UGSM-Monarch Business School Doctoral Dissertation Proposal

The Cancellation Probabilities and Optimal Overbooking Policies in the Austrian Hotel Industry: A Case Study of the Hotel Sonnenberg

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1.0 INTRODUCTION

Hotel rooms are a highly perishable product. The rooms which are not sold on a given arrival day can never be resold. A hotel room is highly perishable in the sense that empty rooms cannot be stored and sold tomorrow. Moreover, since there is always a probability that a guest does not show up or cancels his reservation before the arrival hotels have to manage this uncertainty and optimize sales. As the Austrian Hotel and Tourism Bank indicates, the variable costs for an additional room sold are insignificant compared to the selling price, about 7% to 10% while the fixed costs are substantial. (Tourismusbank, 2012) Therefore, an additional room sold means almost pure cash flow for the hotel operator. For this reason an hotelier strives to maximise occupancy as long as the additional revenue exceeds the variable costs. The Austrian hotel industry generates sales of EUR 30.58 billons and therefore represents Austria's second largest industry. Given that the EBIT percentage of sales is only 3% for the average hotel, any increase, even if it is small has a large effect on bottom line profits. (Tourismusbank, 2012)

In order to address the above, many hotels try to enter guaranteed contracts or to impose cancellation fees or deposit payments if they have the bargaining power. The Austrian tourism landscape consists mainly of family owned, small businesses of 50 to 75 rooms. (Tourismusbank, 2012) Lately, the big success of

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online booking platforms has monopolized bargaining power over the sales channels. Many hoteliers can only sell their rooms over one of the major platforms, thereby losing the possibility to influence the terms and conditions of their reservations. This has been criticized by the Austrian Hotelier Association as the current conflict between the Austrian Hotelier Association and several major online booking platforms demonstrates. (Hoteliervereinigung, 2012) The recent decision of the court in Düsseldorf, Germany against one major booking platform, HRS, shows that the claims of monopolistic structures detrimental to the hotelier are true and substantial.

In order to overcome, or at least partially address the challenges of diminishing bargaining power on the sales side, the low EBIT percentage and the high fixed cost rate, hotels often overbook their accommodation units. As such, an hotelier may agree to offer rooms for certain periods for which they actually do not have any and are in no position to provide. This implies that if all guest show up as agreed some will be denied the service sold. This is referred to as he practice of overbooking. The practice of overbooking has the potential to frustrate guests, reduce the probability of the customer returning to the hotel and creates added stress for the operation, as the staff must deal with the frustrated guests and find alternative accommodation and possibly even offer compensation. Even though overbooking is therefore a suboptimal solution it is widely applied and an important part of a sales strategy to date.

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2.0 THE RESEARCH QUESTION

In order to study the phenomenon of overbooking and to establish new policies
to adequately address it, the Hotel Sonnenburg has been chosen to take part in
a detailed case study. It is a representative resort hotel in a representative
alpine leisure region. Given the above and keeping in mind the overall
importance of the hotel industry to the Austrian economy the main research
question has been formulated as:

Main Research Question:

> "What is the optimal policy or strategy for overbooking leisure hotel
> rooms in order to optimize hotel room revenue demonstrated through
> a specific case study analysis of the Hotel Sonnenburg, an Austrian
> leisure hotel in an alpine location."

The characteristics of an overbooking policy consists of five separate
consecutive decisions which in turn are addressed through the presentation of
three hypotheses:

- What are the costs of an overbooking event;
- What are the benefits of an overbooking event;
- Is the overbooking decision specific to different accommodation
  categories;
- What are the criteria on which the overbooking decision is based;
- Which specific guest type is affected by an overbooking event.

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2.1. HYPOTHESIS 1

$H1_0$: There is no significant relationship between longer stays and the cost of overbooking

As the Austrian Statistical Office indicates on its homepage the average length of stay in Austrian hotels over the past five years is 3.6 days, whereas the average length of stay of the alpine holiday regions lies at 4.7 days (Austrian Statistical Office, 2012). This shows a significant variation in the length of stay pattern between different guests depending on the nature of the stay. In the Arlberg region, in which the Hotel Sonnenburg is located, skiing holidays usually last an average of 6 or 7 days (Kennedy, 2011) (Novosel, 2012). These stays are usually family holidays with great emotional value. On the other hand, short bookings are usually reserved for congresses or business reasons, and subject to many last minute changes.

2.2. HYPOTHESIS 2

$H2_0$: There is no significant relationship between the lead-time of the booking and the costs of overbooking

On one hand, guests booking 200 days in advance are subject to many more unforeseen events and have thus a higher probability of a cancellation. On the other hand, those booking this early want to make sure they are guaranteed a

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room. Further, one can postulate that guest reserving long in advance are most

likely very loyal and returning guests. It is argued that the lead-time, i.e.: the

time between the booking and the actual check in, has some impact on the

cancellation behaviour.

2.3. HYPOTHESIS 3

$H3_0$: There is no significant relationship between the room category
and the costs of overbooking

Given the rather static holiday times, families can only go on holiday in certain

weeks, which are subject to strong demand, but there are room categories

which cannot accommodate a family, because of their size or layout. Different

rooms therefore cater to different markets, and therefore one can assume:

3.0 THE RESEARCH RELEVANCE

The main objective of the contemplate research is to establish a case study to

suggest an optimal overbooking policy that will allow for the maximisation of

revenues by helping to identify and clarify the mechanics of cancellations and

booking behaviour. Zikmund (2003) suggests that one of the outcomes

business research strives for is to reduce uncertainty and thus to achieve a

higher likelihood of correct decision-making.
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The majority of the Austrian hotels operate in rural and alpine areas in the leisure tourism sector. Compared to city hotels which are not further specified in terms of market or location that have been the subject of past research (Gilbert, 1996) (Zhechev, 2010) (Yechiali, 1978) (Ivanov, 2006) (Ivanov S. , 2007) (Talluri K., 2004), their guests tend to book earlier, stay longer and they face a much higher seasonal demand; many are even closed in the off-seasons. Thus, leisure hotels have a particular set of booking imperatives that drive the profitability of the operations as distinct from that of their more urban counterparts.

In general, skiing holidays are family holidays. Between 20 and 25 percent of the generated bed nights in a given year are generated by children. Bed nights are defined as the number of overnight stays for each individual guest, whereas room nights are defined as the number of nights a room is sold. A family of four people staying for three nights generates twelve bed nights and three room nights. Austrian hotel law defines children to be aged twelve and under. This means that many families are tied to their specific holiday weeks if they want to go on winter vacation due to scholastic timetables, so different hotels in the same resort have their demand peaks in the same weeks, which makes relocation of guests to another hotel difficult. These statements also hold true for the Hotel Sonnenburg which makes it a suitable case study to act as a proxy

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from which new insights on the mechanisms affecting overbooking strategies

may be obtained and potentially applied to other similarly based hotel operators.

4.0   CONTRIBUTION TO EXISTING KNOWLEDGE

Given the importance of the leisure sector not only in Austria but globally there

appears to be a limited amount of research in the field of cancellation

probabilities at the industry level. Whereas 623 articles focus on hotel revenue

management, only 195 approach problems of overbooking. (Google Scholar,

2013). Moreover, it appears that the research so far has focused on issues

between different hotels in the same location. It also appears that the research

so far has assumed that if a guest is overbooked and no cancellation occurs

while the hotel is fully booked that this same guest can usually be

accommodated in another hotel. This implies that demand patterns are different

among hotels in the same location. This assumption does not necessarily hold

when it comes to holiday resorts, as they are typically subject to the same

demand patters, i.e.: scholastic vacation timetables. This is a remarkable

difference that exists between resort hotels and city hotels. A preliminary

literature review indicates that the above-mentioned difference between city and

resort hotels has not been adequately studied and that there exist a gap in the

literature that needs to be studied. As stated by the president of the Austrian

Hotelier Association, Michaela Reitterer, the situation of leisure hotels in

remote, that is to say alpine locations, is completely different in terms of their

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overbooking policy, because it is not possible to assume that overbooked

guests can find accommodation nearby (Reitterer, 2013). There are several

specific details that make this situation not only worthy of further research in a

quantitative context but also novel and unique as many effects can be

controlled for and isolated.

That is, the time between reservation and actual arrival varies between one day

and one year before the arrival. This makes it possible to study the cancellation

probabilities over time in great detail even among different market segments.

The development a new formula or model that helps to determine an optimal

policy for overbooking seems to have only been attempted by commercial

companies which are for proprietary reasons reluctant to share their knowledge.

Thus, the contemplated research will not only apply the existing models in the

framework of a typical Austrian resort hotel in a remote location but also will

expand existing models by including several factors which have not to date

been adequately describe within the cancellation phenomenon. The particular

characteristics of a newly designed model includes:

- A logit regression;
- Different lengths of stay;
- Different room types.

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5.0   RESEARCH METHODOLOGY

The principle research methodology being employed is that of a case analysis

with a mixed method approach. Triangulation will form the critical research

method. The research methodology is graphically shown below in Figure 1.

FIGURE 1
The Research Methodology

Source: Monarch Business School Switzerland 2013
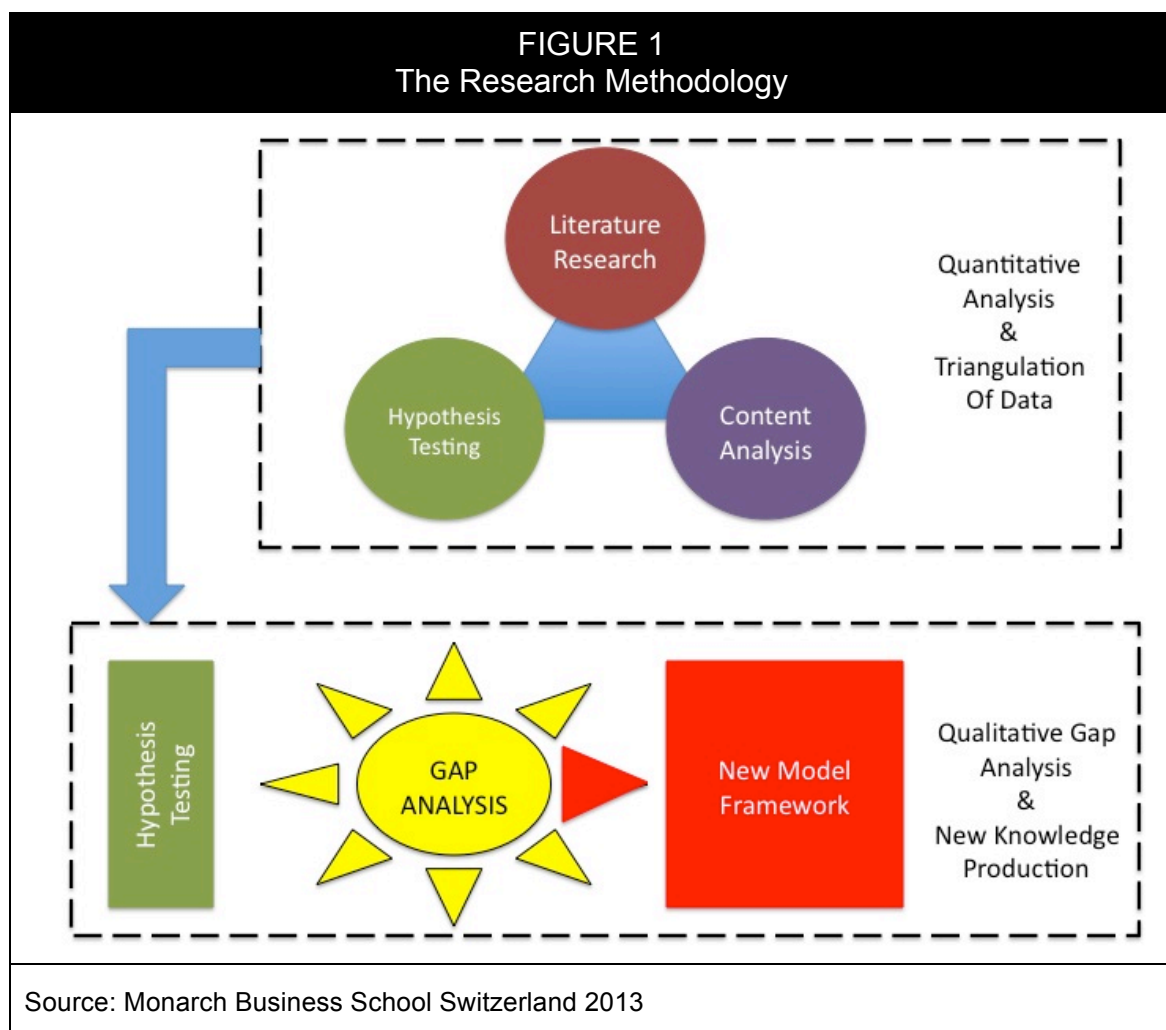
As shown above, an in-depth multi-phase literature review will be combined with

the content analysis of the case data files of the Hotel Sonnenburg to test the

previously introduced hypotheses in an attempt to inform and respond to the main research question. In responding to the main research question a "gap analysis" between the existing literature and the results of the hypothesis testing based on the content analysis will be made. The results of the gap analysis will inform and direct the development and creation of a new model or framework that will fill the existing void in the scholarship pertaining to overbooking policy as discussed.

With respect to the in-depth literature review several well-researched areas will be investigated and studied. First, the field of multivariate research will be examined to establish a sound estimation of cancellation probabilities and pricing mechanics. When it comes to actual application a thorough description of the necessary mathematical basics will be covered. As illustrated in Figure 1 above, the estimation and description of the cancellation probabilities itself is a quantitative process whereas the development of policies, i.e.: new model, to deal with overbooking situations has is considered qualitative in nature. Once it has been understood how the cancellations build up in a generic sense subject to the hypotheses it will become clearer how the resultant policy or new model or framework will optimize along length of stay, market segment, room type, or a mixture of the underlying factors.

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5.1. ORIGIN AND NATURE OF DATA

The data stems from the Hotel Sonnenburg, a classic upmarket Austrian ski hotel. The Hotel Sonnenburg is a leisure hotel located in the Austrian Alps, in the region of Lech am Arlberg. Lech has a rich history of being an upmarket ski resort area. The first ski courses took place in 1906 and the opening of the first ski school in 1925 have made Lech am Arlberg famous as the 'birthplace of Alpine skiing'. Even though the town has only 1,700 permanent residents it sports over 8,500 hotel beds most of which are in the higher categories of: 4 Star, 4 Star superior and 5 Star. The hotel is only open during the winter months which means the dataset covers between 135 and 142 days depending on the specific holiday period of each year. Nevertheless, bookings are being made all year round and the average time between booking and arrival is roughly three to four months. The hotel has a strong seasonality determined by the holiday schedule of its main incoming markets, Germany, the UK and Austria.

The data consists of 144,000 observations over eight. The data set covers both actual materialized bookings and cancellations as well as bookings that have had to be turned away and did therefore not materialize. The data set is sufficiently large enough to cover both boom years, e.g. 2008, as well as recession years like 2011. The data set also covers years with both ample and little snow coverage. Thus, the results of the analysis of the data set are expected to be robust.

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6.0   THE LITERATURE REVIEW

The practice of overbooking is defined as "confirming more reservations than the hotel's available physical capacity to provide the service" (Ivanov, 2006). It relates to increasing the total volume of sales by selling reservations above capacity to compensate for cancellations and no-shows. This policy can increase capacity utilisation when the cancellations of orders are significant.

6.1. OVERBOOKING STRATEGY

The primary principle of an overbooking strategy is to find an optimal overbooking level to maximise the expected revenue and to minimize the potential risk of denied service. The latest and most salient works have been done by Ivanov (2006, 2007) and also Talluri and van Ryzin (2004). Ivanov (2007) provides a critical literature overview which places emphasis on the different directions of Hotel Revenue Management research of which overbooking management is a major part. Van Ryzin (2005) provides an in-depth analysis on the mechanics of cancellations (Ivanov, 2006) (Ivanov, 2007) (Ivanov Z. , 2010) (Talluri K., 2004). Neither of these authors investigates the influence of market segments, difference of stay nor age of the booking which is the focus of the contemplated research.

6.2. RESOURCE AND OTHER OPERATIONAL CONSIDERATIONS

As indicated, the profitability of hotels is largely dependent on their utilization of capacity. However, the demand for rooms and extensions of stay are very unstable and therefore difficult to predict. (van Ryzin, 2005) Hoteliers are challenged by the relative inability to determine the occupation rates of rooms for customers who differ in their willingness to pay and meanwhile maintain a stable rate of demand. (Okumus, 2004) Overbooking, however, enables a more complete allocation of resources and optimization of sales. However, maximizing the number of sold rooms per night has proven to be difficult for the industry to master. One of the most challenging tasks of the hotel operation management is to deal with the unpredictable nature of the guests with respect to their eventual appearance and use of the books rooms (Lai, 2005).

6.3. IMPACT OF OVERBOOKING

Overbooking may have both a positive and a negative impact. On the one hand, it may result in the refusal to provide a service, but on the other, it can also take the form of compensation for those reserved clients who cannot arrive to consume the package they have paid for (Kimes, 2001). There are several possible scenarios that can cause this. Despite their reservations and because of different circumstances some guests cancel their stay and terminate their reservations, some do not cancel their booking but fail to show up, while other guests reduce their stay and as a result the room remains unsold and hence capacity not sold. (Ivanov, 2006) (Talluri K., 2004) (Hung, 2004) To combat this,

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hotels adopt overbooking, among other strategies, in order to protect themselves against losses and to offset the effect of cancellations and shortened stays.

Apart from the opportunity of the hotel to minimize the effect of reservation uncertainties, there is a possibility that the number of cancellations and no-shows to be less than the number of overbookings. In this case some of the clients will not be accommodated and have to be transferred to other hotels. (Ivanov, 2006) Thus, if a hotel decides to employ overbooking in its operations it should manage carefully not only the opportunity cost of the unsold room but also the overbooking costs for alternative hotel accommodation and transportation that the hotel has to pay in order to compensate a customer in case of overbooking. (Ivanov, 2006) (Hung, 2004) Besides the obvious financial costs occurred in the case of transferring a guest, other implicit opportunity costs, such as: 1. the hotel's goodwill lost; 2. damaged reputation and the risks of dissatisfaction; 3. loss of trust; and, 4. loss of future customer loyalty may be much more expensive for the hotel in the long run (Talluri K., 2004). Experts in the field, such as Kimes (2001), Ivanov (2006, 2007), Talluri and van Ryzin (2004, 2005) have not yet considered the special case of remote alpine locations and their policy on the overbooking. Several other important authors touch upon the above issue and their models will be explored, contrasted and

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expanded within the contemplated research, they include: Wetherford,

Subramanian, Karaesman, Rothstein, Chiang, Gilbert, Zhechev and Yechiali.

6.4. OVERBOOKING POLICY AND CONTROL

As mentioned earlier, the objective of an overbooking policy is to find an optimal

overbooking level to maximize the expected revenue and to minimize the

potential risk of denied service. (Chiang, Chen, & Xu, 2007) According to Hung

(2004), the factors that could be considered while setting overbooking limits

include: probabilities of cancellation and no-shows; room demand distribution

over time and conditions of length of stay; and, stay extension probabilities

influenced by the intended length of stay. Moreover, he assumes that the

proportion of cancellations depends on the customer and room category and

the intended length of stay. The contemplated research will elaborate and

expand on the above and will attempt to extend and introduce a new model that

will include other important variables, such as: the lead time, and the time

between the booking day and the arrival day. The omission of these mentioned

variables in the existing models is considered to be in error and as a result the

contemplated research will attempt to fill this gap in the scholarship.

To fully address the issue of overbooking other well-established models and

lessons from tangential industries where such are considered strategic will be

examined. One such industry is the airline industry whose lessons and models

may in turn may be modified and applied to the hotel industry in an attempt to

create more clarity around the critical issue of overbooking. The contemplated

research will complete the above tangential literature review in order to further

illuminate the limits or robustness of the existing models and frameworks within

the hospitality industry (Rothstein, 1971) (Rothstein, 1985) (Falkson, 1969)

(Toh, 1983) (Dunleavy, 1995) (Vickery, 1972) (Pfeifer, 1992).

6.5. THE BINOMIAL MODEL

To explore the classical static overbooking problem, one can look the models of

Beckmann (1958), Taylor (1962), Thompson (1961), Vardi (1975) and Bierman

(1975). In these models, the cancellation process is described as a Bernoulli

process of aggregated individual cancellations. This methodology of modelling

the relevant variable as a binary one assumes that binomial distribution can

safely be followed, as current literature suggests (Zakhary, 2011). Until now,

identical cancellation patterns have been assumed over different seasons. The

contemplated research will drop this assumption and argue that different

seasons or market segments also have different cancellation patterns.

In static models, the dynamics of customer cancellations and new customer

requests over time are ignored. Rather, the models simply determine the

maximum number of reservations to hold at any current time given estimates of

cancellation rates from the current time until the date of service. This maximum

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number of reservations, or overbooking limit, is then recomputed periodically prior to arrival to reflect the changing state and cancellation probabilities over time. According to Talluri K. (2004) simplicity, flexibility and robustness have made these models popular in practice. The simplest of those is based on a binomial model of cancellations in which no-shows are lumped together with cancellations under the following assumptions:

- Guests cancel independently from another;

- Each customer has the same probability of cancelling. As one of the main points of the contemplated research is to elaborate on the differences of the cancellation probability of different consumers, this concept will be significantly evaluated;

- The cancellation probability is Markovian[1] and is therefore independent of the age of the reservation. The contemplated research on the other hand will assume a relationship between the age of a booking and its cancellation probability.

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[1] A Markov chain, named after Andrey Markov, is a mathematical system that undergoes transitions from one state to another, between a finite or countable number of possible states. It is a random process usually characterized as memoryless: the next state depends only on the current state and not on the sequence of events that preceded it. This specific kind of "memorylessness" is called the Markov property. (Markov, 1971).

The dynamic overbooking problem as an extension of the basic model can be found in Chatwin (1999). These will be further analysed and considered in an attempt to create a new and more dynamic model.

6.6. OPTIMISATION OF THE OVERBOOKING POLICY IN THE BINOMIAL MODEL

Once the contemplated research has thoroughly examined and demonstrated the specifics of the cancellation phenomenon, that is the generating function and can estimate the cancellation rates under different circumstances, the findings can be put to use by optimizing the overbooking policy. Shumsky (2002) presents a basic framework which was elaborated by others including: Ivanov (2006) and Talluri (2004). This basic framework of stochastic optimisation has been solved with many extensions, but its basic case is identical to the basic overbooking problem. The optimal number of overbooked rooms is the smallest value Y* such that

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EQUATION
Optimal Number of Overbookings

$$F(Y^*) \geq \frac{B}{B + C}$$

This model and its extensions will be further explored within the context of the contemplated research.

7.0 RESEARCH PLAN

The research consists of four major portions: the literature review, the adapting of existing mathematical models, the empirical analysis of the data set, and the development of a new and more robust model that fills in the existing gap in the literature. The research will be conducted over 36 months with a literature review period of approximately 12 months, a data analysis period of 12 months along with the perfecting of the manuscript in the final 12 months.

8.0 RESEARCH TIMELINE

In the Table below the overview of the estimated time frame for the completion of the proposed doctoral research is presented along with identified milestones.

TABLE 1 Research Timeline	
Phase	Date
Preliminary Literature Review	Apr-2011 - June 2011
In-depth Literature Review	Jun-2011 – June 2012
Chapter 1 & 2: Preliminary Draft	June-2012
Dataset – Calculation & Analysis	Sept-2012 – Dec-2012
Review of Salient Models & Frameworks	Jan-2013 – March-2013
Calculations, Predictions and Optimisation	March-2013 – June 2013
Chapter 3 & 4: Preliminary Draft	June-2013 - Sept-2013
Chapter 5 & 6: Preliminary Synthesis Draft	Sept-2013 - Dec-2013
Chapters 1 – 6: Perfecting of Manuscript	Dec-2013 – April -2014
Submission of Final Copy	April-2014

9.0 RESEARCH BUDGET

The total cost of the research is estimated to be approximately €5,000. No
scholarly or governmental grants will be sought or used in carrying out the
research. No extra supervisory costs or other costs are being requested from
UGSM-Monarch Business School. The budget is presently fully funded and
research may begin immediately.

TABLE 2 Research Budget	
Item	Cost in EUR
Conferences	500
Books and Article purchases	2,000
Travel Expense	150
Statistical Software	1,200
Reproduction	150
Other	500
Total	4,500

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10.0 RESEARCH PROPOSAL APPROVAL

The contemplated research proposed herein has been approved by the

University and the student may commence the research immediately. The

student is not to deviate from the proposed research unless expressly

confirmed by both the Supervisor and the University in written form.

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Approved By The University On
13-March-2013 in Zug-Switzerland
By: Dr. Jeffrey Henderson, D.Phil.

BIBLIOGRAPHY

1. Beckmann, M. J. (1958). Decision and team problems in airline reservations. *Econometrica*, S. 26: 134-145.

2. Birge, L. (1997). Introduction to stochastic programming. New York: Springer.

3. C.U. Lambert, J. L. (1989). The overbooking question: A simulation. *Cornell Hotel and Restaurant Administration Quarterly*, S. 29: 7-8.

4. Caroline Kennedy, P. D. (2011). *www.lech.at*. Von http://www.lech-zuers.at/xxl/_lang/en/_season/at2/_area/595845/_subArea/585688/_pid/597809/index.html abgerufen

5. Chatwin, R. E. (1999). Mulitperiod airline overbooking with a singler fare class. *Operations Research*, S. 46: 805-819.

6. Chiang, W.-C., Chen, J. C., & Xu, X. (2007). An overview of research on revenue management: current issues and future research . *Int. J. Revenue Management*, S. 97-127.

7. Dopson, H. M. (2008). *Food and Beverage Cost Control.* John Wiles and Sons.

8. Dunleavy, H. N. (1995). *Airline passenger overbooking.* (D. Jenkins, Hrsg.) New York: Mc. Graw-Hill.

9. Düsseldorf, O. (15. Februar 2012). Court Decision, JustBookMe GMbH vs. HRS Hotel Reservation Service.

10. Falkson, L. (1969). Airline Overbooking: Some comments. *Journal Transport Economics and Policy*, S. 3: 352-354.

11. Gilbert, G. R. (1996). Managing hotel reservations with uncertain arrivals. *Operations Research*, S. 44:35-49.

12. H. Bierman, J. T. (1975). Airline Overbooking strategies and bumping procedures. *Public Policy*, S. 21: 601-606.

13. Hamilton, L. C. (2006). *Statistics with STATA.* New Hampshire: Thompson Brooks / Cole.

14. Hoteliervereinigung, Ö. (Feburar 2012). *www.oehv.at*.

15. Hung, C. T. (2004). Revenue Management of the Hotel Industry in Hong Kong. *City University Hong Kong, Department of Marketing Science*, S. 1-201.

16. Ivanov, S. (2007). Dynamic Overbooking Limits for guaranteed and nonguaranteed Hotel Reservations. *Tourism Today*, S. 100-108.

17. Ivanov, S. (2007). Dynamic Overbooking Limits for Guaranteed and Nonguaranteed Hotel Reservations. *Tourism Today, Vol. 7*, S. 100-108.

18. Johnston, J. D. (1997). *Econometric Methods.* McGraw Hill.

19. K. Donaghy, U. M. (1995). Yield Management: an Overview. *Journal of International Hospitality management*, S. 139-150.

20. Kanti V. Mardia, J. T. (1980). Multivariate Analysis (Probability and Mathematical Statistics). Academic Press.

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21. Kimes, S. a. (2001). Preserving your revenue-management system as a trade secret. *Cornell Hotel and Restaurant Administration Quarterly*, S. 8-15.

22. Ladany, S. (1976). Dynamic operating rules for motel reservations. *Decision Sciences*, S. 7: 829-841.

23. Lai, K.-K. a.-L. (2005). A stochastic approach to hotel revenue optimization. *Computers & Operations Research*, S. 1059-1072.

24. Lefever, M. M. (1988). The gentle art of overbooking. *Cornell Hotel and Restaurant Administration Quarterly*, S. 30: 15-20.

25. Nahmias, S. (1997). *Production ond Operations Analysis.* McGraw / Hill.

26. Okumus, F. (2004). Implementation of yield management practices in service organisations: empirical findings from a major hotel group. *Service Industries Journal*, S. 65-89.

27. Pfeifer, S. B. (1992). Overbooking decision rules. *Omega*, S. 20:129-133.

28. Pölt. (1988). Forecasting is difficult - especially if it refers to the future. *References of Yield Management study group Annual Meeting Proceedings.* Melbourne: AGIFORS.

29. Rothstein, M. (1971). Airline Overbooking: The State of the Art. *Journal Transport Economics*, S. 5:96-99.

30. Rothstein, M. (1985). OR and the airline overbooking problem. *Operations Research*, S. 33:237-248.

31. Shumsky, N. (2002). Introduction to the theory and practice of yield management. *INFORMS Transactions on Education*, S. 34-44.

32. Sysdsaeter, K., & Hammond, P. (2009). *Mathematik für Wirtschaftswissenschaftler.* Munich: Pearson Education.

33. Talluri K., v. R. (2004). *The Theory and Practice of Revenue Management.* Norwell, Massachusettes: . Kluwer Academic Publishers.

34. Taylor, C. J. (1962). The determination of passenger booking levels. *Proceedings of the second AGIFORS Symposium.*

35. Thompson, H. G. (1961). Statistical Problems in airline reservation control. *Operations Research Quarterly*, S. 12: 167-185.

36. Toh, K. R. (1983). Airline deregulation and the no - show / overbooking Problem. *Logistics and Transportation Review*, S. 19:111-121.

37. Tourismusbank, Ö. H. (Februar 2012). *www.oeht.at.*

38. van Ryzin, G. (2005). Models of demand. *Journal of Revenue & Pricing Management*, S. 204-210.

39. Vardi, E. S. (1975). An Airline overbooking policy. *Transportation science*, S. 9: 101-114.

40. Vickery, W. (1972). Airline Overbooking: Some further solutions. *Journal Transport Economics and Policy*, S. 6: 257-270.

41. Wagner, H. (1975). *Principles of Operations Research.* Englewood Cliffs, N.J. USA: Prentive Hall.

42. Wikipedia/Cluster. (kein Datum). *Wikipedia.* Von http://en.wikipedia.org/wiki/Cluster_analysis. abgerufen

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Doctor of Professional Studies Dissertation Proposal
UGSM–Monarch Business School Switzerland

43. Yechiali, V. L. (1978). On the hotel overbooking problem. *Management Science*, S. 27: 1117-1126.

44. Zakhary, A. E.-S. (2011). Forecasting Hotel Arrivals and Occupancy Using Monte Carlo Simulation. *Journal of Revenue and Pricing Management*, S. 42-68.

45. Zentralamt), A. S. (kein Datum). *www.statistik.at*.

46. Zhechev, A. T. (2010). The impact of overbooking on hotels operation management. University of Wales.

47. Zikmund, W. (2003). In *Business research Methods (7th Edition)* (S. 3-19). Mason, Ohio: Thomson Learning / South-Western.

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