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Using the SUR Model of Tourism Demand for Neighbouring Regions in Sweden and Norway

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1. Introduction

This chapter estimates the international demand for tourism in two neighbouring regions: the objective number 6 (SW:6) in Sweden and North Norway included – Trøndelag (NWT) in North Norway, from five different countries: Denmark, the United Kingdom, Switzerland, Japan, and the United States. For each visiting country, and for Sweden and Norway, we specify separate equations by including the relevant information. we then estimate these ten equations using Zellner's Iterative Seemingly Unrelated Regressions (ISUR). The benefit of this model is that the ISUR estimators utilize the information within and the relation between the equations present in the error correlation of the cross regressions (or equations) and hence is more efficient than single equation estimation methods such as ordinary least squares. Monthly time series data from 1993:01 to 2006:12 are used. The results show that the consumer price index, some lagged dependent variables, and several monthly dummies (representing seasonal effects) have significant impacts on the number of visitors to the SW:6 region in Sweden and NWT region in Norway. We also find that, in at least some cases, relative prices and exchange rates have significant effects on international tourism demand.

Tourism has important impacts on the economies of both developing and industrialized countries, resulting in job creation, additional income for the private and public sectors, foreign currency receipts, higher investment and growth. Indeed, tourism has acted as a catalyst to economic restructuring in many recipient countries, assisting a shift away from primary sector activities, towards greater reliance on services and manufacturing. Given the scale of tourism's contribution to the macroeconomic dimension over time, knowledge concerning the nature of the demand upon which it is based is of both theoretical and practical relevance. It is well known that tourism demand is responsive to such variables as income, relative prices and exchange rates. What is not known is how the responsiveness of demand to changes in these variables alters during a country's economic transition and integration into the wider world initial or subsequent years? Does the sensitivity of tourism demand to changes in its own prices, or those of its competitors, change between different periods? Further questions concern the degrees of complementarity or substitutability between tourism destinations and the extent to which these change during periods of economic transition. Complementarity occurs if holidays in different destinations are purchased as a package. Alternatively, there may be an intense degree of competition between destinations. Relationships of complementarity or substitutability may change over

time as lower income destinations emerge from relative poverty to achieve a higher level of development. Little information is available about this issue. It is not known, for example, whether lower income destinations tend to become more or less competitive over time, either relative to other developing countries or relative to more industrialized nations.

Different models have been used to estimate tourism demand and some types of model are more appropriate for examining the above questions than others. The vast majority of studies of tourism demand have relied on single equation models of demand, estimated within a static context (for example, Uysal and Crompton, 1984; Gunadhi and Boey, 1986). These models are not derived from consumer demand theory and fail to quantify the changes in demand behaviour that occur over time. Innovations in the methodology were subsequently introduced in the form of single equation models of demand estimated using an error correction methodology were subsequently introduced in single equation model of demand estimated using an error correction methodology (Syriopoulos, 1995). Kulendran (1996) used a general to specific, error correction model to estimate the Australia demand for tourism in the form of visits per capita to outbound destinations and demonstrated that the model has good forecasting ability. This modelling approach has the advantage of explicit treatment of the time dimension of tourism demand behaviour and allows for improved econometric estimation of the specified equations.

A More recently approach to tourism demand estimation involves a system -wide approach by using the ISUR Model (Salman et al. 2010). This system of study is particularly useful for testing the properties of homogeneity and symmetry which are basic to consumer demand theory. Hence, it provides a stronger theoretical basic for estimating the cross- price elasticities of demand than the single equation approach.

This chapter was used system wise approach by the ISUR Model to examine tourism demand by the UK, Switzerland, Denmark, Japan and The USA in the neighboring destination number 6 (SW:6) and (NWT) in Norway. The UK, Switzerland, Denmark, Japan and The USA are major origin countries for tourism in the destinations under consideration. SW:6 in Sweden and NWT in Norway are key destinations, accounting for over one-third of all receipts from tourism in the European Union in 2005. The absolute value of their receipts from tourism is very high, at over \$ 200 million in 2005. The choice of the countries as destinations for analysis is also appropriate owing to their position as geographic neighbours. Complementarity or substitutability in tourism demand, as indicated by the signs of the relative-price elasticities of demand, is of particular relevance in this context. This chapter pays attention to this issue, which has not previously been examined for the case of neighbouring countries using the ISUR approach. Sweden and Norway are interesting cases for consideration owing to their position as economies in transition during the period under consideration. By the early 1990s, the start years of the period under study, they had adopted new development policies, high dependence on industry, moving towards increased globalization, economic integration, and foreign competition. Sweden had joined the ranks of the more developed European economies in the period under study. Hence, an innovative feature of this chapter is its examination of the evolution of tourism demand during these countries' transition to a new technological system and globalization status. It also permits examination of the extent to which the behaviour of demand become more or less similar over time with respect to changes in prices and exchange rates. Thus, this study provides useful information, at the cross-country level, about change in a major activity within each of the economies.

The aim of this chapter is to estimate international tourism demand to the two neighbouring regions: objective number 6 (SW:6) in Sweden and North Norway included – Trøndelag

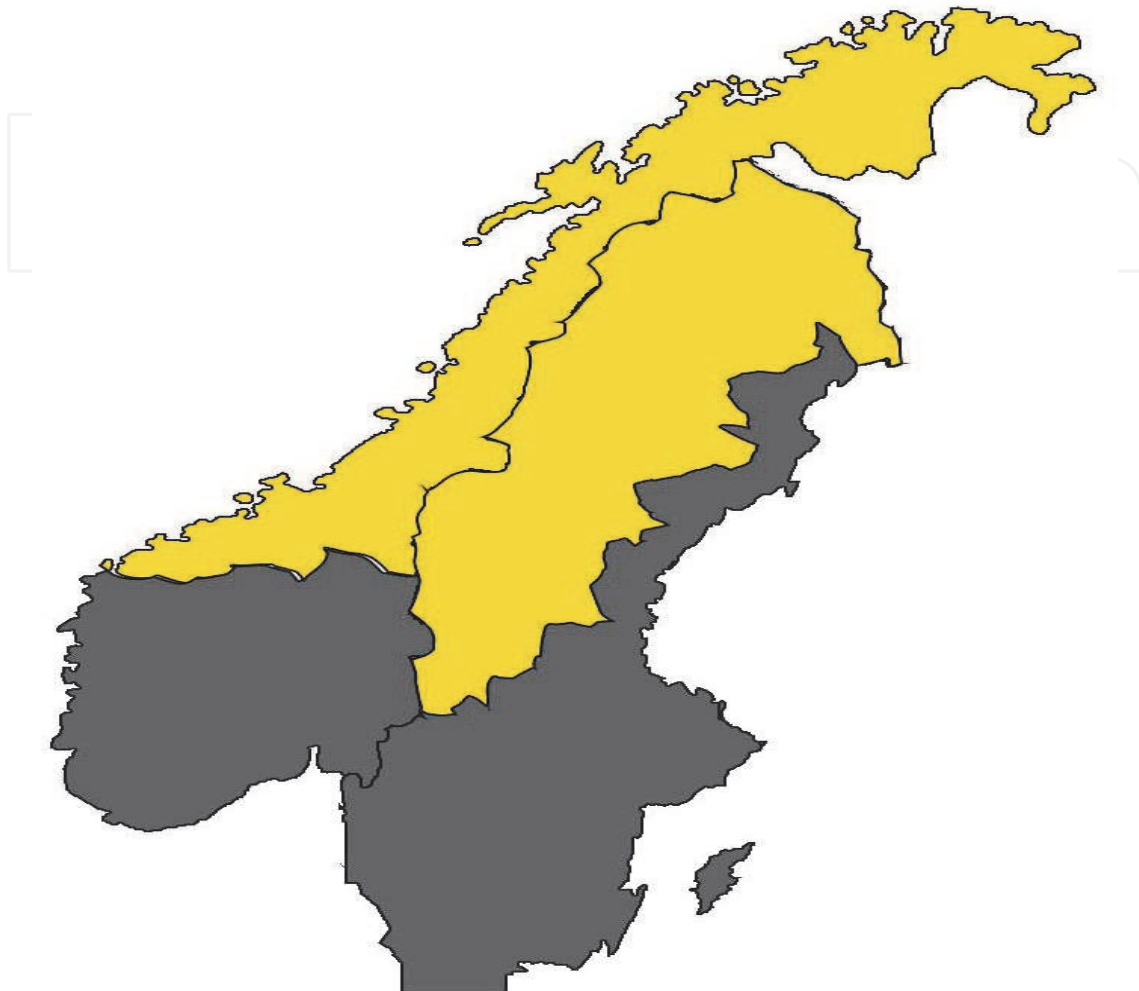


Fig. 1. Swedish and Norwegian Maps; The Objective 6 region (SW: 6) in Sweden is the lightly shadowed area at the top and top-left of the map of Sweden. The North -Norway included and Trøndelag region in Norway (NWT) is the lightly shadowed part on the top right of the map of Norway.

(NWT) by five countries: namely, Denmark, the United Kingdom (UK), Switzerland, Japan, and the United States (US). Since these two regions are geographically very close to each others and highly competitive (although they are located in two different countries) we believe that they can be considered as one larger region with respect to the very similar nature and tourism facilities they supply. For this reason we study the demand for these two regions simultaneously together by specifying a separate equation for these regions from the respective visiting countries. We then merge the ten equations in one system of regression equations model that will be estimated by Zellner's ISUR model.

Previous Scandinavian studies did not study and compare the tourism demand for Sweden and Norway in one overall regression model. Further, previous studies of Norwegian tourism demand have not considered the relative price and substitution effect or complementarity, the real and nominal exchange rate, and personal income. With this method of estimation, I can

come closer to studying the impact of the influences of cultural values, climate natural attraction on the tourism demand. This has earlier been difficult to quantify.

The purpose of this chapter is to use Iterative Seemingly Unrelated Regressions (ISUR) to estimate the relationship between monthly tourist arrivals to Sweden and Norway from Denmark, the UK, Switzerland, Japan, and the US and the factors that influence arrivals. To this end, we use a demand function approach to tourism flow modelling. A large model consisting of ten equations for Sweden and Norway (five for each country) was estimated by the ISUR technique.

The idea of merging the equations from both countries into one overall model, in fact, is necessary to measure the tourism demand to neighbouring regions that are close in their geographical characters, see Figure 1. In other words, tourists can receive the same utility from either region. An important question is “Are there differences between the hedonic regressions for the two neighbourhoods, or not?” If there are no differences, then the data from the two neighbourhoods can be pooled into one sample without parameter restrictions and with no allowance made for differing slope or intercept. Moreover, the estimation has been done by using the ISUR regression.

There is no previous application of this technique to tourism demand modelling for these two regions. With the ISUR technique, we estimate the entire system of equations by taking into account any possible correlations between the residuals from the different equations. Moreover, the ISUR technique provides parameter estimates that converge to unique maximum likelihood parameter estimates.

The remainder of the chapter is organized as follows. Section 2 discusses tourism demand for Nordic countries and the data used. Section 3 presents the estimation and testing methodology. Section 4 provides the results. This chapter has a brief summary and conclusion in Section 5.

2. Economic factors and the model specification

The objective of this section is to analyze how the following macroeconomic and microeconomic variables and seasonal (monthly) conditions influence the demand for tourism for the (SW:6) and (NWT):

1. The Swedish Consumer Price Index (CPI) represents the inflation rate and cost of living in Sweden and is in natural logarithms. The CPI has several advantages for this purpose: it is familiar to the public and is the most widely used measure of inflation in Sweden (Andersson and Berg, 1995). We adjust the CPI for any changes in indirect taxes and subsidies.
2. I use dummy variables for January to November to proxy for seasonal effects (December is the base category).
3. The exchange rate (EX) between the Swedish/Norwegian currencies and the visitors' country of origin currency are included in natural logarithms.
4. The relative price (Pr) reflects opportunity cost. This represents the cost of living in relative terms for Norway and Sweden and a substitute price for an origin country tourist. These are also in natural logarithms.

The SW:6 is a major tourist destination worldwide, with the yearly demand for tourism in this part of Sweden and NWT consistently following an upward trend. However, interruption to these trends has taken place on a number of occasions due to economic

conditions and/or international events. For example, September 11 and the first Gulf War had a detrimental effect on tourism demand in both Sweden and Norway.

A common model used in tourism demand studies is a single equation with demand explained by the tourist's income in their country of origin, the cost of tourism in their chosen and alternative destinations, and a substitute price (Witt and Martin, 1987). To start with, the demand for tourism can be expressed in a variety of ways. The most appropriate variable to represent demand explained by economic factors is consumer expenditure or receipts (Grouch, 1992). Other measures of demand are the nights spent by the tourist or their length of stay. However, due to the lack of data on monthly GDP, personal income (GDP/Population) is not included in this analysis.

The tourism price index (the price of the holiday) is also an important determinant of the decision a potential tourist makes. We can divide this into two components: (i) the cost of living for the tourist at the destination, and (ii) the cost of travel or transport to the destination. I divide the cost of living into two components: (i) the CPI in relative price form assuming that tourists have the option of spending their vacation in either SW:6 or NWT, and (ii) tourist consumer expenditure, real consumer expenditure, real income, and per capita income (Salman, 2003). In this chapter, CPI represents the cost of living. However, we measure transport costs by the weighted mean prices according to the transport mode used by tourists to reach the destination. Changes in travel costs, particularly airfares, can have a major impact on tourism demand. Unfortunately, data on economy class airfares between Stockholm and the capital cities of the countries of origin were not consistently available, so I could not use these in construction of the variables. Moreover, one should also take into account the small proportion of tourists who arrive in Sweden using charter flights destined for regional airports closer to the main tourist resorts, as the airfares for these may differ considerably from those to the capital city's airport. Therefore, in the absence of a suitable proxy, I exclude travel costs from our demand system (Lathiras and Siriopoulos, 1998).

In previous Scandinavian tourism demand studies, the cost of living component was defined in relative price form, assuming that the tourists have the option of spending their vacation in Sweden or at home. The probability of travel to the destination declines if the destination price level increased faster than that of the origin price due to a substitution effect, and also if the reserves occurred and hence the tourist's real income decreased to the substitution effect.

In this study, the cost of living (relative price) component is defined as the Norwegian price relative to the price of a holiday in Sweden. The underlying assumption is that for the tourists, SW: -6 in Sweden is a substitute long-haul holiday destination for NWT in Norway. In recent years, SW:6 in Sweden and NWT in Norway have been competing with each other to attract more tourists. The tourists from these five countries have the option of spending vacations on SW:6 in Sweden or NWT in Norway, both having similar mountains and skiing facilities in winter and similar climate. Furthermore, for visitors from these five countries mentioned above, the travel distances to SW:- 6 in Sweden and NWT in Norway are almost the same. Therefore, for potential visitors, SW:6 is consider a substitute long-haul holiday destination for the NWT and the cost of living variable for the tourism demand model is defined as the cost of living in SW:6 relative to that for NWT in Norway.

Following previous research, we can specify the price of tourism at the destination in a variety of ways. For instance, we can represent prices in either absolute or relative terms. In this chapter, we employ the relative price as an opportunity cost. We define this as the ratio of the CPI of the host country (CPI_{SW}) to the country of origin adjusted by the relative

exchange rate (R_{it}) to obtain a proxy for the real cost of living (Salman, 2004). Therefore, the real cost of tourism in Sweden and Norway are the relative CPIs given by:

$$Rp_{jt} = \frac{\frac{CPI_i}{EX_{it}}}{CPI_{jt}} \quad (1)$$

where i is the host country (Sweden or Norway), j is the visiting (or foreign) country, and t is time. Rp_{it} is the relative CPI for country i in time t , CPI_{it} is the CPI for Sweden or Norway, CPI_{jt} is the CPI for the foreign country, and EX_{ijt} is the exchange rate between the Swedish krona/Norwegian krone and the foreign currency.

In addition to the price variable, the exchange rate is a relevant factor in determining tourism demand. The rationale behind incorporation of the exchange rate as a separate explanatory variable is that tourists may be more aware of the relative exchange rate than the specific cost of tourism at the destination. A question that arises is whether the exchange rate should be included in our model system as an explanatory variable together with the price variable. In an attempt to find a variable to represent a tourist's cost of living, Salman, Shukur, and Bergmann-Winberg (2007) concluded that the CPI (either alone or with the exchange rate) is a reasonable proxy of the cost of tourism. And also the exchange rate and price are used in this study as proxy variables for the structural transformation in these two small open economies and the expansion in international competitions faced by them. We define the exchange rate variable as the foreign exchange rate of the Swedish Krona or Norwegian Krona to the currency of the origin country. This variable represents the relationship between tourism demand and the international money market and international economic events (including recessions and financial crises) as well.

As microeconomic theory suggests, the price of other goods influences the demand for a particular good. In the case of tourism, the identification and separation of substitute products is very difficult to achieve on an a priori basis. In our case, tourists consider NWT region (in the North of Norway) an alternative destination to the SW:6 region (in the north of Sweden). These destinations are among the most popular destinations in Scandinavia, at least in terms of arrivals, for tourists from the origin countries under:

Relative price of tourism for Denmark

$$= \frac{CPI_{SweK} / EX_{SEK/DKK}}{CPI_{Nor} / EX_{NOK/DKK}} \quad (2)$$

Relative price of tourism for the UK

$$= \frac{CPI_{Swe} / EX_{SEK/GBP}}{CPI_{Nor} / EX_{NOK/GBP}} \quad (3)$$

Relative price of tourism for Switzerland

$$= \frac{CPI_{Swe} / EX_{SEK/CHF}}{CPI_{Nor} / EX_{NOK/CHF}} \quad (4)$$

Relative price of tourism for Japan

$$= \frac{CPI_{Swe} / EX_{SEK/JPY}}{CPI_{Nor} / EX_{NOK/JPY}} \tag{5}$$

Relative price of tourism for the US

$$= \frac{CPI_{Swe} / EX_{SEK/USD}}{CPI_{Nor} / EX_{NOK/USD}} \tag{6}$$

Where:

CPI_{Swe} : CPI in Sweden (1998 = 100).

CPI_{Nor} : CPI in Norway (1998 = 100).

$EX_{SEK/DKK}$: An index of the Swedish krona per unit of Danish krona (1998 = 100).

$EX_{SEK/GBP}$: An index of the Swedish krona per unit of British pound (1998 = 100).

$EX_{SEK/CHF}$: An index of the Swedish krona per unit of Swiss franc (1998 = 100).

$EX_{SEK/JPY}$: An index of the Swedish krona per unit of Japanese yen (1998 = 100).

$EX_{SEK/USD}$: An index of the Swedish krona per unit of US dollar (1998 = 100).

A lagged dependent variable may also be included to account for habit persistence and supply constraints. As for the signs of the explanatory variables, we expect a negative sign for the relative price variable and a positive sign for the exchange rate variable. In this study, monthly dummies represent seasonal effects on the number of arrivals from the origin countries. All variables are in natural logarithms, and the data are in index form (1998 = 100). All economic data employed in this study are from Statistics Sweden (Statistiska Centralbyrån) and Statistics Norway (Statistisk SENTRALBYRÅ). Estimation is with the STATA Ver. 10 and EViews Ver. 5.1 statistical program packages. We examine monthly time series data from 1993:01 to 2006:12.

3. Methodology

3.1 Statistical assumptions and the problem of misspecification

In the common stochastic specification of econometric models, the error terms are assumed to be normally distributed with mean zero, constant variance and serially uncorrelated. These assumptions must be tested and verified before one can have any confidence in the estimation results or conduct any specification tests, including standard *t*-tests of parameter significance or tests of theoretical restrictions. Because misspecification testing is a vast area of statistical/econometric methodology, there will only be a brief description of the methods used in this study (in the Appendix) with additional details in the cited references.

The methodology used in this chapter for misspecification testing follows Godfrey (1988) and Shukur (2002). To test for autocorrelation, we apply the F-version of the Breusch (1978) and Godfrey (1978) test. We use White (1980) test (including cross products of the explanatory variables) to test for heteroscedasticity and Ramsey's (1969) RESET test to test for functional misspecification (Ramsey, 1969). We also apply the Engle (1980) Lagrange Multiplier (LM) test for the possible presence of Autoregressive Conditional Heteroscedasticity (ARCH) in the residuals. Finally, we apply the Jarque-Bera (1987) LM test of non-normality to the residuals in model (4).

When building an econometric model, the assumption of parameter consistency is widely used because of the resulting simplicity in estimation and ease of interpretation. However,

in situations where a structural change may have occurred in the generation of the observations, this assumption is obviously inappropriate. Particularly in the field of econometrics where data are not generated under controlled conditions, the problem of ascertaining whether the underlying parameter structure is constant is of paramount interest. However, to test for the stability of the parameters in the models, and in the absence of any prior information regarding possible structural changes, we conduct a cumulative sum (CUSUM) test following Brown et al. (1975). The CUSUM test is in the form of a graph and is based on the cumulative sum of the recursive residuals. Movement in these recursive residuals outside the critical lines is suggestive of coefficient instability.

3.2 The systemic specification

In this chapter, we aim to estimate the number of visitors to Sweden and Norway from five countries (Denmark, the UK, Switzerland, Japan, and the US). For each visiting country and for both Sweden and Norway, we specify a separate equation with the relevant information included in each equation. For this purpose, we follow a simple strategy on how to select an appropriate model by successively examining the adequacy of a properly chosen sequence of models for each country separately using diagnostic tests with known good properties. The methodology used for misspecification testing in this chapter follows Godfrey (1988) and Shukur (2002). We apply their line of reasoning to the problem of autocorrelation, and then extend it to other forms of misspecification. If we subject a model to several specification tests, one or more of the test statistics may be so large (or the p-values so small) that the model is clearly unsatisfactory. At that point, one has either to modify the model or search for an entirely new model.

Our aim is to find a well-behaved model that satisfies the underlying statistical assumptions, which at the same time agrees with aspects of economic theory. Given these equations, we estimate the whole system (consisting of ten equations) using Zellner's ISUR. The ISUR technique provides parameter estimates that converge to unique maximum likelihood parameter estimates. Note that conventional seemingly unrelated regressions (SUR) does not have this property if the numbers of variables differ between the equations, even though it is one of the most successful and efficient methods for estimating SUR. The resulting model has stimulated countless theoretical and empirical results in econometrics and other areas (see Zellner, 1962; Srivastava and Giles, 1987; Chib and Greenberg, 1995). The benefit of this model for us is that the ISUR estimators utilize the information present in the cross regression (or equations) error correlation and hence it is more efficient than other estimation methods such as ordinary least squares (OLS).

Consider a general system of m stochastic equations given by:

$$Y_i = X_i B_i + e_i \quad i = 1, 2, \dots, M \quad (7)$$

where Y_i is a $(T \times 1)$ vector of dependent variables, e_i is a $(T \times 1)$ vector of random errors with $E(e_i) = 0$, X_i is a $(T \times n_i)$ matrix of observations on n_i exogenous and lagged dependent variables including a constant term, B_i is a $(n_i \times 1)$ dimensional vector of coefficients to be estimated, M is the number of equations in the system, T is the number of observations per equation, and n_i is the number of rows in the vector B_i . The m system of m equations can be written separately as:

$$Y_1 = X_1 \beta_1 + e_1$$

$$Y_2 = X_2\beta_2 + e_2$$

$$Y_m = X_m\beta_m + e_m$$

and then combined into a larger model written as:

$$\begin{pmatrix} Y_1 \\ Y_2 \\ \dots \\ Y_m \end{pmatrix} = \begin{pmatrix} X_1 & 0 & 0 & 0 \\ 0 & X_2 & 0 & 0 \\ 0 & 0 & \dots & 0 \\ 0 & 0 & 0 & X_m \end{pmatrix} \cdot \begin{pmatrix} \beta_1 \\ \beta_2 \\ \dots \\ \beta_m \end{pmatrix} + \begin{pmatrix} e_1 \\ e_2 \\ \dots \\ e_m \end{pmatrix} \quad (8)$$

This model can be rewritten compactly as:

$$Y = XB + e \quad (9)$$

where Y and e are of dimension $(TM \times 1)$, X is of dimension $(TM \times n)$, $n = \sum_{i=1}^M n_i$, and B is of dimension $(K \times 1)$.

At this stage, I make the following assumptions:

- X_i is fixed with rank n_i .
- $\text{Plim } \frac{1}{T}(X_i'X_i) = Q_{ii}$ is nonsingular with finite and fixed elements, i.e. invertible.
- addition, I assume that $\text{Plim } \frac{1}{T}(X_i'X_j) = Q_{ij}$ is also nonsingular with finite and fixed elements.
- $E(e_ie_i') = \sigma_{ij}I_T$, where σ_{ij} designates the covariance between the i^{th} and j^{th} equations for each observation in the sample.

The above expression can be written as:

$$E(e) = 0 \text{ and } E(ee') = \Sigma \otimes I_T = \Psi, \text{ where } \Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \dots & \sigma_{1M} \\ \sigma_{21} & \sigma_{22} & \dots & \sigma_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{M1} & \sigma_{M2} & \dots & \sigma_{MM} \end{bmatrix} \text{ is an } M \times M \text{ positive}$$

definite symmetric matrix and \otimes is the Kronecker product. Thus, the errors at each equation are assumed homoscedastic and not autocorrelated, but there is contemporaneous correlation between corresponding errors in different equations.

The OLS estimator of B in (9) is:

$$\hat{\beta}_{OLS} = (X'X)^{-1} X'Y$$

with the variance

$$\text{Var}(\hat{\beta}_{OLS}) = (X'X)^{-1} X'\Psi X(X'X)^{-1}$$

The SUR Generalized Least Squares (GLS) estimator of B is given by:

$$\hat{\beta}_{GLS} = \left(X'(\Sigma^{-1} \otimes I_T)X \right)^{-1} X'(\Sigma^{-1} \otimes I_T)Y$$

and the variance is given by:

$$V(\hat{\beta}_{GLS}) = \left(X'(\Sigma^{-1} \otimes I_T)X \right)^{-1}$$

However, the system of the five equations for Sweden and Norway are as follows:

$$Y_{it} = \alpha_i + S_i + X_{it}B_i + Y_{it-q}\Phi_{iq} + e_{it} \quad i = 1, 2, \dots, 5 \quad q = 1, 2, \dots, 12 \quad (10)$$

where Y_{it} is a $T \times 1$ vector of observations on the dependent variable, e_{it} is a $T \times 1$ vector of random errors with $E(e_t) = 0$, and S_i are monthly dummy variables that take values between 1 and 11 (the twelfth month is the base). X_{it} is a $T \times n_i$ matrix of observations on n_i nonstochastic explanatory variables, and B_i is an $n_i \times 1$ dimensional vector of unknown location parameters. T is the number of observations per equation, and n_i is the number of rows in the vector B_i . Φ_{iq} is a parameter vector associated with the lagged dependent variable for the respective equation.

The dependent variables Y_i are the natural logarithms of the number of monthly visitors from Denmark, the UK, Switzerland, Japan, and the US to either Sweden or Norway. The matrix X_i is the natural logarithm of three vectors that contains monthly information about the CPI in Sweden (or Norway), the exchange rate (Ex) in Sweden (or Norway), and relative price (Rp) for Sweden (or Norway) with respect to each of the abovementioned countries.

Another objective of this study is to test for the existence of any contemporaneous correlation between the equations. If such correlation exists and is statistically significant, then least squares applied separately to each equation are not efficient and there is need to employ another estimation method that is more efficient.

The SUR estimators utilize the information present in the cross regression (or equations) error correlation. In this chapter, we estimated the model in Equation (10) by using the OLS method for each equation separately to achieve the best specification of each equation. We then estimate the whole system using ISUR, see Tables 2 and 3. The ISUR technique provides parameter estimates that converge to unique maximum likelihood parameter estimates and take into account any possible contemporaneous correlation between the equations.

To test whether the estimated correlation between these equations is statistically significant, we apply Breusch and Pagan's (1980) LM statistic. If we denote the covariances between the different equations as $\sigma_{12}, \sigma_{13}, \dots, \sigma_{45}$, the null hypothesis is:

$H_0: \sigma_{12} = \sigma_{13} = \dots = \sigma_{45} = 0$, against the alternative hypothesis,

H_1 : at least one covariance is nonzero.

In our three equations, the test statistic is:

$\lambda = N(r_{12}^2 + r_{13}^2 + \dots + r_{45}^2)$, where r_{ij}^2 is the squared correlation,

$r_{ij}^2 = \sigma_{ij}^2 / \sigma_{ii}\sigma_{jj}$.

Under H_0 , λ has an asymptotic χ^2 distribution with five degrees of freedom. I may reject H_0 for a value of λ greater than the critical value from a $\chi^2_{(45)}$ distribution (i.e. with 45 degrees of freedom) for a specified significance level. In this study, the calculated χ^2 value for Sweden

and Norway together is equal to 100 (p-value = 0.000). This result, reported in Table 1 below for Sweden and Norway together, suggests a rejection of H_0 at any conventional significance level. This implies that the residuals from each ISUR regressions are significantly positively or negatively correlated with each other that might stand for the relation between these equations and the countries thereafter. Also this can show substitutability and complementarity among destinations by indicating positive and negative correlation of residuals. Clear conclusions about the complementarity or substitutability among destinations are not usually obtained in studies using the correlation matrix of residuals and SUR model.

	Dn/s	UK/s	Swit/s	Jp/s	US/s	Dn/n	UK/n	Swt/n	JP/n	US/n
Dn/s	1.0000									
UK/s	0.0269	1.000								
SWIT/s	0.2497	-0.1475	1.000							
JP/s	-0.0284	0.1550	0.0094	1.000						
US/s	-0.1465	-0.0940	0.1320	0.0389	1.000					
DN/n	-0.0909	0.0829	-0.0716	-0.0579	0.0650	1.000				
UK/n	0.0335	-0.1719	0.1384	-0.0985	-0.0632	-0.0216	1.000			
SWIT/n	0.0876	0.0534	0.0999	-0.0606	0.0350	0.0231	0.1036	1.000		
JP/n	0.0195	-0.0235	0.0236	-0.0828	0.2230	0.1444	-0.0414	0.1493	1.000	
US/n	-0.1943	-0.1549	0.1279	-0.1170	-0.0330	-0.0081	0.3869	-0.0895	-0.0010	1.000

Breusch-Pagan test of independence: $\chi^2(45) = 100$, $Pr = 0.0000$

Table 1. Correlation matrix of residuals for Sweden and Norway:

4. The ISUR results

In this section, we present the most important results from the ISUR method to model international tourism demand to SW:6 in Sweden and NWT in Norway. We first conduct single equations estimation on model (10) for the five equations for Sweden and the five equations for Norway, separately. We specify these equations according to a battery of diagnostic tests (see the Appendix). We then select the five most appropriate equations for Sweden and Norway and include them separately in ISUR estimation consisting of ten equations to achieve the best possible efficiency. We then discuss the results for each country separately and also compare them together. We first present the results for the three economic variables and then discuss the results for the seasonal dummy variables (with December as the base month), followed by the lagged dependent variables. Note that the macro variables are in logarithmic form and so we can interpret the estimated parameters as elasticities. The estimated coefficients are included even if they are not significant. For the dummy and lagged dependent variables, only coefficients significant at least at the 10% level in the single equation estimation are included in the ISUR estimation. consisting of ten equations to achieve the best possible efficiency. We then discuss the results for each country separately and also compare them together. We first present the results for the three economic variables and then discuss the results for the seasonal dummy variables (with December as the base month), followed by the lagged dependent variables. Note that the macro variables are in logarithmic form and so we can interpret the estimated

parameters as elasticities. The estimated coefficients are included even if they are not significant. For the dummy and lagged dependent variables, only coefficients significant at least at the 10% level in the single equation estimation are included in the ISUR estimation.

Sweden	Equations				
Parameters	Denmark	UK	Switzerland	Japan	US
Constant	.0662(0.974)	-5.732 (0.103)	.879 (0.850)	16.210 (0.000)	1.288 (0.761)
CPI	-. 197 (0.0.024)	2.474 (0.047)	2.474 (0.070)	-6.205 (0.000)	-.1348 (0.688)
EX	1.821 (0.285)	0.782 (0.462)	-1.564 (0.013)	0.1923 (0.456)	0.140 (0.224)
Rp	-.167(0.000)	0.458 (0.000)	-2.250 (.000)	-6.205 (0.004)	-.135 (1.583)
D1	.605 (0.000)	-.367 (.000)			
D2	.638 (0.000)	-.256 (.000)	.1651 (.024)	.1651 (.002)	
D3	.271 (0.069)	-.4119 (.000)	.0887 (.000)		.132 (.007)
D4	-.397 (0.002)	-.432 (.000)	-.195 (.000)	.165 (.107)	-.235 (.000)
D5	-1.04 (0.000)	-.662 (.000)	-.133 (.000)	-.129 (.001)	-.109 (.000)
D6	-.230 (0 .000)	-.063 (.231)	.493 (.000)	.106 (.023)	.343 (.000)
D7	.323 (0 .000)	-.285 (.0000)	.813 (.000)		
D8	-.373 (0.002)	-.385 (.000)	.479 (.000)		
D9	-.788 (0 .000)	-.645 (.000)			-.246 (.000)
D10	-.823 (0.000)	-.486 (.000)	-.343 (.000)		-.251 (.012)
D11	-.894 (0 .000)	-.294 (.000)	.314 (.000)	275 (.083)	-.137 (.000)
Y(t-1)		.6056 (.000)	0.095 (0.082)		
Y(t-2)					
Y(t-3)					
Y(t-4)		-.169 (.001)			
Y(t-11)	.136 (.061)		.116 (.032)	.208 (.000)	.551 (.001)
Y(t-12)	.0411 (.552)	.275 (.000)	.142 (.010)	.594 (.000)	.215 (.063)
R2	0.941	0.900	0.824	0.845	0.742

The non significant results erased from the Table.

Table 2. ISUR estimation results for Sweden

4.1 Results for Sweden

Table 1 show that the CPI parameter for Denmark is negative and small in magnitude but not statistically significant, indicating Swedish CPI has no effect on the demand for tourism by Denmark. This could be due to low travel costs, whereas countries of origin that are more distant generally have higher price elasticity. The estimated *CPISW* elasticity is -6.205 and greater than that for Japan. This indicates that a 1% increase in *CPISW* results in a 6.2% decrease in tourist arrivals to SW6 from Japan. The low *CPISW* elasticity (-0.13) for the US could be a reflection of the depreciation of the Swedish Krona against the US dollar. The estimated elasticity of the relative (substitute) price ranges from 6.2% to 0.13% and is greater than one for Japan and Switzerland. This indicates that a 1% rise in the relative price

level (price of tourism in Sweden relative to Norway) causes more than 1% fall in tourist arrivals from Japan and Switzerland. These estimates indicate that tourist arrivals in Sweden from these countries are elastic with respect to the relative price variable. This implies that Sweden must maintain its international price competitiveness to maintain high growth in tourist inflow. The estimated relative price level elasticity ranges from 0.2% to 0.8% and is less than one for Denmark and the US. These suggest that a 1% increase in the relative price results in a 0.2% and 0.1% decrease in tourist arrivals to SW6 from Denmark and the US, respectively. The low exchange rate elasticity for Japan, UK and the US may also be a reflection of the depreciation of the Swedish krona against the Japanese yen and US dollar. As expected, the estimated elasticities of CPI_{SW} for the UK and Switzerland are positive.

Parameters	Denmark	UK	Switzerland	Japan	US
Constant	1.848 (0.034)	-2.235 (0.093)	643 (0.784)	-1.964 (0.260)	2.337 (0.110)
CPI	-0.511 (0.256)	2.284 (0.001)	2.601 (0.000)	0.820 (0.272)	-0.5252 (0.373)
Ex	0.241 (0.685)	-0.665 (0.048)	-1.395 (0.092)	- 0.463(0.121)	0.118 (0.579)
Rp	0.204 (0.729)	-1.375 (0.019)	-1.615 (0.013)	-0.994 (0.176)	-0.5272 (0.365)
D1					0.098 (0.056)
D2		0.1549 (0.000)			0.122 (0.042)
D3	0.158 (0.002)	0.210 (0.000)			0.161 (0.004)
D4				-0.476 (0.000)	4
D5	-0.135 (0.018)		0.495 (0.000)	-0.161 (0.025)	0.357 (0.000)
D6	0.308 (0.000)	0.473 (0.000)	1.334 (0.000)	0.235 (0.000)	0.487 (0.000)
D7	0.265 (0.000)	0.443 (0.000)	1.334 (0.000)		0.441 (0.000)
D8			0.721 (0.000)		0.419 (0.000)
D9				-0.227 (0.000)	0.220 (0.001)
D10			-0.331 (0.000)	-0.284 (0.000)	0.172 (0.002)
D11			-0.2136 (0.000)		
$Y_{(t-1)}$	0.212 (0.000)	0.0137 (0.789)	0.1768 (0.000)	0.430 (0.000)	0.334 (0.000)
$Y_{(t-2)}$					-0.157 (0.016)
$Y_{(t-3)}$	-0.135 (0.001)				
$Y_{(t-6)}$	-0.116 (0.002)		-0.183 (0.000)		
$Y_{(t-7)}$	0.144 (0.000)				
$Y_{(t-9)}$	-0.127 (0.005)				
$Y_{(t-10)}$			-0.129 (0.002)		
$Y_{(t-11)}$	0.278 (0.000)			0.187 (0.000)	4
$Y_{(t-12)}$	0.363 (0.000)	0.309 (0.000)		0.263 (0.000)	0.269 (0.000)
R ²	0.924	0.793	0.950	0.808	0.850

The non significant results erased from the Table.

Table 3. ISUR estimation results for Norway

In the case of the UK, we find that all dummies are significant, indicating clear seasonality in the demand for tourism. The demand in December is the highest for the year. we also find lags 4 and 12 are statistically significant. Note that the sign of lag 4 is negative while it is larger and positive for lags 11 and 12. For Switzerland, only the summer dummies are large,

positive, and statistically significant, meaning that the Swiss are relatively more interested in summer tourism. The remaining dummies are either insignificant or small in magnitude. The estimated parameters of lags 1 and 12 are positive and significant.

In general, the lags of the dependent variable for the months of January and December are also significant, supporting the hypothesis of a habit-forming or word-of-mouth effect. Some of the monthly dummies as proxies for seasonal effects are also significant, including January, March, May, June, July, September, October, and November. Estimates of the Denmark dummy show a clear seasonal variation in the pattern of Danish tourism demand in Sweden, such that demand in January, February, March, and July is higher than in December, with lower demand in other months.

4.2 Results for Norway

Table 3 provides estimates of the monthly arrivals from Denmark, Japan, and the US to NWT in Norway. The estimated Norwegian CPI (CPI_{Nor}) long-run elasticity ranges from 0.5% to 0.8% and is lower than that for Denmark, Japan, and the US. The estimated CPI_{SW} coefficients suggest that a 1% increase in CPI_{Nor} results in 0.5%, 0.52%, and 0.8% decreases in tourist arrivals to Norway from Denmark, Japan, and the US, respectively. The low CPI_{Nor} elasticity for Japan and the US may be a reflection of the depreciation of the Norwegian krone against the Japanese yen and the US dollar.

The estimated long run elasticities of the relative price variable for Denmark and the US are less than one (0.2% and 0.6%, respectively), indicating that a 1% rise in the relative price (price of tourism in Norway relative to Sweden) causes about a 1% fall in tourist arrivals from Denmark and the US. The estimated long run elasticity of the relative price for Japan is closed to unity (99%), which indicates that a 1% rise in the relative price (price of tourism in Norway relative to Sweden) causes around a 1% drop in tourist arrivals from Japan. The estimated long-run elasticity of the relative price variable for the UK and Switzerland are greater than one, indicating that the arrival of tourists in Norway from these countries is elastic with respect to the relative price variable. This implies that Norway must also maintain its international price competitiveness to maintain high growth in tourist inflow. Yet again, the low exchange rate long-run elasticity for Denmark, Japan, and the US can be a reflection of the depreciation of the Norwegian krona against the Danish krona, the Japanese yen, and the US dollar.

5. Summary and remarks

This chapter has applied the ISUR model, a model not used in other studies that have estimated models for tourism to these two neighbouring regions. First, the model was applied to the neighbouring destinations for the period of transition from characteristics of a lower level of integration and of facing competition from other countries, to characteristics of a high level of integration, globalization, exposure to an international competitive market, and high levels of income and welfare.

Second, the model allowed for comparison of the changes in the behaviour of tourism demand in each country over time, not only in terms of the number of visitors, price and exchange rate, but also of relative price elasticities. The estimated results show the model to be consistent with the data, as indicated by both the diagnostic statistic and the model's good forecasting ability. Moreover, the results are consistent with the properties of

homogeneity and symmetry. This accords with the microeconomic foundations of the model and increases the credibility of the elasticity values.

Substitutability and complementarity among destinations are indicated by positive and negative relative price elasticities, respectively. Clear conclusions about the complementarity or substitutability among destinations are not usually obtained in studies using the ISUR model, which have produced few well defined relative price effects. However, the results in this study seem consistent and also coincide with a priori expectations. Hence they are taken as an indication of the relative magnitudes and directions of changes in demand.

The main purpose of this chapter is to estimate the demand for tourism to two neighbouring regions in Sweden and Norway from five different countries: namely, Denmark, the UK, Switzerland, Japan, and the US. Monthly time series data from 1993:01 to 2006:12 is collected from Statistics Sweden for this purpose. For each visiting country, We specify a separate equation with the relevant information included in each equation. We conduct several diagnostic tests in order to specify the five equations for SW:6 in Sweden and NWT in Norway. We then estimate these equations using Zellner's ISUR, which takes into consideration any possible correlation between the equations and hence is more efficient than other single equation estimation methods, such as OLS.

The results also indicates that CPI, some lagged dependent variables, and several monthly dummy variables representing seasonal effects have a significant impact on the number of visitors to SW6 in Sweden and NWT in Norway. The results also show that the relative price and exchange rate have a significant effect on international tourism demand for some countries. However, although we could view this conclusion as supporting a theoretical framework that describes tourism demand model variable relationships, our demand system lacks a travel cost variable. Nonetheless, our results could also have important implications for the decision-making process of government tourism agencies in both countries when considering influential factors in their long run planning.

6. Appendix

6.1 Diagnostic tests

6.1.1 The Cusum test

This test is used for time series and checks for structural changes. In the Cusum test Recursive Residuals (RR) calculated by the Kalman Filter are used.

I now describe the construction of recursive residuals and the Kalman filter technique. The recursive residuals can be computed by forward or backward recursion. Only forward recursion is described, backward recursion being analogous.

Given N observations, consider the linear model (2 . 2 . 1) but with the corresponding vector of coefficient β expressed as β_t , implying that the coefficients may vary over time t .

The hypothesis to be tested is $\beta_1 = \beta_2 = \dots = \beta_N = \beta$. The OLS estimator based on N observations is:

$$b = (X'X)^{-1} X'y,$$

where X is a N by k matrix of observations on the regressors, and y is an N by 1 vector of observations for the dependent variable. Suppose that only r observations are used to estimate β . Then for $r > k$, where k is the number of independent variables,

$$b_r = (X_r'X_r)^{-1} X_r'y_r,$$

$$r = k+1, \dots, N.$$

Using b_r , one may "forecast" y_r at sample point r , corresponding to the vector X_r of the explanatory variables at that point.

Recursive residuals are now derived by estimating equation (2.2.1) recursively in the same manner, that is by using the first k observations to get an initial estimate of β , and then gradually enlarging the sample, adding one observation at a time and re-estimating β at each step. In this way, it is possible to get $(N-k)$ estimates of the vector β , and correspondingly $(N-k-1)$ forecast errors of the type:

$$Wr = y_r - X_r b_{r-1}$$

$$r = k+1, \dots, N$$

where b_{r-1} is an estimate of β based on the first $r-1$ observations. It can be shown that, under the null hypothesis, these forecast errors have mean zero and variance $\sigma^2 d_r^2$, where d_r is a scalar function of the explanatory variables, equal to $[1 + X_r'(X_{r-1}'X_{r-1})^{-1} X_r]^{1/2}$.

Then the quantity:

$$W_r = \frac{y_r - X_r b_{r-1}}{[1 + X_r'(X_{r-1}'X_{r-1})^{-1} X_r]^{1/2}}$$

$$r = k+1, \dots, N$$

gives a set of standardized prediction errors, called "recursive residuals". The recursive residuals are independently and normally distributed with mean zero and constant variance σ^2 . As a result of a change in the structure over time, these recursive residuals will no longer have zero mean, and the CUSUM of these residuals can be used to test for structural change. CUSUM involves the plot of the quantity:

$$V_r = \sum_{t=k+1}^r W_t / \sigma^*$$

$$r = k+1, \dots, N,$$

where σ^* is the estimated standard deviation based on the full sample.

The test finds parameter instability if the cumulative sum goes outside the area between the two error bounds. Thus, movements of V_t outside the error bounds are a sign of parameter instability.

6.1.2 The Breusch-Godfrey-test

The Breusch-Godfrey test can be separated into several stages:

1. Run an OLS on:

$$y_t = \alpha + \beta X_t + \theta y_{t-i} + \varepsilon_t$$

This gives us $\hat{\varepsilon}_t$

2. Run an OLS on:

$$\hat{\varepsilon}_t = \alpha + \beta X_t + \theta_1 y_{t-1} + \rho_1 \hat{\varepsilon}_{t-1} + \rho_2 \hat{\varepsilon}_{t-2} + \dots + \rho_p \hat{\varepsilon}_{t-p} + u_t$$

This equation can be used for any AR(P) process. From this equation the unrestricted residual sum of squares (RSS_U).

The restricted residual sum of squares (RSS_R) is given from the following equation:

$$\hat{\varepsilon}_t = \alpha + \beta X_t + \theta y_{t-1} + v_t$$

The null hypothesis is:

$$H_0 : \rho_1 = \rho_2 = \dots = \rho_p = 0$$

3. Run an F-test:

$$F = ((RSS_R - RSS_U) / p) / (RSS_U / (T - k - P))$$

This has a distribution: $F(P, T - k - P)$ under the null hypothesis.

The Breusch-Godfrey test can be tested for AR(P) processes which gives this test a clear advantage over other available tests for autocorrelation.

6.1.3 The Ramsey RESET-test

RESET test stands for Regression Specification Error Test. The test is very general and can only tell you if you have a problem or not. It tests for omitted variables and incorrect functional forms or misspecified dynamics and also if there is a correlation between the error term and the independent variable. The null hypothesis is:

$$H_0: E(\varepsilon_i / X_i) = 0$$

$$H_1: E(\varepsilon_i / X_i) \neq 0$$

(and an omitted variable effect is present)

Thus, by rejecting the null hypothesis indicates some type of misspecification. First a linear regression is specified:

$$y_i = \alpha + \beta X_i + \varepsilon_i$$

This gives the restricted residual sum of squares (RSS_R). After the RSS_R has been found the unrestricted model is presented by adding variables (three fitted values):

$$y_t = \alpha + \beta X_i + \theta_1 \hat{y}_i^2 + \theta_2 \hat{y}_i^3 + u_t$$

This gives us the unrestricted residual sum of squares (RSS_U). In the third step the RESET-test uses a F-test:

$F = ((RSS_R - RSS_U) / \text{number of restrictions under } H_0) / (RSS_U / (N - \text{number of parameters in unrestricted model}))$

The F-test checks if $\theta_1 = \theta_2 = 0$, if $\theta_1 = \theta_2 \neq 0$ I have an omitted variable or a misspecification in the model.

6.1.4 The White's test

This test is a general test where I do not need to make any specific assumptions regarding the nature of the heteroscedasticity, whether it is increasing, decreasing etc. The test only tells us if I have an indication of heteroscedasticity.

$$H_0 : \sigma_i^2 = \sigma^2 \quad \forall i$$

The alternative hypothesis is not H_0 , anything other than H_0 .
The test can be divided into several steps:

1. Run an OLS on:

$$y_i = \alpha + \beta_1 X_{1i} + \dots + \beta_k X_{ki} + \varepsilon_i$$

From this equation I get $\hat{\varepsilon}_i$ which is used as a proxy for the variance.

2. Run an OLS on:

$$\hat{\varepsilon}_i^2 = \alpha_0 + \alpha_1 X_{1i} + \dots + \alpha_k X_{ki} + \alpha_{k+1} X_{1i}^2 + \dots + \alpha_{k+k} X_{k+k}^2 + \alpha_{k+k+1} X_{1i} X_k + \delta_i$$

Where k is the number of parameters. The variance is considered to be a linear function of a number of independent variables, their quadratic and cross products. Thus, the X :s is used as a proxy for Z .

3. Calculate an F-test:

Restricted model:

$$\hat{\varepsilon}_i^2 = \alpha_0' + \delta_i'$$

From this test the restricted residual sum of squares (RSS_R) is measured.

The F-test is:

$$F = ((RSS_R - RSS_U) / k) / (RSS_U / (n - k - 1))$$

Where

$$H_0 : \alpha_i = 0 \quad \forall i = 1, 2, \dots, k$$

6.1.5 The ARCH Engle's LM test

This is a test for AutoRegressive Conditional Heteroscedasticity (ARCH). The ARCH process can be modeled as:

$$y_t = \alpha + \beta X_t + \varepsilon_t$$

where the Variance of ε_t conditioned on ε_{t-i} : $\text{Var}(\varepsilon_t \mid \varepsilon_{t-i}) = \alpha_0 + \alpha_1 \varepsilon_{t-i}^2$

1. Use OLS on the original model and get: $\hat{\varepsilon}_t$. Square it and use it in the following unrestricted model:
2. $\hat{\varepsilon}_t^2 = \alpha_0 + \alpha_1 \hat{\varepsilon}_{t-1}^2 + \delta_t$
3. Test whether $\alpha_i = 0$, for any $i = 1, 2, \dots$. By an F-test as before.

6.1.6 Test for non-normality

The test for non-normality is normally done before one test for heteroskedasticity and structural changes.

The test used here for testing for normal distribution is the Jarque-Bera test. The Jarque-Bera test is structured as follows:

$$T \left[1 / 6 \hat{b}_1^2 + 1 / 24 (\hat{b}_2 - 3)^2 \right]$$

$$b_1 = \mu_3 / (\mu_2)^{3/2}$$

$$b_2 = \mu_4 / (\mu_2)^2$$

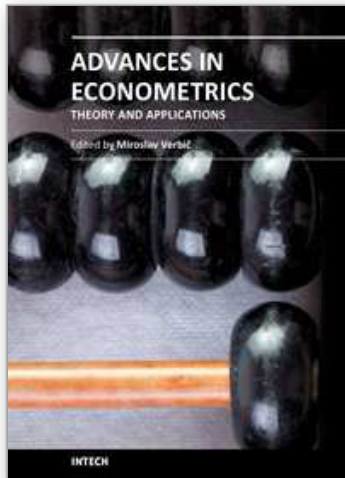
Where T is the total number of observations, b_1 is a measure for skewness and b_2 is a measure for kurtosis. The μ are different moments. The test has a chi-square distribution with two degrees of freedom under the null hypothesis of normal distribution. The two degrees of freedom comes from having one for skewness and one for kurtosis.

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Advances in Econometrics - Theory and Applications

Edited by Dr. Miroslav Verbic

ISBN 978-953-307-503-7

Hard cover, 116 pages

Publisher InTech

Published online 27, July, 2011

Published in print edition July, 2011

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How to reference

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Khalik Salman (2011). Using the SUR model of tourism demand for neighbouring regions in Sweden and Norway, *Advances in Econometrics - Theory and Applications*, Dr. Miroslav Verbic (Ed.), ISBN: 978-953-307-503-7, InTech, Available from: <http://www.intechopen.com/books/advances-in-econometrics-theory-and-applications/using-the-sur-model-of-tourism-demand-for-neighbouring-regions-in-sweden-and-norway1>

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