Tourist Accommodation Effects of Festivals*

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Abstract

Lately the interest in arranging festivals or special events has increased in many cities. In this paper we present an econometric model to account for the tourism accommodation impact of such events. The autoregressive count data model incorporates some of the more important factors in the planing and evaluation of an event, such as spare capacity, displacement effects and the costs that face the visitors. The results for two large Swedish festivals indicate that there are some displacement effects, but that the net tourism effect is positive only since the average visitor stays longer during festival periods.

Key Words: Binomial, autoregression, estimation, demand analysis, festivals, rationed.

JEL Classification: C22, C25, C51, D21, L83.

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1. Introduction

In recent years the interest in arranging festivals or special events have increased in many cities, and today festivals are held for many reasons. From a tourism perspective a special event is of short duration and has an extraordinary impact on the host area in terms of, e.g., tourism volumes, visitor expenditures, and publicity that may lead to heightened awareness and a more positive image of the city or region (Getz 1999). Special events may also have an impact on the resident population, and one reason for arranging a special event may be to create a surplus value for the residents. In studying events several alternative measures of impact can therefore be used.

One question that one may ask in the economic evaluation of an event, is whether the value of the event exceeds the opportunity cost, i.e. the value of resources in the best alternative use (e.g., Hultkrantz 2000). However, to do that kind of *ex ante* analysis, one often needs good *ex post* analyses of previous events. So independently of whether one would like to predict, say, the differences in visitor volumes or conduct a more elaborate cost benefit analysis one needs good estimates of the impact from previous events.

According to Getz (1999), achieving tourism-related goals is often one of the most important reasons to undertaking a festival, although other economic, social, political and environmental goals are also important. Yet there are many questions and issues surrounding the tourism roles of festivals, such as their zone of influence and potential displacement effects. Whether the region will gain economically from the event depends largely on whether local producers are able to meet the extra demand that is directly and indirectly generated by the event. That is, besides the fact that the festival area is sufficiently large to meet the extra demand, there has also to be spare capacity in, say, the accommodation and transport sectors. If not, there will be leakage and reduced effects for the local economy. In the planing of an event there are also a number of other contracting factors, such as competing events and costs to consumers that one has to consider.

In this paper we focus on the tourist accommodation impact of two large periodic festivals in Sweden, for the period January 1, 1993 – August 31, 1999. The two festivals are the Water Festival in Stockholm and the Gothenburg Party. Both festivals are held in August and offer a large supply of activities to the visitors, such as concerts, theater, parades and fireworks. In both cities there are also an increased supply of food and drink establishments during the festival periods. In the first two years the festival periods did not overlap. The number of common days has thereafter increased from three days in 1995-1996 to eight to nine days in 1997-1999. The Stockholm Water Festival usually lasts for nine days, whereas the Gothenburg Party usually has a duration of ten days. Previous studies that consider the impact of events can be found in, e.g., Andersson, Persson, Sahlberg and Ström (1999), Mossberg (2000) and McDonnell, Allen and O'Toole (2001).

To study the impact of the events we formulate an econometric model based on daily observations of guest-nights in hotels and cottages. This model departs from the autoregressive binomial model of McKenzie (1985) in which the capacity constraint is an integral part. Our extensions to the basic model makes it possible to evaluate the effects from festivals and to account for time-variation in the parameters and the capacity constraint. The model can accordingly account for some of the more important factors in the planing of an event, such as: spare capacity, competing events and the costs that face the visitor. In the analysis it will be possible to study the effects on, say, the occupancy probability, the length of stay, and possible displacement effects. The integer-valued nature of this type of data has previously been utilized by Brännäs, Hellström and Nordström (2002) and Brännäs and Nordström (2000), whose studies for international guests were based on monthly data at the national level, and did not utilize information on capacity constraints. For general accounts of count data modelling, see Cameron and Trivedi (1998), Winkelmann (2000) and Brännäs and Hellström (2001).

The paper is organized as follows. In the next section we introduce the basic time series model. Section 3 presents the data, while Section 4 captures the results from the estimation. Section 5 concludes.

2. The Model

To evaluate the tourism impact of festivals daily accommodation time series for hotels and cottages in Stockholm and Gothenburg are used. The number of occupied cottages and hotel rooms are always subject to capacity constraints, cf. Figures 1 and 2. In enforcing this feature into a stochastic model, the binomial distribution comes naturally to mind. In a binomial model the number of occupied rooms lies in the interval 0 and the maximal number of rooms in hotels, N, $y \in [0, N]$. The other parameter that is required for the binomial distribution is the probability, θ, for a hotel room to be occupied. The number of occupied hotel rooms can be represented as

$$y = \sum_{i=1}^{N} u_i = \theta \circ N,$$

where the final expression is shorthand for the binomial thinning operation and is defined by the sum over independent and identically distributed 0 (representing an empty hotel room) and 1 (representing an occupied hotel room) random variables $u_i, i = 1, \ldots, N$. The probability $\Pr(u_i = 1) = \theta$, so that the expected value of the number of occupied hotel rooms is $\mathrm{E}(y) = \theta N$.

For the time series context, McKenzie (1985) suggests a first order autoregressive model with a binomial marginal distribution for y_t having parameters θ and N. The model is

$$y_t = \alpha \circ y_{t-1} + \beta \circ (N - y_{t-1}), \qquad t = 2, \ldots, T, \tag{1}$$

where the parameter $\beta = (1-\alpha)\theta/(1-\theta) \in (0, 1)$ and $\alpha \in (0, 1)$. The probability of a room being occupied is then $\theta = \beta/[1 - (\alpha - \beta)]$, and it depends both on α and β.

To adapt the model for the current empirical purposes a few changes to (1) need to be made. The changes enables the use of the conditional expectation expression for estimation, but destroy the binomial property of the model. First, to capture the effect of festivals, α and β are allowed to depend on calender time variables. Second, economic variables such as prices for accommodation in hotels and cottages are allowed to have an effect on α and β. Third, to capture the varying capacity over days an innocent change is to introduce time variation in the total capacity variable N, i.e. N_t is used. In addition, it is assumed that N_t is pre-determined, in the sense that its value is set in advance of day t. The model can then be written as

$$y_t = \alpha_t \circ y_{t-1} + \beta_t \circ (N_t - y_{t-1}). \tag{2}$$

The property of the model in (2) that is of main interest is the conditional mean

$$\begin{aligned} \mathrm{E}(y_t | y_{t-1}) &= \alpha_t y_{t-1} + \beta_t (N_t - y_{t-1}) \\ &= (\alpha_t - \beta_t) y_{t-1} + \beta_t N_t, \end{aligned} \tag{3}$$

which is linear in past guest nights y_{t-1} as well as in the capacity constraint N_t. Instead of enforcing an interpretation of β_t in terms of the underlying α_t and θ_t parameters during estimation, estimates of θ_t are obtained from the estimates of α_t and β_t. Therefore, the restrictions $\beta_t \in [0, 1]$ and $\alpha_t \in [0, 1]$ are accounted for by using logistic distribution functions for β_t and α_t.

The expressions for the conditional expectations in (3) suggest that $\alpha_t - \beta_t$ may be interpreted as the probability of a hotel room remaining occupied an additional night, while β_t reflects the ability of hotels of filling free room capacity $(N_t - y_{t-1})$ with new guests. The hotel industry therefore likes to see a large $\alpha_t - \beta_t$ probability. A large β_t probability would minimize spare capacity but result in additional costs due to large guest turnover (small $\alpha_t - \beta_t$). Since, $1/[1 - (\alpha_t - \beta_t)]$ is the expected length of stay for a hotel guest, the expected income from a hotel guest is $p_t/[1 - (\alpha_t - \beta_t)]$, where p_t is the price for a single night.

Explanatory variables in vectors $\mathbf{x}_t$ and $\mathbf{z}_t$ are introduced through logistic distribution functions (cf. the logit model)

$$\begin{aligned} \alpha_t &= 1/[1 + \exp(-\mathbf{x}_t\boldsymbol{\gamma})] \\ \beta_t &= 1/[1 + \exp(-\mathbf{z}_t\boldsymbol{\delta})], \end{aligned}$$

where $\boldsymbol{\gamma}$ and $\boldsymbol{\delta}$ are vectors of unknown parameters. The parameters explain events occurring over the time interval $(t-1, t]$ and depending on the context they may through the explanatory variables $\mathbf{x}$ and $\mathbf{z}$ depend on the state at time $t-1$ or at t. The explanatory variables included in the $\mathbf{x}_t$ and $\mathbf{z}_t$ vectors are described in the next section. Using the definition of β (see above), the probability for a room being occupied at day t is

$$\theta_t = \beta_t/[1 - (\alpha_t - \beta_t)].$$

Using the conditional expectation in (3), nonlinear least squares can be applied by minimizing the criterion function

$$S = \sum_{t=2}^{T} \left(y_t - \frac{y_{t-1}}{1 + \exp(-\mathbf{x}_t\boldsymbol{\gamma})} - \frac{N_t - y_{t-1}}{1 + \exp(-\mathbf{z}_t\boldsymbol{\delta})} \right)^2.$$

By using a robust covariance matrix estimator for the parameter estimator any remaining serial correlation and heteroskedasticity is accounted for.

3. Data

The daily time series for the number of occupied hotel rooms and cottages cover seven day weeks for Stockholm and Gothenburg, for the period January 1, 1993 – August 31, 1999 (source: Statistics Sweden; $T = 2434$). Also available for the same period are the local capacities corresponding to the four guest night series. Figures 1 and 2 illustrate by subsets of the series. As can be seen the festival periods of the two cities almost overlap.

Table 1 gives the definitions and descriptive measures for the price variables. As the table reveals it is cheaper to stay over in a cottage than in a double room of a hotel, although the hotel price is reduced during weekends. The estimated hotel model uses six dummy variables. There are two dummy variables for the festival periods of the two cities. The Sunday number of guest nights is throughout small but still the higher weekday price level is used, cf. Table 1. A Sunday dummy variable controls for this irregularity. A dummy variable for Monday and Thursday is used as these days appear to have slightly lower frequencies than the Tuesday and Wednesday nights. Another dummy variable catches the month of July, when the hotel price is at a lower level during the entire month. The fourth dummy variable accounts for the seven days before the new year and seven days after, as there is a relatively large drop in the demand for accommodation during these days. For the cottage models five dummies are used. Two dummies reflect the festival periods, and one refers to weekends (Friday-Saturday) to capture the higher demand during these days. The final two dummy variables reflect the summer months June-August and July.

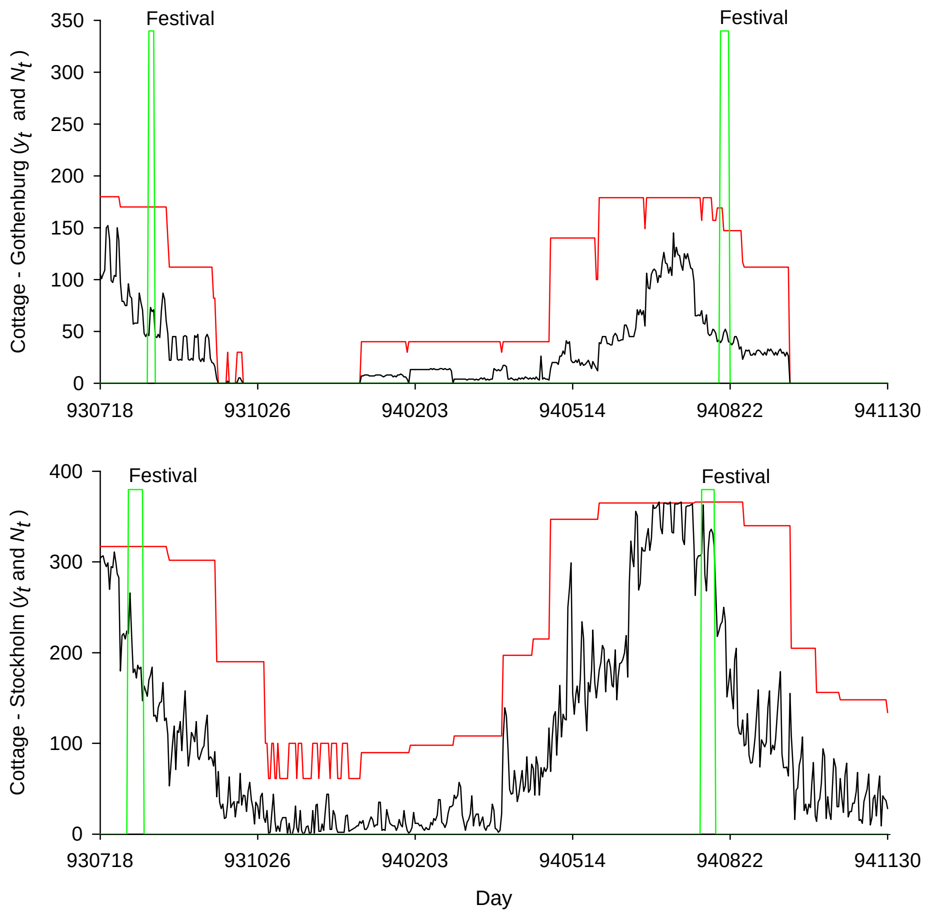

Figure 1: Parts of time series for the number of cottage nights, capacity constraint and periods of festivals.

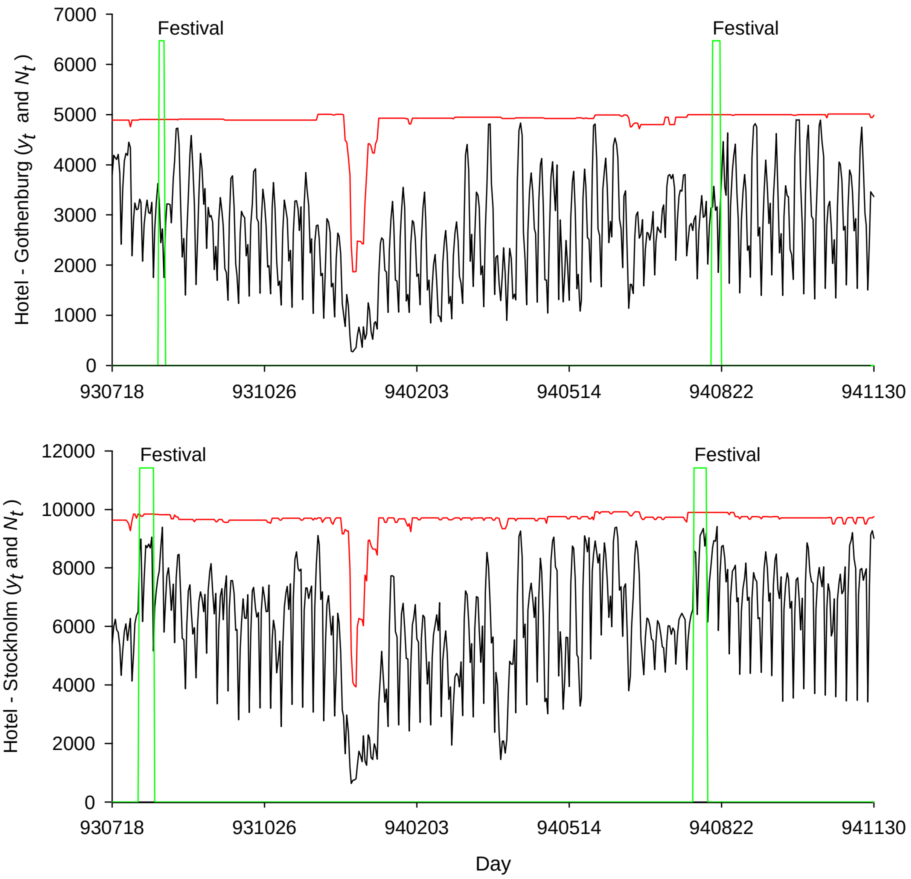

Figure 2: Parts of time series for the number of occupied hotel rooms, capacity constraint and periods of festivals.

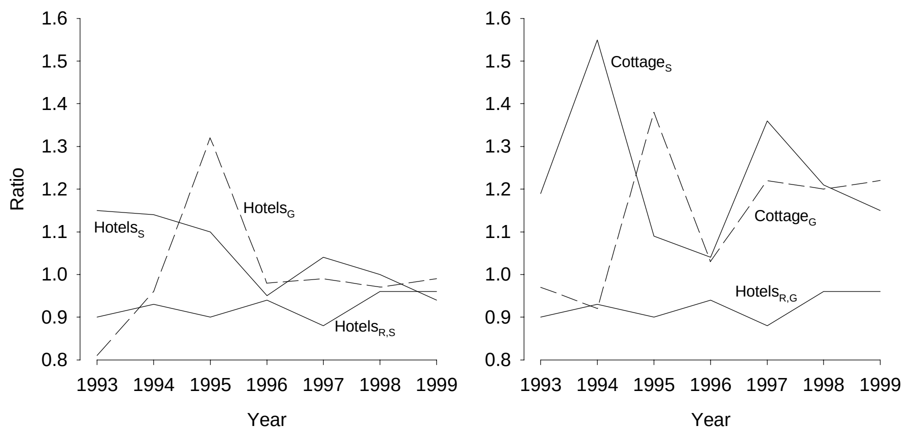

Figure 3: Ratios relating average numbers of occupied hotel rooms or cottages during festivals in Stockholm (index S) and Gothenburg (G) to averages over the other days in August. As references corresponding ratios for hotels outside Stockholm and Gothenburg (R,S and R,G) are included.

Table 1: Price variable definitions and descriptive statistics ($T = 2434$, period January 1, 1993 – August 31, 1999).

Variable	Mean	Standard deviation	Min	Max
Cottage price[a]	279.99	34.97	-	-
Hotel price[b]	477.89	97.45	309.42	670.43
– Friday-Saturday[c]	365.31	34.91	309.42	442.72
– Sunday-Thursday[c]	536.98	61.00	394.84	670.43
– July	375.80	53.73	312.27	667.05

Notes: [a] The cottage price reported by Statistics Sweden (updated annually) has been adjusted by an additive seasonal pattern based on expenditures for nights spent in cottages. Source: the Tourist and Travel Data Base (TDB) 1990:1-1996:9.
[b] Hotel price for all days, constant pattern within the month as it is constructed from monthly values for weekdays and weekends (Friday and Saturday), respectively. The hotel price reflects the price for a guest night in a double room.
[c] Hotel price excludes July and 14 days before and after the new year. For Friday-Saturday n = 696 and for Sunday-Thursday n = 1738.

Figure 3 mirrors the importance of festivals in the two cities by comparing average visit numbers in the festival period with average numbers in other parts of the festival month of August. It is quite obvious that the importance of festivals has had a varied effect on hotels over the years. For cottages it appears that an enhancing effect of about 1.2 holds for both cities. Note that the peak in 1995 for Gothenburg is largely an effect of the World Championships in Athletics.

4. Results

The estimation results are presented in Tables 2 and 3. The results clearly indicate that there is a festival effect, and that it mainly affects the probability of staying another night (i.e. $\alpha - \beta$) through the α-part. The effect of the other festival is generally insignificant. The only exception is the model for hotels in Gothenburg as this city benefits from the festival in Stockholm. For Gothenburg there is a negative effect (only significant for the cottage model) from the own festival on the ability to fill free capacity β, which indicates the presence of displacement effects from the festival. This effect seems nevertheless to be outweighed by the larger and significant effect on α from the own festival.

Through α, an increase in the own-price will reduce the probability that a guest stays another night in a hotel. There are no substitution effects of an increased cross price. Instead, there are significant negative effects of an increase in the cottage price on the hotels' ability to fill free capacity. From the weekend and July dummies in the cottage model it appears that visitors tend to increase their lengths of stay, through the α-part, during these time periods. The same pattern is present for the July dummy in the hotel models, although the effect is not significant in Stockholm.

To study the effects of the festivals in a more dynamic setting survival functions for stays in

Table 2: Parameter estimates for cottage models.

	Stockholm		Gothenburg	
Variables	α	β	α	β
Cottage price/100	-0.464	-0.331	1.678	-0.876
	(0.286)	(0.203)	(0.408)	(0.307)
Hotel price/100	–	-0.153	–	-0.130
		(0.087)		(0.057)
Weekend	2.207	-0.106	0.877	0.050
	(0.376)	(0.210)	(0.278)	(0.216)
Summer	1.354	-0.087	0.176	0.572
	(0.215)	(0.153)	(0.236)	(0.215)
July	1.142	1.720	0.609	0.736
	(0.374)	(0.410)	(0.310)	(0.232)
Festival - own	0.245	0.101	1.282	-0.775
	(0.333)	(0.277)	(0.285)	(0.207)
Festival - other	–	0.283	–	-0.244
		(0.236)		(0.182)
Constant	1.605	0.191	-3.348	0.309
	(0.748)	(0.781)	(1.086)	(0.902)
$\bar{\alpha}, \bar{\beta}$	0.74	0.16	0.82	0.08
$\bar{\theta}$ based on $\bar{\alpha}, \bar{\beta}$		0.38		0.31
R^2, Ljung-Box(15)	0.95	961	0.97	601

Table 3: Estimation results for hotels (s.e. in parenthesis).

	Stockholm		Gothenburg	
Variables	α	β	α	β
Hotel price/100	-0.732	0.529	-0.351	0.157
Friday-Saturday	(0.149)	(0.151)	(0.160)	(0.125)
Hotel price/100	-0.039	0.411	0.235	0.146
Sunday-Thursday	(0.099)	(0.101)	(0.103)	(0.084)
Cottage price/100	–	-0.523	–	-0.489
		(0.142)		(0.096)
Sunday	-4.173	-1.229	-3.840	-0.537
	(0.481)	(0.331)	(0.405)	(0.163)
Monday and Thursday	-2.900	1.131	-2.510	0.976
	(0.476)	(0.129)	(0.375)	(0.112)
July	0.782	1.061	2.284	0.362
	(0.549)	(0.562)	(0.600)	(0.483)
New Year	0.645	0.135	–	-0.400
	(0.639)	(0.547)		(0.349)
Festival - own	0.512	0.633	1.315	-0.551
	(0.191)	(0.259)	(0.505)	(0.291)
Festival - other	–	0.254	–	0.260
		(0.130)		(0.076)
Constant	4.462	-2.039	1.921	-0.580
	(0.553)	(0.645)	(0.586)	(0.510)
$\bar{\alpha}, \bar{\beta}$	0.84	0.24	0.72	0.27
$\bar{\theta}$ based on $\bar{\alpha}, \bar{\beta}$		0.60		0.49
R^2, Ljung-Box(15)	0.80	766	0.79	599

Note: Hotel price not effective in July nor around the new year.

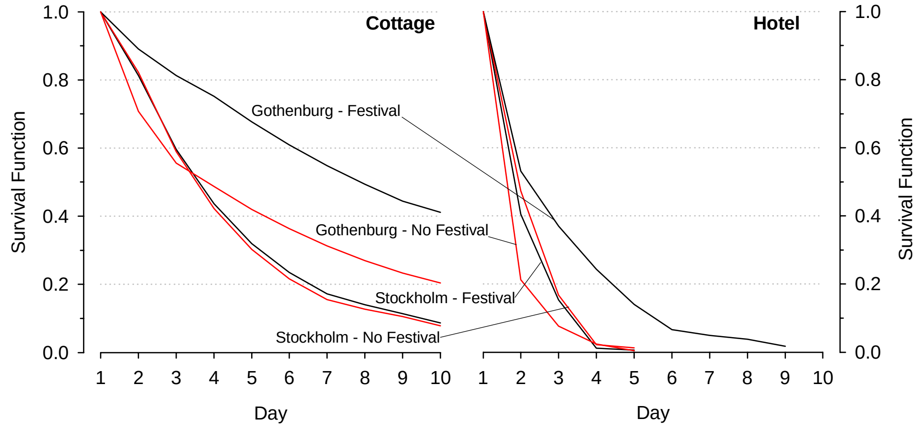

Figure 4: Estimated and simulated survival functions for the festival period in August 1999. Simulation is performed under a no-festival assumption.

hotels and in cottages

$$\bar{F}(d|t-1) = \begin{cases} 1, & d = 0 \\ \prod_{i=t}^{t+d}(\alpha_i - \beta_i), & d = 1, 2, \ldots \end{cases}$$

are obtained. These are calculated as the products of probabilities of stay from some initial time t to some time point d days later. Figure 4 contains some survival function results. For cottages the duration of visit is estimated to be longer in Gothenburg (median duration is about 7.9 days) than in Stockholm (median 3.6 days). If there was no festival, medians are estimated to drop to 3.9 days (51 percent) for Gothenburg and to about 3.4 days (6 percent) for Stockholm. Hotel durations are much shorter, about 2.15 days for Gothenburg and 2.3 days for Stockholm. The reductions due to a cancelled festival are estimated to be 26 and 33 percent, respectively. Hence, Stockholm has more to gain in terms of hotels and Gothenburg in terms of cottages.

To study the effect of festivals on the probabilities of occupied hotel rooms and cottages, θ_t, estimated probabilities are compared with probabilities that are calculated with the festival dummy variables set to zero throughout. The results for the final festival year in the time series (August 1999) are summarized in Figure 5. In all cases the presence of a festival increases the occupancy probability. The displacement effect in Gothenburg that emerged from a reduced ability to fill free capacity (less check-ins) are thus outweighed by the effect that the actual visitors extend their visit owing to the festival. For cottages the effect is larger for most days and more extended in time for Gothenburg, while for hotels the differences between cities are smaller over time. Note the larger estimated capacity utilization for hotels in Stockholm throughout the festival period. For cottages the patterns over the period are quite different.

The occupancy probability can also be used to calculate the direct monetary impact (DMI) on the hotel and cottage sector in the host city/region from the festival by using the expression

$$\text{DMI} = \sum_{\tau=1}^{M}[\theta_{\tau,f} - \theta_{\tau,nf}] \times \text{price}_{\tau,f} \times \text{max. capacity}_{\tau,f}.$$

Here, $\theta_{\tau,nf}$ is the occupancy probability from the simulated version of the model in which there are no festivals and $\theta_{\tau,f}$ is the corresponding probability in the model when festivals are present, cf. Figure 5. The M is the duration in days of the festival. For Stockholm the revenues for the

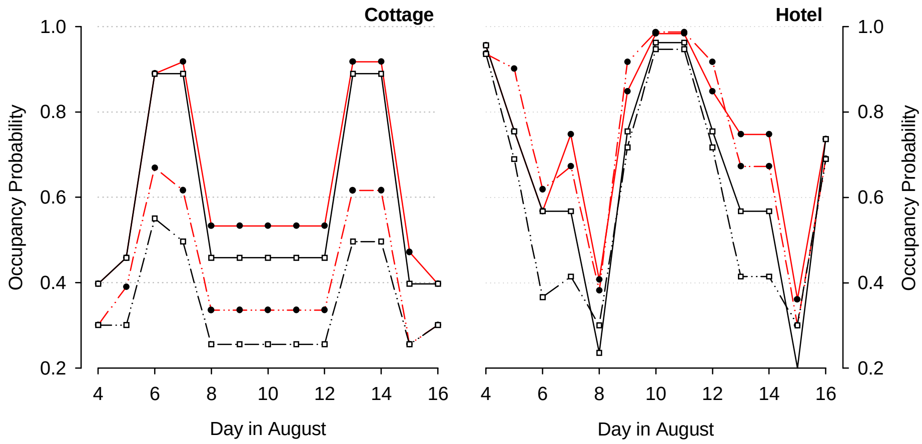

Figure 5: Estimated and simulated occupancy probabilities 4-16 August 1999. Simulation assumes no festival. In Gothenburg the festival period is 10 days long, August 5 (Thursday) – 14 (Saturday), and in Stockholm 9 days, August 7 (Saturday) – 15 (Sunday). Notation: Stockholm (solid line), Gothenburg (dot-dashed line), festival (circle marker) and no festival (squared marker).

hotel sector increases by 6.550.000 SEK, whereas the impact on the cottage sector is more modest and amounts to only 47.000 SEK. The hotel sector in Gothenburg benefits about one million less than the hotel sector in Stockholm from the own festival. For Gothenburg the revenues in the hotel and cottage sectors increase by 5.600.000 SEK and 82.000 SEK, respectively.

5. Conclusion

This study has considered the tourist accommodation impacts of festivals. The results are clear-cut in the found positive effect of tourism demand in both cities thanks to festivals. However, for some of the observed tourists it may well be a matter of time switching, i.e. the city or region would have been visited at some time, but thanks to the extra supply of activities within the festival they allocate there stay to the event period. The model can therefore be said to capture the maximal tourism effect. As well as there are people that are attracted by the event there are also potential visitors who dislike the event or the side effects that it generates. These displacement or crowding out effects will either result in a cancelled trip or a trip to another city during the event period, but it may also lead to advance or postponed trips to the city. Although the model can identify the probability of filling free capacity, one would need individual survey data to capture the time switching behavior.

References

Andersson TD, Persson C, Sahlberg B and Ström L-I. 1999. The Impact of Mega Events. Örnsköldsvik: Ågrens Tryckeri.

Brännäs K, Hellström J. 2001. Generalized Integer-Valued Autoregression. Econometric Reviews 20: 425-443.

Brännäs K, Hellström J, Nordström J. 2002. A New Approach to Modelling and Forecasting Monthly Guest Nights in Hotels. To appear in International Journal of Forecasting.

Brännäs K, Nordström J. 2000. A Bivariate Integer-Valued Allocation Model for Guest Nights in Swedish Hotels and Cottages. Umeå Economic Studies 540.

Cameron AC, Trivedi PK. 1998. Regression Analysis of Count Data. Cambridge: Cambridge University Press.

Getz D. 1999. The Impacts of Mega Events on Tourism: Strategies for Destinations. In The Impact of Mega Events. Andersson TD et al. editors. Örnsköldsvik: Ågrens Tryckeri.

Hultkrantz, L. 2000. Event Economics: Top-Down Approaches. In Evaluation of Events: Scandinavian Experiences. Mossberg LL editor. New York: Cognizant Communication Corporation.

McDonnell I, Allen J, O'Toole W. 2001. Festival and Special Event Management, New York: Wiley.

McKenzie E. 1985. Some Simple Models for Discrete Variate Time Series. Water Resources Bulletin 21: 645-650.

Mossberg LL. 2000. Evaluation of Events: Scandinavian Experiences. New York: Cognizant Communication Corporation.

Winkelmann R. (2000). Economic Analysis of Count Data. 3rd edition. Berlin: Springer-Verlag.