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Variable Check-In Time:

Raising Room Revenue With Multiple Daily Check-In Times

Matthew Kaplan

## Abstract

An exploration of a new theory of hotel room valuation and pricing called “Variable Check-In Time”. The theory holds that hotels could increase room revenue by instituting multiple daily check-in times, rather than the typical, universal 3:00 p.m. to 12:00 p.m. room-day. In doing so, hotels could accommodate guests for more hours per day, thus raising the room night’s salable value. The paper presents the concept of the room-hour and of room-hour utility, making a quantitative case for increased room revenue on utility-maximization grounds. A model for the optimization of room-hour utility is presented, as well as a demonstration of that model – using historic check-in time data from a large Las Vegas strip hotel.

## Introduction

### *Purpose*

In Las Vegas, hoteliers have long lived with a paradox. This hospitality oriented city caters to the gambler and the partier. Las Vegas expects its guests to keep late hours, and accordingly it provides entertainment and activity during those late hours, including gambling, 24-hour dining and nightclubbing. However, despite the nocturnal nature of its most valuable guests, these hotels continue to rely on the traditional 3:00 p.m. check-in and noon check-out times; ensuring that some guests will arrive after check-in time and ensuring that some will be evicted when they most want to sleep. What if Las Vegas hotels were to try something radical: aligning the start times of their room-days with the predictable arrival times of these lucrative guests? Would they then not increase the value of the room? Would occupancy increase overall? Would the average daily rate (ADR) rise? Would there be a windfall of goodwill and customer delight?

Questions such as these lie at the heart of Variable Check-in Time: a new theory of room-night valuation and pricing. The purpose of this paper is to challenge the orthodoxy of the 3:00 p.m. to noon room-day and to articulate the theory of Variable Check-In Time (VCI) in detail. It will be argued that hotels would be better off finding a new room-day schedule that best accommodates known patterns of guest arrival and departure; not just in Las Vegas, but anywhere where guests do not arrive collectively in a 3:00 p.m. herd. The purpose of the new room day schedule would be twofold: to maximize the value of the rooms being sold and to strengthen the hotel's brand by fostering customer delight.

There are several ways to approach the argument for multiple daily check-in times, including:

1. The revenue case for VCI: If the hotel can accommodate the guest for more of the guest's desired hours, the hotel can theoretically optimize the per-hour value of its rooms and can therefore charge more for them.
2. The customer service case for VCI: Later check-outs and earlier check-ins will boost customer satisfaction, enhancing the hotel's reputation and boosting its intangible assets.
3. The operational efficiency case for VCI: With check-in times spaced out over the course of the day, crunch times and capacity stress points are alleviated on the operational level. Housekeepers no longer have to turn over every room in the hotel at noon, for example, and the front desk no longer has to field the same rush-hour crowds.

The focus of the paper will be on the first argument, since it is the most consequential, the most persuasive and requires the most discussion. The other two, while discussed briefly, will not be the subject of this paper. They are large topics in their own right and worthy of full exploration, but this paper's analysis will be limited to the revenue-based case for VCI.

Part 1 of the paper will consist of a full articulation of the theory of Variable Check-In Time, along with a discussion of its underlying assumptions. Part 2 is a literature review whose purpose is to bolster the case for the necessity of VCI and add credence to the arguments made in Part 1.

Part 3 will introduce the VCI model: a program written in Microsoft Excel. The VCI model is a tool for determining optimal check-in time based on historic arrival data. It also prescribes ADR based on historical ADR data and a new understanding of the utility of the room-hour. Part 3 also includes a demonstration of the model, using actual historic check-in time data from a major Las Vegas strip hotel.

The goal is to offer a blueprint for hotel operators to increase room revenue in a tangible way. To do this, a new way of valuing the hotel room is offered; one that attempts to mirror the

way the guest estimates room value.

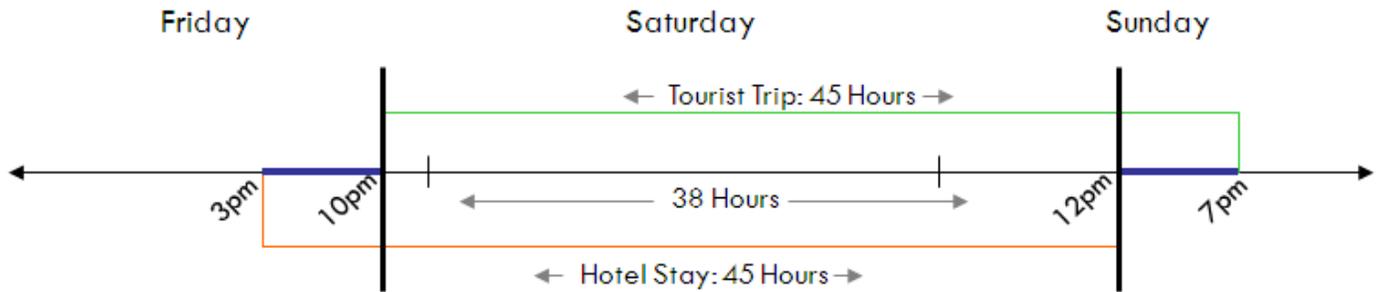
### *A Hypothetical*

The room-day, the time-based unit in which hotel rooms are sold, is a perishable product. During the 24 hours of its existence, a room-day will either be sold or lost (Varini, Engelmann, Claessen, & Schleusener, 2003). The question that must be considered is when to start the clock on these 24 hours. Exactly when does the room day begin? The current practice, which barring a few scattered exceptions is universal, is to begin the room-day in the early afternoon and end it in the late morning (Dube & Enz, 1999). A 3:00 p.m. to 12:00 p.m. room-day is typical and will be the one used in examples.

There are sound reasons why this particular room-day is practiced everywhere; among them that it has traditionally met the needs of travelers and that its very ubiquity has made lodging more convenient. The origins of the 3:00 p.m. to 12:00 p.m. room-day are discussed in more detail in the literature review.

What is long overdue however is an examination of room-day start time from a room revenue perspective. Consider a simple hypothetical that will frame the issue. A tourist from California drives to Las Vegas for the weekend. She arrives at 10:00 p.m. Friday night and plans to stay until 7:00 p.m. Sunday night. This creates a total trip time of 45 hours. The tourist would like to buy a hotel room for all 45 hours. However, her hotel of choice only offers the traditional room-day, with a 3:00 p.m. check-in and 12:00 p.m. check-out. The full timeline is illustrated in Figure 1.

Figure 1



Notice something peculiar: though the hotel will sell the tourist a 45 hour stay, and though the tourist is trying to buy a 45 hour stay, the two stays do not overlap cleanly. The tourist will only be accommodated in a room for 38 hours; from 10:00 p.m. Friday to 12:00 p.m. Sunday. These 38 hours are bounded within the two black vertical bars shown in Figure 1. Outside the black bars are two blue lines. Each represents an area of missed opportunity. The left-side blue bar represents the time period from 3:00 p.m. Friday to 10:00 p.m., seven hours in which the hotel is forcing the tourist to pay for room time that she doesn't want. The right-side blue bar shows the seven hours after check-out on Sunday, when the tourist would like to be accommodated and paying for a room, but the hotel will not accommodate her.

The theory of Variable Check-in Time holds that customers value a hotel room-day (at least in part) as a function of time. So, when the tourist desires a 45 hour stay, but is only sold a 38 hour stay, the amount she is willing to pay for the room corresponds to her valuation for a 38 hour stay. If the tourist valued a room as a \$10 per hour proposition, she would be willing to pay a maximum of \$380 for her stay ( $\$10 \times 38$  hours). It does the hotel no good to claim the tourist was truly given the room for 45 hours, because the guest places no value on room time that she was not present to consume. If the hotel had, in this hypothetical, set aside a room for this tourist with a dedicated room-day start time of 10:00 p.m. and a corresponding check-out time of 7:00

p.m., then the hotel could have “optimized” the value of the room from the per-hour valuation perspective, and sold it for its full value of \$450 ( $\$10 \times 45$  hours), a not insignificant difference.

Underlying the hypothetical, and necessary to its validity, are a few major assumptions; primary among them that the guest places an hourly value on a room purchase. Much of the paper will be spent building the case for this assumption, since it is not a claim that has received scrutiny before now. But if the assumption can be temporarily granted that a guest places more value on a longer hotel stay than on a shorter hotel stay, many things follow. It follows that if a hotel has guests who arrive at varied times, that hotel ought to try to accommodate each guest’s unique schedule as best it can in order to maximize room revenue. It follows that having a single, universal check-in time is inferior to multiple daily check-in times, so long as instituting multiple daily check-in times does not come at excessive cost. And it follows that an entirely new dimension of yield management – the consideration of the room-hour – has gone unexplored and unexploited.

#### *Concept: The Room-Hour*

The concept that informs the previous example (and forms the foundation of VCI) is that of the room-hour. This is the notion that the value of a room-day can be expressed in terms of the value of its component hours. A guest who will pay \$240 for a 24 hour room-day can be said to have paid \$10 per room-hour. If that guest arrives at the hotel in the middle of a room-day where there are only 12 hours remaining – and buys a room for \$240 anyway – then the guest is now paying \$20 per room-hour ( $\$240/12 = \$20$ ).

Hoteliers have always understood the inverse relationship between average daily rate and occupancy (Steed & Gu, 2005). As ADR rises, occupancy falls. The simple mathematics of yield management hold that there exists an ADR and corresponding occupancy level that maximize

overall room revenue<sup>1</sup>. The job of the revenue manager is to find this optimal rate, fine-tune it with all manner of discounts and incentives, and to consider the role of ancillary spend (Noone & Griffin, 1997).

The reason the relationship between ADR and occupancy is inverse is because the potential guest assigns a value to the room-day (Varini et al. 2003). If the ADR exceeds this privately computed value, the guest will not buy the room. If it is lower than the value, then the guest perceives a bargain, and will buy the room. In the case where the guest buys the room, the difference between the guest's perceived value of the room and the dollar amount actually charged is what economists call consumer surplus. The guest was willing to pay \$200, but was only charged \$150. The guest buys the room and in his private estimation is \$50 wealthier for the transaction. How the guest arrives at this personal valuation of the room-day is not necessarily a conscious process. (Chan, Wong, 2006) He may have a vacation budget or a business travel budget, which he can spend up to but not exceed. He may have a gut-level intuition about what price would be fair. He may shop online and receive multiple offers and come to a decision that way. But however it is done, it is true that for any guest there is a room-price that represents the limit of what the guest will pay. (Molitor, 2000)

VCI does not challenge this logic – it merely takes it a step further. VCI asks: what about the guest's valuation of the room-hour? The guest may be willing to pay \$200 for a room-day. But what if he arrives in the late evening and half of the room day is already gone? What if three quarters of it is gone? What if 90% is gone? Is the room still worth \$200?

Consider the 3:00 p.m. to 12:00 p.m. room day and a rack rate of \$210. The room-hour rate is \$10. But as each hour of the room day elapses, the room-hour rate rises for the newly arrived guest (see Figures 2 and 3). In the final hour, the price of a room-hour becomes \$210.

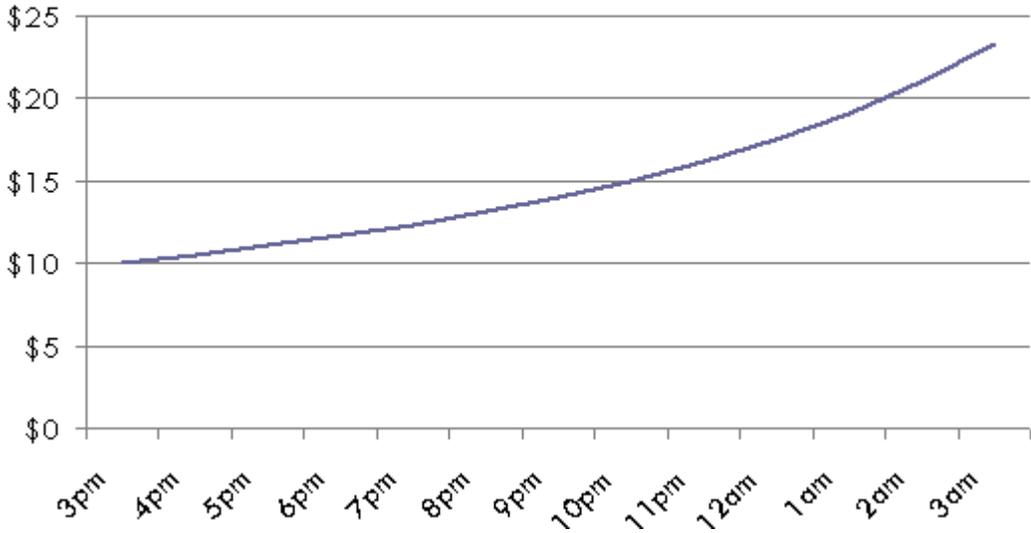
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<sup>1</sup> Assuming costs held constant.

Price of Remaining Room-Hours

**Figure 2**

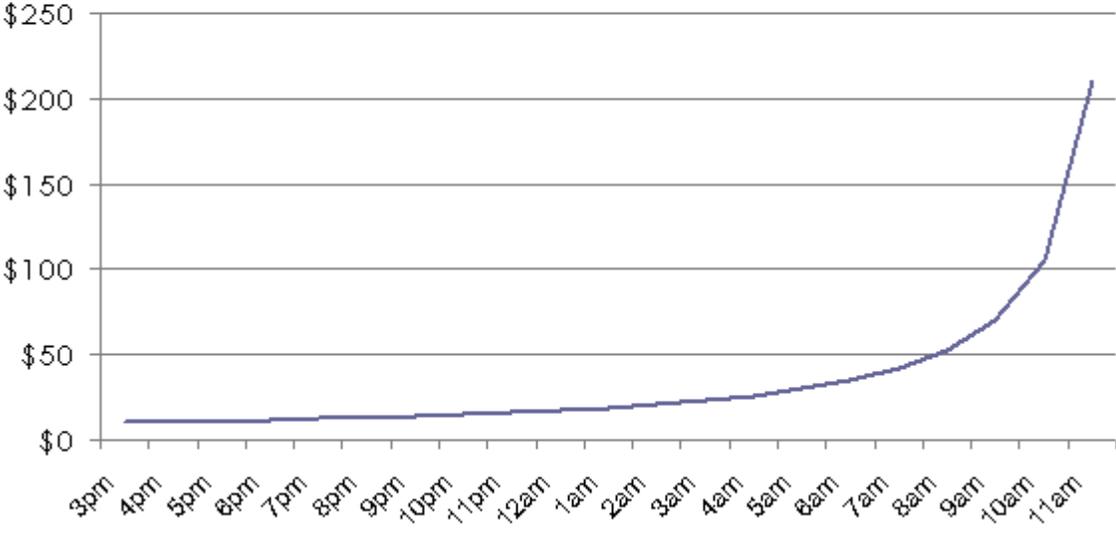
3:00 p.m. to 3:00 a.m.



Price of Remaining Room-Hours

**Figure 3**

3:00 p.m. to 11:00 a.m.



What this means is that as the room-day elapses, it gets steadily more expensive from the perspective of the potential buyer. At 3:00 p.m. the hotel charges \$10 per room-hour for the arriving guest. By 10:00 p.m. however, the room-hour rate has risen to \$15, due to the shrinking

hours in the room-hour denominator. Therefore, if a guest internally values the room at \$12 per room-hour, he would buy the room at 3:00 p.m., but would not buy it at 10:00 p.m.<sup>2</sup>

What do late arriving guests do when the room-hour cost exceeds what they are willing to pay? The guest in that case has no choice but to find a different hotel with a smaller rate. VCI predicts that as the room-hour cost rises (as the day elapses), guests will migrate down-market to find a suitable room rate. Consider the three hotels in Figure 4:

**Figure 4**

Hotel	Room Rate	Effective Room-Hour Rate		
		12pm Arrival	8pm Arrival	4am Arrival
The Jackson	\$20	\$0.83	\$1.25	\$2.50
The Grant	\$50	\$2.08	\$3.13	\$6.25
The Franklin	\$100	\$4.17	\$6.25	\$12.50

The effective room-hour rate for each hotel depends on when the guest arrives. If we imagine a guest who is willing to pay \$5 per room-hour, at which hotel will he stay? If he arrives at noon, he will stay at the luxurious Franklin and pay \$4.17 per room-hour. If he doesn't arrive until 8:00 p.m., the Franklin has become too expensive (\$6.25 per room-hour) and the best he can do is The Grant. If he doesn't arrive until four in the morning and simply needs a room to get a few hours of sleep, the only affordable option is the Jackson. This example illustrates how the wildly fluctuating value of a hotel's room-hour rate can send guests up-market and down-market

<sup>2</sup> Note that if the guest intends to stay multiple nights, the effect that late arrival would have on the purchase decision decreases proportionally. For a two night stay at the hypothetical \$210 per night hotel, the room-hour rate falls from \$10 (\$210/21 hours) to \$9.33 (\$420/45 hours) for a 3:00 p.m. arrival. The falling of the room-hour rate is due to the three bonus hours – noon to 3:00 p.m. – that the guest acquires between the first and second room-day. If the hotel permits early check-in, the room-hour rate could fall still further. If the guest arrived at 11:00 p.m. for a two night stay, the room-hour rate would be \$11.33 (\$420/37 hours). The guest who valued a room at \$12 per room-hour would find this rate to be acceptable and would book the room. Accordingly, as we add more days to the total stay, the room-hour rate experienced by the guest gradually declines to the theoretical minimum of rate/24.

depending on when they arrive and how long they intend to stay.

Looking at the picture now not from the guest's perspective but from the hotel's perspective – it becomes clear that as the day progresses, the “quality” of the arriving guest starts low, and ends high. That is to say, the guest that arrives at noon has the least money to spend, and can only enjoy a room-day at my establishment because he arrived early and realized the lowest possible room-hour cost at my standard room rate. The guest that arrives late in the day was forced down-market to my hotel, realizing a punishing room-hour rate relative to his early arriving peer. This particular consequence of room-hour analysis – the increasing value of the arriving guest as the room day elapses – could have fascinating and profitable consequences for the hotelier able to recognize the distinction and harness it. It is outside the scope of this paper however, and will have to be left to future pursuit.

#### *Examination of the Room-Hour Assumption*

Before going further, an examination of the assumptions behind the notion of the room-hour is due. Does a guest really value a hotel room by its room-hour rate? Does it make sense to refer to a \$12 per room-hour guest? What guest arrives at a hotel, pulls out a calculator, punches in some figures concerning room-hours remaining and his own private valuation of the room, and arrives at a purchase decision that way? Previous literature has identified transactional elements that influence the guest's perception of what price is “fair”. Is the pricing method transparent? Is the guest treated the same as other guests? Is competitive pricing information available (Choi & Mattila, 2004)? Unexplored, however, is the extent to which the per-hour rate influences the purchase decision.

Furthermore, there exists a deeper criticism of the room-hour valuation concept. Namely, why would anyone assume that each hour in a room-day is equally valuable? Intuitively, the

notion seems false. If person A buys a hotel room for 12 hours and person B buys a room for 24 hours, is person B really getting twice the value? More value, perhaps – but twice the value? Unlikely.

Both of these questions deserve full answers before an explanation of VCI can continue. It is true that a guest does not explicitly calculate room-hour rates when making a purchase decision. But that does not mean that room-hour considerations are ignored. Any guest that has ever inquired about a half-day rate has an intuitive understanding of how a room's value can be expressed in terms of hours. The traveler who is debating the merits of a paying a full day's rate for a short nap, or the visitor inquiring about the fee for a late check-out – all of these people understand the value of discrete hours in the calculation of total value. Consider this online review from a guest at the Grand Hyatt in Santiago, Chile:

*My friend and I were stunned when we arrived at the hotel around 8am from our overnight flight to Santiago. The check in clerk on the club level welcomed us, presented us with welcome drinks, and proceeded to photocopy our passports and print out our hotel folios complete with our room numbers. Like virtually every other hotel in the world where I have ever stayed I figured "great, I am lucky, there is availability and I can check in early to take a shower." Only once all documents were signed and the keys were ready to be handed to us were we informed that the early check-in fee would be 50% of our room rate... I left with a bitter taste when I checked out at 5:45am two days later for an early flight. I could not help but think that my room would be quickly cleaned and the next weary traveler would be charged an extra US\$200 or so to get in early even though I left early and, theoretically, was still paying for the room through check-out. (SFTraveler10, 2007)*

Apparent in this testimonial (besides the issue of the guest feeling cheated by an undisclosed fee) is the fact that (a) The Grand Hyatt recognized the value of the room-hour, and had a policy of charging for additional room-hours for early arriving guests, and (b) The guest was aware he was paying for time unused: specifically the time after he left (5:45 a.m.). The implicit argument of the guest: if the hotel charges extra for early arrival, it should reimburse for early departure.

Whatever the merits of that argument, what is clear is that both the guest and the hotel are acutely aware of the value of room-hours, and that room-hours factor into pricing and purchase decisions.

#### *Decreasing Marginal Room-Hour Utility*

The second criticism of the room-hour approach to valuation - that it is unreasonable to think that all hours in a day are equally valuable - is well taken. Indeed, they cannot all be equally valuable. There is decreasing marginal utility for each hour in a room-day, and the VCI model takes this into account when it solves for optimal check-in times.

In economics, the utility of something is its inherent desirability to the possessor. It is a subjective value and not always quantifiable. When one talks about the *value* of a hotel room or a hamburger or any consumable economic good, that person is actually considering its utility to the customer. Utility can be measured in terms of the number of dollars the customer is willing to part with to obtain the good.

It is clear that the desirability of a room-hour – its utility - changes from hour to hour. Give a guest who has rented a room for two hours an additional hour, and you have given 50% more room time. Give a guest who has rented a room for 22 hours a 23<sup>rd</sup> hour, and the additional time is not nearly as meaningful. In the first instance, the hotel owner could charge more money

for the extra hour, in the second instance he would have a hard time doing so.

This realization, rather than negating the VCI argument, actually enhances it and permits a certain degree of fine tuning to the optimization process. Return to the example of the Jackson, Grant, and Franklin, this time approaching the problem from the perspective of the guest's expected utility.

Before, it was showed that as the room-day slowly expired, the per hour cost of each room rose higher and higher from the perspective of the newly arriving guest. If the guest valued a stay in terms of the room-hour rate, he would be forced gradually down-market the later he arrived.

**Figure 5**

Hotel	Room Rate	Effective Room-Hour Rate			\$5/Hour Guest
		12pm Arrival	8pm Arrival	4am Arrival	
The Jackson	\$20	\$0.83	\$1.25	<b>\$2.50</b>	
The Grant	\$50	\$2.08	<b>\$3.13</b>	\$6.25	
The Franklin	\$100	<b>\$4.17</b>	\$6.25	\$12.50	

Now, make an assumption about the guest's utility of room-hours. For the sake of argument, let us suppose that the first 10 hours of his stay are high utility hours, and bestow one util per hour. (A util is a unit of utility.)

Say that the next 8 hours are medium utility hours – only half as useful (0.5 utils). And the remaining 6 hours in the day are low utility hours (0.25 utils). Now, calculate how many utils there are in a 24 hour stay:

$$10 \text{ hours at } 1 \text{ util} + 8 \text{ hours at } 0.5 \text{ utils} + 6 \text{ hours at } 0.25 \text{ utils} = 10 + 4 + 1.5 = 15.5 \text{ utils}$$

For a 16 hour stay:

$$10 \text{ hours at } 1 \text{ util} + 6 \text{ hours at } 0.5 \text{ utils} = 10 + 3 = 13 \text{ utils}$$

And for an 8 hour stay:

8 hours at 1 util = 8 utils.

Now, we will re-compute the values from Figure 5 for each hotel's rate per-util. Note that in Figure 6, the room price was divided by the expected utils, not the hours remaining, to find the effective rate per-util.

**Figure 6**

Hotel	Room Rate	Effective Rate per-Util			\$5/Util Guest
		12pm Arrival	8pm Arrival	4am Arrival	
The Jackson	\$20	\$1.29	\$1.54	<b>\$2.50</b>	
The Grant	\$50	<b>\$3.23</b>	<b>\$3.85</b>	\$6.25	
The Franklin	\$100	\$6.45	\$7.69	\$12.50	

When utility is introduced in this fashion, it changes the guest migration scenario. Specifically, it has the effect of diminishing the distinction between a 24 hour stay and a 16 hour stay, while preserving the significance between a 16 hour stay and an 8 hour stay. In the original calculation, the Franklin was affordable at \$5 per hour for a 24 hour stay because every hour had equal value. The \$100 room rate, divided by 24 hours, equaled \$4.17 an hour which was well within the per-hour budget of the guest. However, when the effect of room-hour utility was added, the Franklin ceased to be affordable at noon. The reduced utility of the day's final room-hours was the culprit.

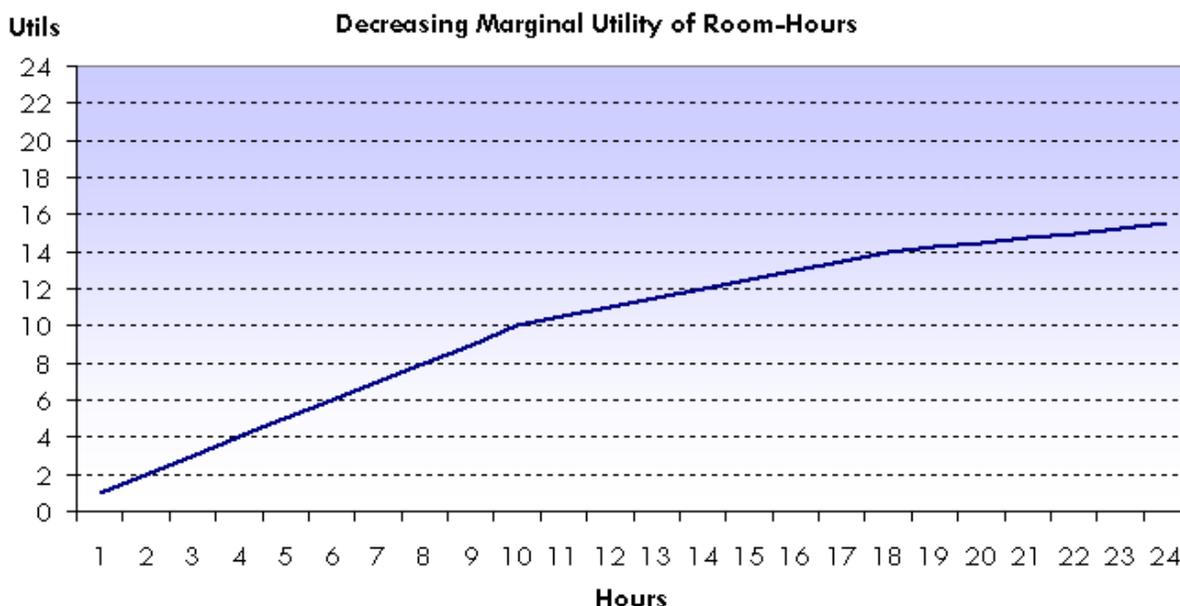
This example begs the question: what *is* the slope of the curve of decreasing marginal room-hour utility? Unfortunately the derivation of such a function is beyond this paper's scope. It seems clear that if some function were offered, it couldn't be universal and apply to all guests equally. A guest who needed a quick hotel room for a nap and a shower during an airport layover would have one distinct room-hour utility curve; whereas a guest in town for a month's vacation

would surely have an entirely different one. The airport layover guest would find the utility of his room dropping to zero after hour 5 or 6, and the vacationing guest would have room-hour utility that started high and barely flattened at all.

Absent a definitive answer on what a hotel's true room-hour utility curve might look like, we will continue to use the estimated utility curve of:

- Hours 1-10 = 1 util
- Hours 11-18 = 0.5 utils
- Hours 19-24 = 0.25 utils

This estimate is non-scientific, but intuitive. It is based on the knowledge that of the many services a hotel provides, there are services of primary and secondary utility. Among the primary services: the use of a clean bedroom and bathroom. Among the secondary services: the television and telephone, the swimming pool and workout room, the business center and the continental breakfast. One does not need 24 hours to derive usefulness from the primary services. 12, 10, 8, or even fewer hours can suffice for resting and ablutions. It is when extra hours are provided that some of the secondary services can enter the picture. (No one pays a full night's rate at a hotel just to take a swim in the indoor pool.) This intuitive understanding of the hierarchy of services a hotel provides informs our estimate of a slope of room-hour utility. But it is not meant to be the last word on the matter, and the VCI model allows the user to define her own utility curve when calculating optimal check-in times.

**Figure 7**

### *Optimizing the Value of the Room-Day*

With all of the preceding discussion in mind, it is time to turn to what VCI actually proposes. In order to realize the full value of its rooms and prevent the migration of its guests, a hotel should adjust its room-day start times to that hour which would maximize the total utility of room-hours sold. In plain language: if all of your guests are arriving at 6:00 p.m., and official check-in time is 3:00 p.m., you would be better off changing check-in time to 6:00 p.m. If your guests arrive at many different times, the goal would be to collect and aggregate the data to determine which check-in hour would maximize the total utils sold.

Once this optimal hour is determined, the next question is how to set the room rate to extract maximum value from the utils sold. The VCI model takes your old check-in time, your old ADR, and your data set of historic arrival times. It figures out how many utils you sold and at what price-per-util. Once the new optimal check-in time is found, it determines the new number of utils that could have been sold at that check-in hour, applies the old price-per util, and delivers

the new recommended ADR.

For example: if you had one room, which provided an average of 10 utils per customer, and sold for \$100 a night, your de-facto price per-util would be \$10. If the VCI model determined that a new, optimal check-in time of 6:00 p.m. would result in an average 12 utils sold per customer, it would prescribe a new room rate of \$120. The reasoning is simple: your customers have already shown a willingness to pay \$10 per util. Since you are providing 20% more utils, you can charge an extra 20% and still give the customer the same value per-util. From a value perspective, the customer has not been asked to pay a higher rate. The guest is paying the same rate per-util as before.

#### *Seasonal and Other Considerations*

Based on the particular hotel, the clientele, the location and the market, there could be major differences between weekend/weekday visitation, seasonal visitation, special event visitation, and so on. The VCI prescription is not intended to be monolithic. There is no claim that the prescribed check-in time and average rate is optimal for any given day. The claim is merely that it is the optimal time and rate when averaged over all days for which historical data is provided.

If the historic data set is parsed based on weekend/weekday, for example, the model could return one optimal check-in time for the weekend and another for weekdays. It could return one time for January-March, and another for April-June. It could return a best-time for August 26, and a best time for November 15. It is up to the operator to decide how best to group the data, and also up to the operator to decide how many new check-in times to implement. There is a tradeoff between the increased utility maximizing precision of room-day start times that change monthly, weekly or daily – and the increased confusion such a schedule would

cause. Frequently changing check-in times also introduce the problem of “empty time”, a unique inventory shrinkage issue that only occurs when check-in times are frequently changed. “Empty time” is discussed in the literature review.

#### *Multiple Check-In Times per Day – True Variable Check-In Time*

The preceding discussion of VCI addressed the problem of “solving” for the check-in hour that would optimize guest room-use utility, based on a historic data set. It is possible to go further. In a large, busy hotel, such as the Las Vegas strip hotel whose check-in data will be analyzed in the methodology section, the argument can be made that utility optimization could be taken further if the hotel offered several check-in times per day.

If a hotel had three check-in times per day, blocks of rooms would be dedicated to those check-in times. In a 100 room hotel, 25 rooms might end up as 11:00 a.m. check-in rooms. 50 might become dedicated 3:00 p.m. rooms, and the remaining 25 might become 10:00 p.m. check-in rooms. The number of rooms to dedicate and the hours at which to set the check-in times would not be chosen randomly. Rather, the VCI model (using the same historic data sets as before) can solve for the number of rooms to set aside, and the hours at which to set check-in times, all based on the principle of maximizing total utils sold.

The implications of implementing true Variable Check-in Time are potentially enormous. If guests are in the habit of arriving at all hours of the day, in large numbers, (as they are in Las Vegas) then it is certain – no matter what optimal check-in time is assigned – that many customers will arrive during off hours. Those that arrive at inconvenient times will migrate down-market to hotels that can accommodate their desired per-util rate. They will be replaced by up-market guests migrating down to your establishment. If *you* operate the up-market establishment, then there will be no replacement guests.

Having multiple daily check-in times is a powerful solution in these instances. Every arriving guest can be paired to a room that provides close to the maximum possible utils. A 7:00 p.m. arrival guest can be placed in a dedicated 8:00 p.m. check-in room, (with check-out at 5:00 p.m.) and the 9:00 a.m. arrival guest could choose a dedicated 10:00 a.m. arrival room (with 7:00 a.m. check-out). In each case, utils are maximized and a higher rate can be charged than if both guests were put into a single, universal check-in time room.

With multiple check-in times per day, operational efficiencies become possible, as housekeepers no longer have to struggle with the burden of turning over the whole hotel in one three hour window. Front-desk crunch times are alleviated because the whole hotel isn't trying to check-in simultaneously. Fewer front desk agents would be necessary if guest arrivals were spaced out evenly over the course of a day. The degree to which VCI implementation could result in smaller employee headcount or Full Time Equivalents is one of the most useful side effects predicted by the theory, though it is not explored in depth here.

## Literature Review

In this section, current hospitality practices that relate to VCI are examined. Examples taken from the literature, from journalism, websites, and personal testimonials will add credence and weight to VCI's core contention: that hotel rooms become more valuable when offered to the guest at a more favorable hourly schedule.

### *History*

*Traditional hours of check-in and check-out are an icon of the hotel industry, even though making guests wait (or pay more) to check in or out often incurs their wrath. Nobody knows why the day still begins at 3pm and ends at Noon, if there was ever a reason for it. (Dube & Enz, 1999)*

The reason dates back to the purpose of the inns of antiquity. Meant as a safe place to rest during journeys on dangerous roads, the inn provided food and a warm bed for the well-to-do traveler, as well as feed for the horse ("Inns of Antiquity", 1927). Its' duties were principally nocturnal, beginning with supper and ending with breakfast. Most of the early innkeepers' laws were focused on stopping the host from robbing the guest in his sleep, and not on standards of service. (Hammurabi for example, in the oldest known hotel law, prescribed the death penalty to any innkeeper whose negligence caused the injury of a guest.) (Bradley-Hole, 2007)

The 3:00 p.m. to 12:00 p.m. room-day evolved out of the needs of the highway traveler. It represented a compromise between three competing pressures: the old guest who wanted to linger, the new guest who wanted a room right away, and the housekeeper – pushing against both sides from the middle – who needed the time necessary to turn over the room. That the check-in schedule became universal and standardized (and now, ossified) was in the best interests of operators and guests. A guest can travel to virtually any hotel in the world and take a few

standards for granted; among them that a room day begins in the mid-afternoon and ends in the late morning.

For perspective, consider the oldest operating hotel in the world, the Hoshi Ryoken in Japan. It opened for business in 717 A.D. Its natural hot springs were thought to have divine origin and possess unusual curative powers. For those interested in visiting though, check-in is still at 2:00 p.m., and check-out is at 11:00 a.m. (Houshi Hotel, n.d.)

### *Customer Satisfaction and the Front Desk*

According to a J.D. Power and Associates Study, the hotel check-in/check-out experience ranks only behind guestroom quality as the top driver of overall guest satisfaction. (Higgins, 2004) And, approaching the issue from another side, a study reported in *Hotel & Motel Management* found that the third most frequent source of guest complaints was arrival-related (after guestroom, and facility related) (Barsky & Lin, 2005).

What these studies suggest is that if hoteliers value guest satisfaction, they cannot afford to ignore the challenge of meeting/surpassing expectations at arrival and at the front desk. The problems that guests can encounter at these times include (a) long lines, (b) rooms that are not ready, and (c) inattentive staff. In a 2000 study that ranked the importance of over 30 hotel attributes for guests aged 55 and older (Callan & Bowman, 2000), the following attributes all appeared in the top 10 :

- Politeness of Staff
- Efficiency of Service
- Responsiveness of Staff
- Promptness of Service
- Friendliness of Staff

These particular service attributes are very pertinent to the front desk experience, and are likely to suffer when lines are long and clean rooms are delayed. When the front desk becomes a bottleneck, the clerk is faced with a dilemma. If he gives full attention, friendliness and responsiveness to the guest in front of him, he creates a longer line (and a less pleasant experience) for the next guest. If he hurries through each transaction he will keep the line moving but will not be meeting the full expectations of the guest in front of him.

More interesting than piecemeal solutions to these problems would be an understanding of their root causes. Why are lines long at check in? Why are clean rooms not always available when the customer needs them? Why are the standards of service strained at some times but not others? VCI offers a new perspective from which to analyze these questions.

With a one check-in time per day for the entire hotel, several operational consequences are apparent. First, the housekeeping staff is expected to clean and turn over all vacated rooms in a short window of time. If a hotel has a housekeeping staff of 10, a noon check-out time, 100 freshly vacated rooms, and an average cleaning time of 20 minutes per room, it follows that at 3:00 p.m., only 90 rooms will be clean out of 100 – and some newly arriving guests will be forced to wait.

Also, with one check-in time per day, there is an increased likelihood that many guests will want check-in service simultaneously. Hence, a daily rush hour at the front desk, and the potential for long lines. What will be argued throughout this discussion is that multiple daily check-in times are a way of alleviating these capacity crunch times, and thus have the potential of improving the service experience at the front desk and elsewhere.

#### *Automated Check-in Kiosks*

Academic hospitality literature is virtually silent on the topic of modern check-in times.

Indeed, new ideas in hotel management that do produce comment from the academy, such as the advent of automated check-in kiosks, seem to be concessions to the absolute nature of the 3:00 p.m. to noon room-day. If you take 3:00 p.m. check-in as given, you may as well install check-in kiosks to process nighttime check-in, and to alleviate capacity stress at the front desk at the busiest hours.

“The use of kiosks will grow as hospitality companies recognize the value proposition of using them.” opined Steve Laughlin of IBM business consulting services (Adams, 2004). Time has borne out Mr. Laughlin’s prediction. At large hotels, self-serve check in kiosks have become ubiquitous. The question: what is the problem that a self-serve kiosk addresses? Could it be that hotels are looking to cut staff?

Not according to Starwood technology Vice President Carl Cohen: “We’re not really looking at kiosks for streamlining operations. Guests tell us that they want this alternative to improve our check-in process.” (Shaw, 2004). For Mr. Cohen, the purpose of the kiosk is not simply to reduce operational costs (as Mr. Laughlin suggests it is). It is about increasing customer satisfaction. An opinion from blogger David Pogue from the New York Times’ technology blog seems to confirm this perspective:

*There were about 400 people waiting in line for the Reception desk. But me, I just breezed up to the kiosk, fed it a credit card for I.D. purposes, and pocketed the card key that the machine spat out. The machine then printed a page that identified my room number, and even gave me directions on how to find the elevator! (“Cross the lobby,” etc.) They’ve had check-in kiosks at airports for years now. But in my view, hotels need them far more desperately. What the heck took so long?” (Pogue, 2007)*

The advent of the check-in kiosk appears to be a response to an unasked question: Why are there such long lines at the front desk? 400 may have been an exaggeration from Mr. Pogue, but long check-in lines do have a way of seeming interminable. But are kiosks the answer?

On the face of it, it seems very counterintuitive that a hospitality operator would claim that changing a core hospitality service experience, the check-in, to an automated procedure with a machine somehow results in increased guest satisfaction. Isn't personalized service supposed to be a hallmark of hospitality high standards? How inconvenienced does the guest have to be that interacting with a machine becomes a superior choice to dealing with a human? A 2006 study in hotel guest satisfaction reported that the friendliness of the front-desk staff ranks in the top five drivers of customer loyalty (Barsky & Nash, 2006) A kiosk, it would seem, stands in the way of guest satisfaction.

Kiosks, in this view, are not so much a grand solution as they are an effective illustrator of the severity of the problem they were designed to combat: the interminable check-in line. If VCI could be shown to reduce lines at the front desk, would kiosks still be desirable? The kiosk owning hotelier might be well advised to study the root cause of the bottleneck that necessitates the check-in kiosk.

#### *Existing Hotels With Non-Standard Check-In Time Policies*

Modern hotel yield management is a direct descendant of airline industry yield management (Norman & Mayer, 1997). What both industries have in common is a perishable product; an unsold hotel room-day, like an airline seat, is lost forever. What distinguishes the two industries though is the value-of-time factor. A hotel guest can arrive at 11:00 p.m. and purchase what from his perspective is half a room night. An airline passenger, by contrast, cannot board a cross-country flight for only the last half. He must take the whole flight or nothing.

This is an important distinction. The idea that a room-day has a fluctuating value is central to the thesis of VCI. Yield managers have long known that the room-night's value fluctuates in certain regards (Norman & Mayer, 1997). The value of a room is known to change based on:

- The season
- The day of week
- Variable demand between transient, group and contract guests
- The number of days the room is sold ahead of time

The value of a room-night over time is a well known and understood concept. In Las Vegas, a guest wanting to book a room a year in advance will get a healthy discount. A guest looking online for a last-minute deal on a room for tonight can also command a discount. In between the two extremes is a parabola of price. One Las Vegas hotel has pinpointed 56 days as the peak of the parabola. In other words, a guest attempting to book a Las Vegas hotel room exactly 56 days in advance can expect the highest prices.

But the notion of intra-day fluctuation of value seems to have eluded the yield managers. The simple idea that a guest paying \$200 to check in at 3:00 p.m. may be sitting on a wholly different demand curve than a guest who pays \$200 at 11:00 p.m. has escaped observation. There are, however, a few hotels in the world that have non-standard check-in policies. These institutions may not have started out with the goal of maximizing the fluctuating intra-day value of a room-night, but they provide compelling examples nonetheless. Here, we will examine a few of them.

*The Peninsula Beverly Hills.*

The Peninsula Beverly Hills has a novel check-in policy. A guest can check-in at any time and keep his room for 24 hours – while paying a single day's rate. This new operational

model is called “24-Hour Check-In Service” and has earned the Peninsula a “Best Practices Champion” award from the Cornell School of Hotel Administration (Dube & Enz, 1999).

**Figure 8**

The screenshot shows the website for The Peninsula Beverly Hills. At the top, it reads "THE PENINSULA BEVERLY HILLS" and "PROMOTIONAL RATE FROM US\$ 475 WITH COMPLIMENTARY IN-ROOM HIGH SPEED INTERNET ACCESS". A navigation menu on the left includes "RESERVATIONS" and "Hotels" with links to various hotel services. A central image shows a hotel lobby with a reception desk and a decorative table. Below the image, the text "24-hour Check-in Service" is written in a cursive font. Further down, there are links for "Hotel Information | Awards & Accolades | Business & Technology | Executive Contacts | 24-hour Check-in Service | Luggage Storage | Nearby Leisure Facilities | Hotel Highlights". At the bottom, a section titled "E-MAIL NEWS" features a "SPA" logo and the text "The Peninsula Spa". A paragraph of text describes the 24-hour check-in service, stating it dispenses with traditional check-in/out procedures and guarantees a full 24-hour room stay for every guest, earning a "Best Practices Champion" award from Cornell University's School of Hotel Administration.

At first blush, this policy appears to be one of optimal room value maximization. Indeed, it seems to be Variable Check-In Time taken to its logical extreme. Whereas VCI only tries to maximize the number of hours *on average* that a guest’s stay will overlap with the hotel’s room-day, the Peninsula Beverly Hills guarantees a 24 hour room-day for every guest! If every guest is

getting full value from the room-day, then the hotel is well positioned to determine a rack rate that reflects this full value. Because the entire purpose of Variable Check-In Time is to increase room revenue by maximizing the per hour value of rooms, it is tempting to concede that the Peninsula has admirably solved this puzzle.

But the Peninsula is in fact making a costly error. Just as a 100 car parking lot might become a 75 car parking lot if you removed the striped lines and invited people to park wherever they wanted, so too does the Peninsula Hotel lose capacity by eliminating enforced check-in times and creating a room day free-for-all.

The problem has to do with the spaces between the cars, or at the Peninsula, the rooms that lie fallow between guests who arrive at odd times. Imagine a guest checking into the Peninsula at 2:00 a.m., and then checking out at 2:00 a.m. After the guest's late night departure, the room is turned over by the night housekeepers and is ready again at, say, 4:00 a.m. Where is the 4:00 a.m. arrival guest? If she does not exist, then the room lies empty until the next transient or scheduled guest arrives.

It is these unavoidable "empty" times that end up undermining the room revenue argument for a 24-Hour Check-In Service arrangement. If the hotel experiences periodic maximum occupancy, then the empty times are deadly. If, during a maximum occupancy day, you have six rooms that experience empty time of four hours apiece (due, again, to no transient guest arriving at the specific hour the room becomes available), then you have essentially forfeited 24 hours of room – a full room night at the rack rate. Forfeiting this entire room night will be more costly than whatever is gained from maximizing room value in the aforementioned six rooms.

Is empty time avoidable at the Peninsula Beverly Hills? No, it is not. By the very

structure of the program, individual rooms are guaranteed to have a fluctuating room-day start time. A guest who checks in at 3:00 p.m. and checks out at 3:00 p.m., leaves a dirty room which will not be available to the next guest until 5:00 p.m. The 5:00 p.m. guest leaves a room which will not be available to the next guest until 7:00 p.m., and so on. Unless the Peninsula has a regular stream of transient guests who wish to check in, in equal numbers, at all hours of the day and night, then it cannot avoid having rooms that regularly experience empty nights. If the Peninsula experienced chronic low occupancy, and rooms were always empty anyway, then perhaps a shoulder could be shrugged at these instances of forfeited room nights. But at times of peak business, the policy is a drain on revenue.

The Peninsula Beverly Hills, in its defense, deals with a rarefied clientele. Its rooms host movie stars and assorted industry big players. To give up two room-days for the price of one may not be too big a sacrifice if the goal is to attract celebrities and maintain a reputation for extravagance. The average, unremarkable hotel however would not find it profitable to emulate this service concept.

*Love Hotels in Tokyo's Kabukicho District.*

Hourly hotels of ill repute have been around for a long time. Today in Japan they are enjoying a vogue. Numbering perhaps over 17,000 (Kelly, 2006) they are technically illegal (every hotel in Japan must have a restaurant) but prosper nonetheless.

*Each of the 43 rooms in Haniuda's Kabukicho hotel averages three occupants a day, generating \$8,600 in revenue a month. A touch-screen display in the automated lobby means guests never have to meet Haniuda or any of his staff. Additional services, including rentals of school uniforms, doctor and nurse costumes and other fetishistic accessories, add another 10% to sales. (Kelly, 2006)*

Here is an example of the hotel that explicitly offers a partial room-day. The kiosks in this case provide the necessary privacy for a clientele seeking a higher level of discretion. But where is the hotel's break even point? How much empty time can they stand before a traditional room-night structure becomes more profitable by comparison?

*You will also see a sign on the outside with two prices: the first is the price of a "rest", usually up to two hours, and the second is a "stay", or overnight. Dogenzaka's love hotels tend to be on the expensive side, most are around Y5000 for a rest and Y10000 for a stay (and these are starting prices, fancier rooms cost more). Still, the price is naturally for two, and thus quite competitive considering that an ordinary youth hostel might set a couple back over Y6000. (gn0sis, 2002)*

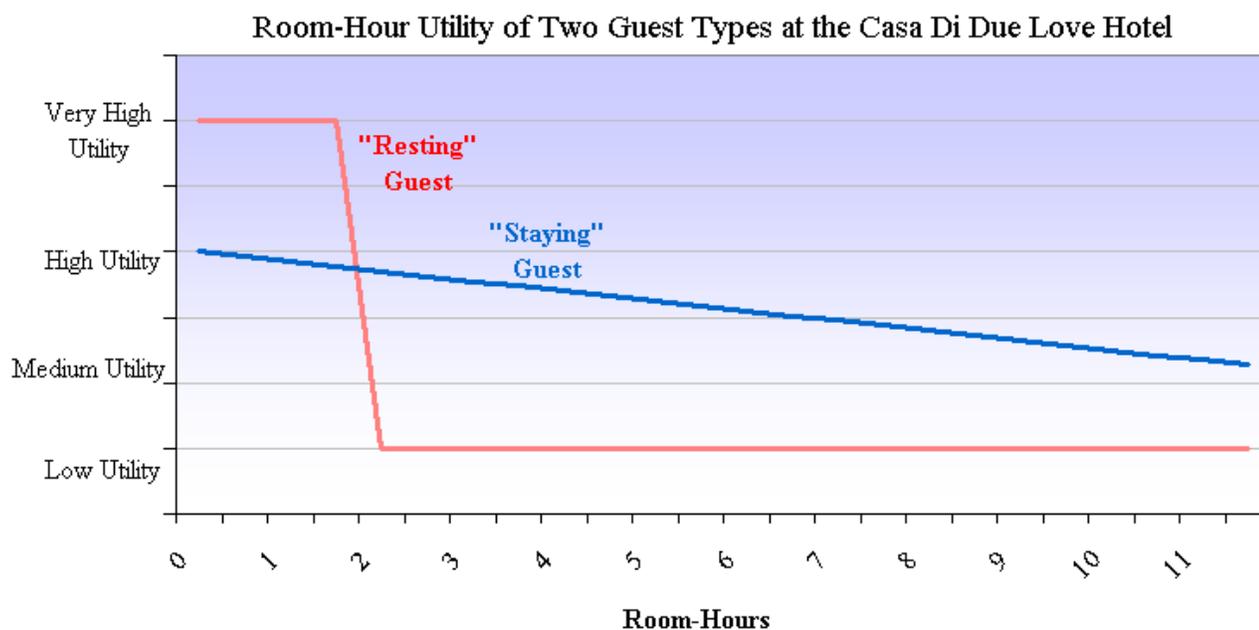
The Dogenzaka love hotel Casa Di Due offers a model. The hotel charges Y5000 for two hours, or Y10000 for a full room-day (we will assume a full day is 12 hours, since guests who purchase "stays" cannot check in until 10:00 p.m.). If the hotel can sell two "rests" per day, it is breaking even with the full day's rate. If it can sell more than two rests, then the love hotel strategy is superior. Between two rests and one stay, the hotel would prefer one stay – it requires only one housekeeping turnover, and less use of the kiosk.

From a VCI perspective, is the Love Hotel model superior to VCI in terms of room-hour utility maximization? As with the Peninsula Beverly Hills, the answer depends on occupancy. It also depends on the desired length of stay. At maximum occupancy, empty times are every bit as problematic as they were in Beverly Hills. Note that the pricing structure at the Casa Di Due *implies* a room-hour utility curve. By pricing a two-hour rest at half the cost of a 12 hour stay, they make the assumption that half of the room's nightly utility is contained in the first two hours of use. In other words:

- First Two Hours: Y2,500/hour
- Remaining 10 Hours: Y500/hour

Does the Casa Di Due really believe that the first two hours in a hotel room provide five times as much utility as the next 10 hours, on a per hour basis? Unlikely. What is more likely is that the hotel has identified two kinds of customers: one who has extremely high utility for 2 hours with no utility thereafter, and a second customer with an initially lower utility value on the room-hour – but one that does not fall off sharply.

**Figure 9**



The love hotels in Dogenzaka have found a way to price discriminate: to offer one price to the first type of guest, and another to the second type. In doing so it cannily extracts the maximum from each customer. Unfortunately for hotel operators who do not run love hotels, it is not always so easy to discern which guests have different personal utility curves and to segregate them in this manner.

*New York City's Airway Inn.*

The Airway Inn services neither the Hollywood rich and famous, nor the anonymous, amorous couple. It caters to airport travelers who arrive and depart at odd, unpredictable hours. As the travel guide service Gridskipper phrased it in a review:

*This locale, next to LaGuardia, could deter anyone who isn't already marooned in Queens. However, the airport location gives it some credibility -- instead of renting hourly rooms exclusively to prostitutes, they also rent to travelers enduring long layovers. Rates are \$61 for four hours, plus \$13 for each additional hour. After 9 p.m., it's \$70 for four hours and \$13 for each additional hour. (Kludt, 2007)*

It is important to note immediately that the very idea of hourly hotel rooms, or a prorated room night seems to carry the stigma of prostitution. No discussion of hourly rooms comes without the kind of disclaimer seen above. For VCI to take hold in the public imagination, it may be necessary to counter this perception. In the words of the Malaysian Budget Hotel Association:

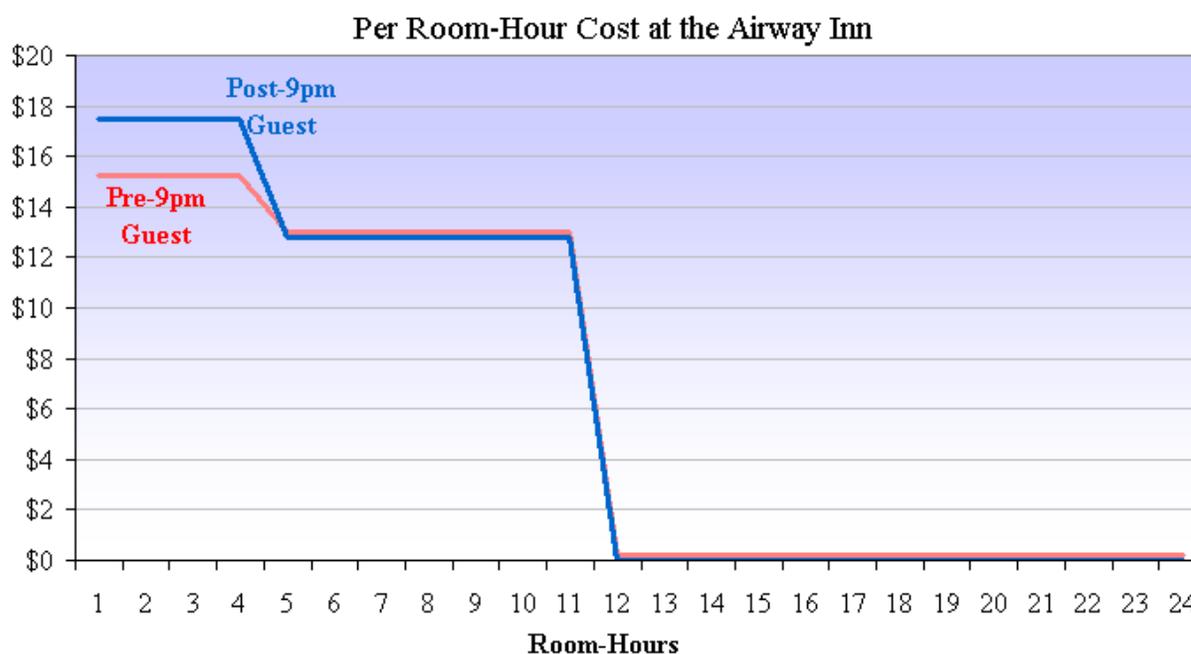
*It is time to change the negative connotations associated with hotels that provide "hourly usage" or "hourly rates" as the Malaysia Budget Hotel Association works toward creating an image of clean, comfortable and cheap accommodation. Indeed, bona fide tourists find the cheap hourly rates a boon, especially in cases of hotels located near bus stations, jetties, train stations and airports as they can freshen up before their departure. (Som, 2006)*

The Airway Inn has also created an interesting policy, one that seems well tailored to the habits of the traveler on a layover. The Inn offers 24 hour staffing at the front desk and 24 hour airport shuttle service. Rooms can be purchased at a daily rate of \$154, but hourly rates are also available at the figures quoted above. There are three guest types to consider at the Airway Inn:

- The full day guest - \$154 for 24 hours
- The pre 9:00 p.m. arrival hourly guest - \$61 for 4 hours, \$13/hour thereafter
- The post 9:00 p.m. arrival hourly guest - \$70 for 4 hours, \$13/hour thereafter

Note that the Airway Inn's pricing also implies a utility curve. The first four hours are high utility and cost \$15.25 an hour (\$17.50 if bought after 9:00 p.m.). The next seven hours are medium utility at \$13 an hour. The remaining 10 hours are low utility, and the hotel gives them away for free. We can say free because the full day rate costs the same as an 11 hour stay. The guest is better off buying a full day if staying longer than 11 hours.

**Figure 10**



The same “empty time” considerations apply. Only if the Airway Inn always had rooms free could this be a winning strategy. However, and similar to the Dogenzaka love hotels, the Inn could potentially sell the same room twice or more in a single day. If the Inn sold a room three times for \$61 each in a single day, the single day revenue would be \$183, more than the \$154

rate for a full day's stay. Enough of these multi-day sales could potentially offset the revenue problems caused by empty time.

### *Lessons*

The purpose of exploring these other pricing systems in depth is not merely to demonstrate that VCI has a better approach to non-standard check-in policy and pricing strategy. It is also to add weight to the argument that room-hours, room-hour utility, and room-hour based pricing are powerful concepts. That these ideas are already being exploited in the marketplace to the hotelier's advantage (though not always consistently and well). The Four Points Sheraton in Los Angeles, an airport hotel next to LAX, has just copied the Peninsula strategy and implemented a 24-hour check-in policy:

**Figure 11**

The image is a screenshot of the Four Points Sheraton LAX website. At the top, there are navigation links: "BOOK NOW", "24hr Check-In/Check-Out", and "Specials & Packages". The main content area features a large banner with the hotel's logo on the left, a photo of the hotel building in the center, and two photos of hotel interiors on the right. A dark blue banner across the bottom of the interior photos reads "24 Hr Check-In/Check-Out". Below the banner, there is a navigation menu on the left with items like "Home", "Property Overview", "Services", "Reservations & Rates", "Accommodations", "Four Comfort Bed", "Dining", and "Meetings & Catering". The main text area contains a paragraph about the 24-hour service, followed by a smaller paragraph explaining the benefits. To the right of the text is a large image of a red alarm clock with the text "24hr Check-In/Check-Out" below it.

(Four Points Sheraton LAX, n.d.)

While none of these hotel operators would articulate why their check-in policies are smart ideas in the language of room-hour utility, they surely intuitively understand the value of the discrete room-hour, and how the changing availability of room-hours affects what the guest

is willing to pay.

The advent of the check-in kiosk is part of the puzzle. Meant to alleviate the annoyance of interminable front desk lines, they are a monument to the inefficiency of the current system. Only by re-examining an age-old standard, the 3:00 p.m. room-day, and realizing that hotels need not abide exclusively by the schedule of ancient highway traveler, can hotels unlock this untapped revenue source that hides in plain sight.

## Methodology

In this section, the VCI Model is presented, and a demonstration offered using historic check-in data from a large (1,500+ rooms) Las Vegas strip hotel.

### *The VCI Model*

To understand the purpose of the VCI model, it would be useful to briefly recap the purpose of Variable Check-In Time. The theory contends that the value of a hotel room night can be broken down into discrete room-hour values, and that furthermore each room-hour confers utility (measured in utils) on the buyer. A hotel guest who buys a room-night, in this view, is buying a bundle of room-hours. By shifting the starting time of the room-day, or even offering multiple daily check-in times, a hotel could maximize the value of the rooms sold, permitting the rooms to command a higher rate.

If a hotel consults its records and identifies the arrival time of each historic guest, it can determine how many room-hours it sold over any given length of time. Once this information is in hand, a discrete room-hour value can be computed by dividing total room revenue by total room-hours sold over the given time period. If the hotel is prepared to make an estimate of room-hour utility, it becomes possible to compute how many utils were sold as well, and at what per-util price.

With this information, it is possible to “solve” for a new check-in time that, applied retroactively, would have maximized the total room-hours (or, total utils) sold for those historic arrivals. In this manner, a hotel could discover that a 6:00 p.m. check-in time would permit maximum overlap between guest stay and room-night, given known patterns of guest arrival.

Finally, a new average daily rate can be computed. The hotel would take the old price per room-hour (or price per util) and apply it to the new room-hours sold – resulting generally in a

higher ADR.

The VCI Model, a program written into a Microsoft Excel 2007 workbook, does most of the legwork in this process, requiring only that the user input a few raw numbers. The VCI Model uses a brute force technique to find its solutions. In essence, it considers every possible check-in time (or, for multiple daily check-in times every possible *combination* of times) and then chooses the best result among all the possible outcomes. A copy of the program is included on CD in the back of the paper.

The VCI Model can currently compute optimal check-in times for four scenarios:

- Best daily check-in time for maximizing room-hours sold
- Best daily check-in time for maximizing total utils sold
- Three best daily check-in times for maximizing room-hours sold
- Three best daily check-in times for maximizing total utils sold

### *A Brief Tour of the Model*

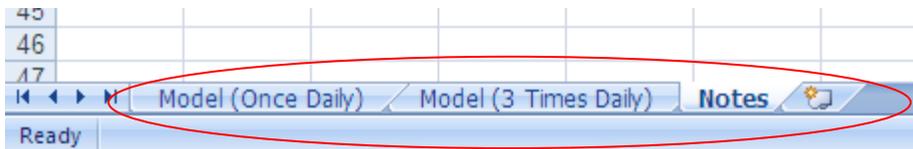
#### *Solving for One Daily Check-In Time.*

Using the VCI model involves two stages of data entry. First, the user must describe some of the operational parameters currently in use at the hotel being analyzed. These include current ADR, number of rooms in the hotel, and the current check-in and check-out times. Once these basic conditions have been inputted, the second step is to enter the historic check-in data. Doing this requires that the user has, of course, already collected this data. The user will need to come prepared with a list of arrival times and dates of all guests at the hotel, for a given date period. If guests are missing, then the optimization process will be faulty.

When a user boots up the VCI Model, the first decision to make is whether to solve for one daily check-in time, or three daily times. The user can choose between them by selecting

the desired tab at the bottom of the screen.

**Figure 12**



After selecting the first tab: “Model (Once Daily)”, the user inputs data in 13 fields, as shown here:

**Figure 13**

VCI Model	
One Check In Time Per Day	
<b>Required Data</b>	
Number of Rooms	10
Number of Guests	10
Old ADR	\$100
Old Check in Time	3:00 PM
Old Check Out Time	12:00 PM
# of Hours Guest can Check in Early	3
Hours a Guest Will Wait	4
<b>Room Hour Utility Assumptions</b>	
Hours of High Utility	10
Hours of Medium Utility	8
Hours of Low Utility	6
Value of High Utility Hour	100%
Value of Medium Utility Hour	50%
Value of Low Utility Hour	25%

Here, an explanation of these 13 fields:

- Number of rooms - Total rooms in the hotel
- Number of Guests - This refers to the total number of records in the data set. Every

check-in counts as one record

- Old ADR - The average daily rate for the time period of the historic data set
- Old Check-In Time - The hotel's official check-in time
- Old Check-Out Time - The hotel's official check-out time
- # of Hours Guest can check-in Early - Some hotels will allow a guest to check-in early for no fee if a clean room is available. Here, the user should enter the maximum number of hours a guest can check in early and pay no fee.
- Hours a Guest Will Wait: Here, the user must enter a number that represents how many hours a guest will wait before checking in. For example, if the estimate is "4", then the model will assume that a guest who arrives at 11:00 a.m. will wait until 3:00 p.m. to check in. If "2" had been entered, that same guest would not have waited until 3:00 p.m., because of an unwillingness to wait more than two hours. Early check-in and waiting-hours work in tandem. For example, if a hotel (a) permitted early check-in of up to three hours, (b) had a 3:00 p.m. check-in time, and (c) the guest was willing to wait four hours, then a guest arriving at 8:00 a.m. would wait until 12:00 p.m. and check in at that time.

Underneath these first seven data fields are the room-hour utility assumptions. As discussed in depth in the Introduction, this is where a user can estimate a function for room-hour utility. At present, the model cannot accept a true slope function in the form of  $y=mx+b$ . The model's simplified version allows users to divide the 24 hour day into up to three segments: high utility, medium and low. The high utility hour will always be equal to 1 util, and the user can specify what fraction of a util to assign to medium and low utility hours.

The last piece of data entry required is to tell the VCI Model when the guests from the historic data set checked in. Underneath "Arrival Time", the user can either paste in a column of

times, or manually select times from the pull down menu. As each arrival time is entered, numbers will appear in the grid to the right. These numbers represent the result of a what-if scenario: room-hours sold to that individual for every conceivable check in hour.

**Figure 14**

			Arrival Time	12:00 AM	1:00 AM	2:00 AM	3:00 AM	4:00 AM
<b>Enter the Arrival Time of Each Guest in Column F</b>	Guest	1	10:00 AM	11	12	13	14	15
	Guest	2	12:00 PM	9	10	11	12	13
	Guest	3	2:00 PM	7	8	9	10	11
	Guest	4	4:00 PM	5	6	7	8	9
	Guest	5						
	Guest	6						
	Guest	7	<input type="text"/>					
	Guest	8						
	Guest	9						
	Guest	10						

Observe the number 9 in the red, highlighted box. The way to interpret this is (a) the guest's arrival time was 12:00 p.m. and (b) the check-in time was 12:00 a.m. The number 9 indicates the room hours sold to this customer. He checks in at noon, but must vacate the room at 9:00 p.m. for a total of 9 hours. This calculation is done for every guest, for every possible check-in time, given the hotel policy parameters that the user has already assigned.

Once this data is entered, the user returns to the top of the worksheet where the results are available:

Figure 15

Results (No Utility Considerations Included)		Results (Utility-Based Valuation)	
Old Total Room Hours	210	Old Total Utility	145.8
Old Total Room Revenue	\$1,000	Old Total Room Revenue	\$1,000
Old Room/Hour Price	\$4.76	Old Price per Unit Utility	\$6.86
Optimal Check In Time	5:00 PM	Optimal Check In Time	5:00 PM
New Total Room Hours	221	New Total Utility	149.5
New Room Rate	\$105	New Room Rate	\$103
New Total Room Revenue	\$1,052	New Total Room Revenue	\$1,026
Additional Nightly Revenue (\$)	\$52	Additional Nightly Revenue (\$)	\$26
Additional Nightly Revenue (%)	5.2%	Additional Nightly Revenue (%)	2.6%

The results for room-hour maximization and util maximization are presented side by side. The top three rows in the results table show the old room-hours sold, the old ADR and the old price per room-hour (or util). This is for the user's reference. The subsequent rows show the VCI prescription. In this example, a new check-in time of 5:00 p.m. is advocated, as it boosts total room-hours sold from 210 to 221, and total utils sold from 145.8 to 149.5. ADR can be raised 5.2% on a dollar per-room-hour basis, or a more conservative 2.6% on a dollar per util basis.

*Solving for Three Daily Check-In Times.*

For the more complex solution of three optimal daily check-in times, the user should select the "Model (3 Times Daily)" tab at the bottom of the spreadsheet. Initially, the data entry will be the same. The user will enter all the same conditions and parameters as shown in Figure 13. But now, the data entry of the historical records is somewhat different:

Figure 16

Total Guests		10:00 AM							
		2:00 PM	3:00 PM	3:00 PM	3:00 PM				
		6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	7:00 PM	8:00 PM	9:00 PM
11	12:00 AM	15	16	17	18	19	16	17	18
8	1:00 AM	12.50	13.00	13.50	14.00	14.25	13.00	13.50	14.00
		14	15	16	17	18	15	16	17
4	2:00 AM	12.00	12.50	13.00	13.50	14.00	12.50	13.00	13.50
		13	14	15	16	17	14	15	16
1	3:00 AM	11.50	12.00	12.50	13.00	13.50	12.00	12.50	13.00
		12	13	14	15	16	13	14	15
1	4:00 AM	11.00	11.50	12.00	12.50	13.00	11.50	12.00	12.50
		11	12	13	14	15	12	13	14
1	5:00 AM	10.50	11.00	11.50	12.00	12.50	11.00	11.50	12.00
		10	11	12	13	14	11	12	13
		10.00	10.50	11.00	11.50	12.00	10.50	11.00	11.50

The colored stripes seen here in Figure 16 have been added to aid in the explanation. In the green striped column, the user must enter the *total number* of guests who arrived at each hour. Which is to say: all guests in the historic data set must be assigned an arrival hour, and then the user must total all the 1:00 a.m. arrivals, followed by all the 2:00 a.m. arrivals, and so on. When the user has arrival totals for each of the possible 24 hours, those totals must be inputted into the green striped column. Here in the example, 11 individuals from the data set arrived at the 12:00 a.m. hour, 8 individuals arrived at the 1:00 a.m. hour, and so on.<sup>3</sup>

In the red striped row are all possible combinations of three check-in hours. There are 2,024 such unique combinations. For the purpose of simplicity for the example, the list has been shortened. No times earlier than 10:00 a.m. or later than 10:00 p.m. were considered, and each time was spaced no fewer than four hours apart. This has produced 35 possible combinations.

The blue striped row shows calculations of room-hours sold, considering all manually

<sup>3</sup> We consider the 12:00 a.m. arrival hour to mean the guests who arrived between 11:30 p.m. and 12:29 a.m., not the guests who arrived between 12:00 a.m. and 12:59 a.m.

entered parameters. In this case, the guest arrived at 4:00 a.m. The first numerical result shown on the blue stripe is 11. The interpretation: the 4:00 a.m. arrival guest could choose one of three check-in times (10:00 a.m., 2:00 p.m. or 6:00 p.m.). The most convenient one from a 4:00 a.m. arrival's point of view is the 6:00 p.m. check-in time, since it has the most distant check-out time (3:00 p.m.). A 4:00 a.m. to 3:00 p.m. stay is 11 hours long, hence the number 11 in the cell. The gray stripe underneath is the corresponding number of utils for that stay.

When all data is entered, the model performs its brute force calculations. Every guest is paired with every combination of 3-check-in-times; and in each case the model picks the one time of the three that would be most agreeable to that particular guest. All room-hours and utils are totaled for every combination, with the model selecting the one that offers the most room-hours or utils sold, given the data set.

In most cases, optimizing for three daily check-in times will produce more total room-hours and more utils for the historic data set than the optimal single daily check-in time, and will never produce fewer hours or utils. As such, three daily check-in times will generally be a superior proposition to a single best daily check-in time from a utility maximizing perspective.

#### *A Demonstration of the Model*

For the demonstration, an anonymous Las Vegas strip hotel with over 1,500 rooms has donated a historic data set to be optimized by the VCI Model. The data set contains over 370,000 records of check-in times, each recorded by day, hour and minute. These records represent every check-in processed by the hotel for two full calendar years, from November 2004 to November 2006. The average daily rate of the hotel over this two year period is unknown, but for analytical purposes here it will be assumed to be \$100 – not because \$100 is accurate, but so that the VCI deviation from it will be easily understood as a percentage.

The complete entry:

Number of rooms:	1,500
Number of Guests:	373, 482
Old ADR:	\$100
Old Check-In Time:	3:00 p.m.
Old Check-Out Time:	12:00 p.m.
# of Hours a Guest Can Check-In Early:	3
# of Hours a Guest Will Wait:	4
Hours of High Utility:	10
Hours of Medium Utility:	8
Hours of Low Utility:	6
Value of High Utility Hour:	100%
Value of Medium Utility Hour:	50%
Value of Low Utility Hour:	25%

The data itself has been included on the CD at the end of the paper.

### *Results.*

Here, the results of the demonstration for (a) one best daily check-in time (Figure 17), (b) three best daily check-in times (Figure 18), and (c) the room dedication breakdown for each of the three daily check-in times (Figure 19).

Figure 17

Results (No Utility Considerations Included)		Results (Utility-Based Valuation)	
Old Total Room Hours	7194168	Old Total Utility	5297430.8
Old Total Room Revenue	\$37,349,600	Old Total Room Revenue	\$37,349,600
Old Room/Hour Price	\$5.19	Old Price per Unit Utility	\$7.05
Optimal Check In Time	5:00 PM	Optimal Check In Time	3:00 PM
New Total Room Hours	7255930	New Total Utility	5297430.8
New Room Rate	\$101	New Room Rate	\$100
New Total Room Revenue	\$37,670,247	New Total Room Revenue	\$37,349,600
Additional Nightly Revenue (\$)	\$320,647	Additional Nightly Revenue (\$)	-
Additional Nightly Revenue (%)	0.9%	Additional Nightly Revenue (%)	-

Figure 18

Results (No Utility Considerations Included)		Results (Utility-Based Valuation)	
Old Total Room Hours	7194168	Old Total Utility	5297430.8
Old Total Room Revenue	\$37,348,200	Old Total Room Revenue	\$37,348,200
Old Room/Hour Price	\$5.19	Old Price per Unit Utility	\$7.05
Optimal Check In Time	10am/3pm/9pm	Optimal Check In Time	10am/3pm/9pm
New Total Room Hours	7530944	New Total Utility	5406795.0
New Room Rate	\$104.68	New Room Rate	\$102.06
New Total Room Revenue	\$39,096,557	New Total Room Revenue	\$38,119,245
Additional Nightly Revenue (\$)	\$1,748,357	Additional Nightly Revenue (\$)	\$771,045
Additional Nightly Revenue (%)	4.7%	Additional Nightly Revenue (%)	2.1%

Figure 19<sup>4</sup>

Hour	Rooms Dedicated	Percentage Dedicated
Check-In 1 10:00 a.m.	386	25.73%
Check-In 2 3:00 p.m.	738	49.18%
Check-In 3 9:00 p.m.	376	25.09%
Total	1,500	100.00%

<sup>4</sup> To preserve the hotel's anonymity, we have rounded the total number of rooms from the true number down to 1,500.

### *Limitations of the Data Set*

There are two significant limitations to the data set used in the VCI model demonstration. Though the data is accurate – presenting discrete records of check-in for two calendar years – it creates a slightly imperfect base from which to draw VCI conclusions.

First, there is a “chicken and egg” problem. Did people historically arrive at 3:00 p.m. because it reflected their true arrival preference? Or did they arrive at 3:00 p.m. because they knew it was the check-in time? The VCI model requires the former, while the latter is surely reflected in the data set. The VCI model considers an actual arrival time to be a “preference”, and models its solutions accordingly. But many people have a preference to arrive at a time when they know the hotel can accommodate them. The logic becomes circular. 3:00 p.m. is the best check-in time because that’s when people arrive, and people arrive at 3:00 p.m. because that is check-in time. A purified data set would have to find a way to get at true preference, untainted by expected check-in times.

The second limitation concerns morning arrivals. If a guest arrived at the hotel at 11:00 a.m., was told his room wouldn’t be ready until 3:00 p.m., and then finally checked in at 3:00 p.m., then the data set treats that guest as a 3:00 p.m. arrival with a 3:00 p.m. preference. That guest should have been treated as an 11:00 a.m. arrival. This problem would not impact the post 3:00 p.m. arrivals, since generally these people would be accommodated with a room immediately.

Put together, these two problems could have potentially skewed the results with an unknown severity. The effect of the first problem would be to cluster data points around 3:00 p.m., and the effect of the second would be to push morning data points forward in time by a few hours, also clustering around 3:00 p.m. The combined effect is a clustering of arrival points at

3:00 p.m. that (a) does not fully reflect true guest preference, and (b) would tend to lead to an overly conservative VCI prescription, one that would not deviate far enough from the status quo.

### *Discussion of Results*

It is important to draw attention to what the demonstration was meant to accomplish. The demonstration of the VCI Model should not be confused with an actual VCI trial. No actual guests were subjected to non-standard check-in times and adjusted room rates. The demonstration cannot prove or disprove the validity of VCI's assertions. The purpose of the demonstration was twofold:

1. The demonstration was meant to show how the VCI Model can process a large body of data and produce a coherent, detailed prescription
2. The demonstration was a reality check on the basic assumptions of VCI.

What is meant by "reality check" in this context? From the perspective of the VCI theorist, there were several possible results to the demonstration that would have raised serious concerns regarding VCI's validity as a theory. The first of these possibilities was that the Model's prescription would be a dramatic departure from the status quo. The prescription, in that case, would indicate a non-intuitive optimal check-in hour, and a significantly higher room rate. This would be a serious red flag. If optimal room rates and check-in times were truly so far removed from their status quo positions, one would wonder how hotels could be thriving under current policies. More likely, VCI would be operating under some erroneous assumption, or else a flaw would be present in the model.

Another possible result that would conflict with intuition would be a prescription advocating no change at all from the status quo. If, after looking at two years of check-in data, the VCI model had concluded that the status quo was already optimal, it would belie the claim

that VCI could be an effective tool to raise revenue and drive customer delight.

The results as observed however display neither of these characteristics and are quite encouraging. (a) Knowing that the data set biases check-in times toward 3:00 p.m., and (b) using a conservative estimate of room-hour utility (one in which room-hour utility declines quickly and steeply) the one day optimal check-in time (no utility considerations) was found to be 5:00 p.m. This is a modest departure from the status quo, with a correspondingly modest rise in room price of just under one percent. As the full data set shows, people start showing up at 12:00 p.m. to the hotel in large numbers. The influx is steady until 5:00 p.m., after which it tapers off rapidly. In such an environment, it is logical that you would want official check-in time to be at the end of the peak arrival period; the early arriving guests would have access to rooms as soon as they were available (clean), and the late arriving guests would be accommodated immediately. The real gain though is at check-out time, which has been moved to 2:00 p.m. Now, every guest in the hotel that arrived during the peak hours of 12:00 p.m. and 5:00 p.m. will enjoy an extra two hours in the room, raising their room-hour utility total and justifying the higher room price.

When a utility assumption was added, the one day optimal check-in time remained 3:00 p.m. As such, there was no change in recommended ADR. Because the addition of utility as a consideration tends to decrease the value of the last hours in a room-day, the model concluded that the move to 5:00 p.m. didn't add sufficient value after all and couldn't be recommended.

The three day optimal check-in time prescription was for a 10:00 a.m. / 3:00 p.m. / 9:00 p.m. schedule, with 26%, 49% and 25% rooms dedicated to each time, respectively. This is consistent with both a bias toward 3:00 p.m. arrivals in the data set, and the knowledge that arrivals are just as likely (at this hotel) to occur in the early morning as they are in the late evening. The bias that pushes morning arrivals closer to 3:00 p.m. may explain why 10:00 a.m.

was a preferred check-in time over 9:00 a.m.

With the three day optimizing, a greater increase in room price is justified because the number of utils sold is commensurably higher than it was in the one day check-in time solution. This is the real benefit of implementing a three day check-in time policy: it permits more guests to be matched to rooms that offer maximum utils.

Without a utility consideration, the model prescribed an ADR increase of 4.7% for the three daily check-in times. When utility was added, the model prescribed an ADR increase of 2.1%. In real dollars, (again, assuming an original \$100 ADR) that extra revenue amounts to \$771,045 over the two year period.

### *Conclusions*

This paper has made a case for hotels to adopt a variable check-in time policy, where multiple daily check-in times are offered for full 21 hour stays. The core of the argument has been that the “value” a customer perceives in his room purchase can be broken into hourly units called room-hours. Furthermore, if the hotel can sell more room-hours to the guest by choosing a room-day start time that pairs well with the guest’s arrival time, the hotel can charge more (at no significant cost to itself) for the extra room-hours it is selling.

The argument has been buttressed by the examination of current hotel practices in instances where hotels are charging hourly, or using non-standard check-in hours. Clearly, some hotels realize the value of the discrete room-hour.

A spreadsheet that can perform check-in time and room-pricing optimization when fed historic arrival data was shown in detail. A demonstration of the spreadsheet’s capability was offered, using two years of historic check-in data from a large, Las Vegas strip hotel. The demonstration resulted in a prescription: the hotel should adopt 3 daily check-in times – at 10:00

a.m., 3:00 p.m. and 9:00 p.m. Room rates should be raised 2.1%, and the rooms to dedicate to each check-in time should be 26%, 49%, and 25%, respectively. The method of the Model was to calculate what each guest had paid per util, historically, then maximize potential utils through the altering of check-in times, and then apply the old per-util price to the new total of utils sold - arriving at a new room rate.

Other ancillary topics were raised that merit future study. Among them:

- How customers would perceive and react to the VCI policy
- The operational efficiencies/deficiencies that could arise from a VCI policy
- How best to implement VCI
- The migration of guests from up-market hotels to down-market hotels as the room-day elapses
- How exactly a hotel would calculate an average room-hour utility curve for its guests
- Whether customers could be persuaded that unusual check-in hours and hourly room rates were not necessarily related to prostitution
- Which hotel markets would benefit most from VCI implementation, and which least

As the length of the list shows, this is hardly a closed topic. This paper scratches the surface of the room-hour valuation concept and is meant to open a discussion, not to close the book on the subject. It is a starting point for hotels to examine their room pricing from a new perspective, and to address longstanding customer headaches. The force of inertia is strong in hotel operations – nearly as strong as the drive to succeed and lead the market. It will not be easy for hotel operators to abandon something as well established as the 3:00 p.m. to 12:00 p.m. room-day. But at the end of the transition to VCI is an engine for profit-making whose limits are as yet unknown.

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