such as constructing companies, hotels etc, and for this the financial performance of these firms have a major effect in the tourism development of these countries. On the other hand, we have the case of Portugal where the tourism sector performance have a large impact in the financial performance of the country.

The next step of our study was to examine how economic activity affect the tourism development as well how tourism sector impacts in the economic expansion of the countries. The findings confirm the literature on this topic. It is clearly that when we are using the Hong test we find a strong bidirectional causality in mean for all the countries of our sample in a 1% nominal size, while when we are using the Cheung & Ng test we can detect a unidirectional causal pattern in mean from industrial production to tourist arrivals in three countries except Austria which exhibits a bidirectional causality in mean in a 1% nominal size. Also for causality in variance, according to the Cheung & Ng test, we detect a unidirectional volatility spillover from tourist arrivals to economic activity for Austria and France, while for the case of Portugal there is bidirectional relationship in volatility and for the case of Spain there is no causality in volatility between the two variables. Now according to the Hong test for causality in variance, we detect no volatility spillovers for the case of Spain, a weak volatility spillover from tourism development to industrial production in the case of France in the first bandwidths and for Portugal from industrial production to tourist arrivals in the two last lags of the truncated kernel and a strong volatility spillover from industrial production to tourist arrivals in the case of Austria.

At this point we have to remark that the return spillover is detected more times than the volatility spillover, because the GARCH model constitutes a short-non persistent memory process.

Also comparing the two causality tests we can reveal that the Hong test is more severe and accurate than the Cheung & Ng test and the reason is that the Hong test is weighted scheme which uses kernel functions which weights the lags regarding the volatility persistence, the so called “bandwidths”.

CONCLUSION

This dissertation empirically investigates the causal relationships that can be detected among financial activity, economic activity and the tourism expansion. There is a vast amount of research on the economic impact of tourism literature in the tourism literature. The results of many of these studies have shown that there is a causal relation between economic activity and tourism. Despite these findings, not many studies have examined a causal relationship between tourism and financial performance. The aim of this dissertation was to examine the causal patterns in mean and variance that may occur between tourism development and stock market and between macroeconomic conditions and tourism development. For this purpose we used monthly data of the share price index, industrial production and total tourist arrivals of four countries. To detect the causal relationships we apply an econometric model. The model that we were used detect the appropriate ARCH and GARCH models which provide no autocorrelation to the residuals of the time series we have used. After the selection of the appropriate models, we implement the causality tests of Cheung & Ng and Hong in order to examine the causality patterns in mean and volatility. The current dissertation discovered a strong causality pattern from stock market to tourism in both in mean and variance and also confirmed the empirical findings of other researches such as **Balaguer and Cantavella-Jorda (2002), Chi-Ok Oh (2003), Lee and Chien (2008),** regarding the causal relationship between economic expansion and tourism. More precisely, we find that the stock market performance could influence the tourism development of a country, because many firms that cover a wide range of economic activities such as construction, hotels and other accommodations ,etc. in the examined countries have invested in the tourism sector and by their performance can influence tourism demand. Also regarding the economic activity, this dissertation indicated that there is also a bidirectional causality pattern in mean for these two variables in some countries while in others there is a unidirectional return and volatility spillover. The causality results can be used from policy makers and also from any other authorities in order to plan both financial and economic strategies for making appropriate investments to increase tourism demand in their countries. An interesting topic that other researchers may examine with the implementation of the causality tests of Cheung & Ng and Hong is the relationship between the stock markets and economic performance of the countries of tourists with the tourism development of the destination countries.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΑ

REFERENCES

Abu-Bader, S. and Abu-Qarn A.S. (2008) "Financial development and economic growth: The Egyptian experience", *Journal of Policy Modeling*, Vol. 30, pp. 887-898

Antzoulatos, A.A. and Tsoumas, C. (2009) "Financial development and household portfolios – Evidence from Spain, the U.K. and the U.S.", *Journal of International Money and Finance*, Vol. xxx, pp. 1-15

Apergis, N. and Miller, S.M. (2006) "Consumption asymmetry and the stock market: Empirical evidence", *Economics Letters*, Vol. 93, pp. 337-342

Baillie, R.T., Bollerslev, T. and Mikkelsen, H.O. (1996), "Fractionally Integrated Generalized Autoregressive Conditional Heteroscedasticity", *Journal of Econometrics*, Vo. 74, pp. 3-30

Balaguer, J. and Cantavella-Jorda, M. (2002) "Tourism as a long-run economic growth factor: The Spanish case", *Applied Economics*, Vol. 34(7), pp. 877 – 884

Barry, P.A. (1997) "Tourism and the economic development of cornwall", *Annals of Tourism Research*, Vol. 24(3), pp. 721-735

Bonham, C., Gangnes, B. and Zhou, T. (2009) "Modeling tourism:A fully identified VECM approach", *International Journal of Forecasting*, Vol.25, pp. 531-549

Booth, G.G., Martikainen, T. and Tse, Y. (1997) "Price and Volatility Spillovers in Scandinavian Stock Markets", *Journal of Banking and Finance*, Vol. 21, pp. 811-823

Brooks, C. and Henry, O.T., (2000) "Linear and Non Linear Transmission of Equity Return Volatility: Evidence from the US, Japan and Australia", *Economic Modeling*, Vol. 17, pp. 497-513

Butler, R. (2009) "Tourism in the future: Cycles, waves or wheels?", *Futures*, Vol. 41, pp. 346-352

Caporale, G.M., Pittis, N. and Spagnolo, N. (2002) "Testing for Causality in Variance: An Application to the East Asian Markets", *International Journal of Finance and Economics*, Vol. 7, pp. 235-245

Chan, F., Lim, C. and McAleer, M. (2005) "Modelling multivariate international tourism demand and volatility", *Tourism Management*, Vol. 26, pp. 459-471

Chao, C.C., Hazari, B. and Sgro, P. (2005) "Tourism and economic development in a cash-in-advance economy", *Research in International Business and Finance*, Vol. 19, pp. 365-373

Chen, M.H. (2007) "Interactions between business conditions and financial performance of tourism firms: Evidence from China and Taiwan", *Tourism Management*, Vol. 28, pp. 188-203

Chen, C.F. and Chiou-Wei, S.Z. (2009) “Tourism expansion, tourism uncertainty and economic growth: New evidence from Taiwan and Korea”, *Tourism Management*, Vol. 30, pp. 812-818

Chen, Y.C., Kang, H.H. and Yang, T.C., (2009), “Impacts of Volatility on Forecasting Inbound Tourists into China”, *Academy of International Business Research Conference*, Dubai, United Arab Emirates

Cheung, Y.-W. and L.K. Ng (1996), “A causality-in-variance test and its application to financial market prices”, *Journal of Econometrics*, Vol. 72, pp. 33-48

Cheung, Y.W. and Fung, H.G. (1997) “Information Flows Between Eurodollar Spot and Futures Markets”, *Multinational Finance Journal*, Vol. 1 (4), pp. 255–271

Choi, J.J., Hauser, S. and Kopecky, K.J. (1999) “Does the stock market predict real activity? Time series evidence from the G-7 countries”, *Journal of Banking & Finance*, Vol. 23, pp. 1771-1792

Choudhry, T. (2003) “Stock market volatility and the US consumer expenditure”, *Journal of Macroeconomics*, Vol. 25, pp. 367-385

Chu, F.L. (2009) “Forecating tourism demand with ARMA-based methods”, *Tourism Management*, Vol. 30, pp. 740-751

Coshall, J.T. (2009) “Combining volatility and smoothing forecasts of UK demand for international tourism”, *Tourism Management*, Vol.30, pp. 495-511

Dijk, D.V., Osborn, D.R. and Sensier, M. (2005) “Testing for Causality in Variance in the Presence of Breaks”, *Economics Letters*, Vol. 89, pp. 193 – 199

Divisekera, S. (2003) “A model of demand for international tourism”, *Annals of Tourism Research*, Vol. 30(1), pp. 31-49

Dritsakis, N. and Athanasiadis, S. (2000) “An econometril model of tourism demand: The case of Greece”, *Journal of Hospitality and Leisure marketing*, Vol. 7(2), pp. 39-49

Dritsakis, N. (2004) “Tourism as a long-run economic growth factor: an empirical investigation for Greece using causality analysis”, *Tourism Economics*, Vol. 10(3), pp. 305-316

Eadington, W.R. and Redman, M. (1991) “Economics and tourism”, *Annals of Tourism Research*, Vol. 18, pp.41-56

Engle, R.F (1982), “Autoregressive Conditional Heteroskedasticity with Estimates of United Kingdom Inflation”, *Econometrica*, Vol. 50, pp. 987-1008

Eugenio-Martín, J.L., Morales, M.N. and Scarpa, R. (2004) "Tourism and Economic Growth in Latin American Countries: A Panel Data Approach", *Working Papers*, Vol. 26, Fondazione Eni Enrico Mattei

Fase, M.M.G. and Abma, R.C.N. (2003) "Financial environment and economic growth in selected Asian countries", *Journal of Asian Economics*, Vol. 14, pp. 11-21

Federici, D. and Caprioli, F. (2009) "Financial development and growth: An empirical analysis", *Economic Modelling*, Vol. 26, pp. 285-294

Fung, M.K. (2009) "Financial development and economic growth: Convergence or divergence?", *Journal of International Money and Finance*, Vol. 28, pp. 56-67

Granger, C.W.J. (1969) "Investigating causal relations by econometric models and cross-spectral methods", *Econometrica*, Vol. 37(2), pp. 424-438

Granger, C.W.J. (1980) "Testing for causality", *Journal of Economic Dynamics and Control*, Vol. 2, pp. 329-352

Gregorio, de J. and Guidotti, P.E. (1995) "Financial development and economic growth", *World Development*, Vol. 23(3), pp. 433-448

Grimes, A. (2006) "A smooth ride:Terms of trade, volatility and GDP growth", *Journal of Asian Economics*, Vol. 17, pp. 583-600

Hamao, Y., Masulis, R.W. and Nig, V. (1990) "Correlations in Price Changes and Volatility across International Stock Markets", *The Review of Financial Studies*, Vol. 3, pp. 81-307

Hong, Y. (2001), "A test for volatility spillover with application to exchange rates", *Journal of Econometrics*, Vol. 103, pp.183-224

Hoti**,** S., McAleer**,** M. and Shareef, R. (2005) **"**Modelling multivariate volatility in international tourism and country risk for Cyprus and Malta"**,** *Tourism Management*, Vol. 28, pp. 1472-84

Hu, J.W.S., Chen, M.Y., Fok, R.C.W. and Huang, B.N., (1997) "Causality in Volatility and Volatility Spillover Effects between US, Japan and four Equity Markets in the South China Growth Triangular", *Journal of International Financial Markets*, Institutions and Money, Vol. 7, pp. 351-367

Inagaki, K. (2007) "Testing for Volatility Spillover between the British Pound and the Euro", *Research in International Business and Finance*, Vol. 21, pp. 161 – 174

Jang, S. and Chen, M.H. (2008) "Financial portfolio approach to optimal tourist market mixes", *Tourism Management*, Vol 29, pp. 761-770

Kanas, A. and Kouretas, G.P. (2002) "Mean and Variance Causality between Official and Parallel Currency Markets: Evidence from four Latin American Countries", *The Financial Review*, Vol. 37, pp. 137-164

Kim, H.J., Chen, M.H and Jang, S.S (2006) "Tourism expansion and economic development: The case of Taiwan", *Tourism Management*, Vol. 27, pp. 925-933

Kim, s.S. and Wong, K.K.F. (2006) “Effects of news shock in inbound tourist demand volatility in Korea”, *Journal of Travel Research*, Vol. 44, pp. 457-466

Lee, C.C. and Chien, M.S. (2008) “Structural breaks, tourism development, and economic growth: Evidence from Taiwan”, *Mathematics and Computers in Simulation*, Vol. 77, pp. 358-368

Lee, C.C. and Chang, C.P. (2008) “Tourism development and economic growth: A closer look at panels”, *Tourism Management*, Vol.29, pp. 180-192

Leon, C., Filis, G. and Eeckels, B. (2006) “Cyclical Movements of Tourist Income and GDP and their Transmission Mechanism. Evidence from Greece”in *24th International EUROCHRIE Conference*, University of Aegean, Thessaloniki

Leung, W.K. and Lee, T.S. (2006) “Institutional investors and the Monday effect on tourism stocks”, *Hospitality Management*, Vol. 25, pp. 348-372

Li. Y. (1998) “Expected stock returns, risk premiums and volatilities of economic factors”, *Journal of Empirical Finance*, Vol.5, pp. 69-97

Lin, W.-L., Engle, R.F. and Ito, T. (1994) ‘Do bulls and bears move across borders? International transmission stock returns and volatility’, *Review of Financial Studies*, Vol. 7, pp. 507-538

Malik, A. K. (2005) “European exchange rate volatility dynamics: an empirical Investigation”, *Journal of Empirical Finance*, Vol. 12, pp. 187 – 215

Morelli, D. (2002) “The relationship between conditional stock market volatility and conditional macroeconomic volatility Empirical evidence based on UK data”, *International Review of Financial Analysis*, Vol. 11, pp. 101-110

Oh, C.O. (2005) “The contribution of tourism development to economic growth in the Korean economy”, *Tourism Management*, Vol. 26, pp. 39-44

Pantelidis, T. and Pittis, N. (2004) “Testing for Granger causality in variance in the presence of causality in mean”, *Economics Letters*, Vol. 85, pp. 201-207

Po, W.C., Huang, B.N. (2008) “Tourism development and economic growth- a nonlinear approach”, *Physica A*, Vol. 387, pp. 5535-5542

Rose, A.K. and Spiegel M.M. (2009) “International financial remoteness and macroeconomic volatility”, *Journal of Development Economics*, Vol. 89, pp. 250-257

Rosentraub, M.S. and Joo, M. (2009) “Tourism and economic development: Which investments produce gains for regions?”, *Tourism Management*, Vol. 30, pp. 759-770

Shareef, R. and McAleer, M. (2005) "Modelling international tourism demand and volatility in small island tourism economies", *International Journal of Tourism Research*, Vol. 7, pp.313 - 333

Smeral, E. and Witt, S.F. (1996) “Econometric forecasts of tourism demand to 2005”, *Annals of Tourism Research*, Vol. 23, pp. 891-907

Sola, M., Spagnolo, F. and Spagnolo, N. (2002) “A Test for Volatility Spillovers”, *Economics Letters*, Vol. 76, pp. 77-84

Tang, C.H. and Jang, S. (2009) “The tourism-economy causality in the United States: A sub-industry level examination”, *Tourism Management*, Vol. 30, pp. 553-558

Wang, Y.S. (2009) “The impact of crisis events and macroeconomic activity on Taiwan’s international inbound tourism demand”, *Tourism Management*, Vol. 30, pp. 75-82

Webber, A.G. (2001) “Exchange rate volatility and cointegration in tourism demand”, *Journal of Travel Research*, Vol.39, pp.398-405

Witt, S.F. and Martin, C.A. (1987) “International Tourism Demand Models - Inclusion of Marketing Variables”, *Tourism Management*, Vol. 8 (1), pp. 33-40