USING DYNAMIC PRICING TO TARGET OFF-PEAK HOURS IN A BRICK-AND-MORTAR SERVICE ENVIRONMENT TO INCREASE REVENUE

by

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Master of Digital Media

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Abstract

This paper will analyze and consider the effect dynamic pricing (also known as: flexible pricing, demand pricing, time-based pricing and surge pricing) has on the current business environment and how it can potentially be applied to small to midsized brick and mortar service businesses specifically through the use of dynamic discounts. Utilizing a metasynthesis research method, this paper will analyze existing qualitative research and overarching themes and provide a simplified interpretation. The interpretation will be applied to several real-world use cases, analyzing the similarities and differences between those cases. This paper will propose a solution, that utilizes dynamic pricing through discounts to increase revenue by utilizing the metasynthesis and cases as justification.

Dedication

In dedication to my partner, Reisha Fernandes.
Thank you for your infinite support and encouragement.

Also, for pointing out an error that saved my paper.
You joked about half my degree being yours, but this dedication will have to do.

Acknowledgements

I would personally like to thank all those who helped me throughout this journey and helped steer me in the right direction when I began to lose my way. I would like to thank Sean Wise, my supervisor, for being tough but always pushing me towards greatness. Thank you to my second reader Michael Carter for helping light the way and making the big picture more digestible and easy to navigate. I want to thank the entire MDM 6.0 cohort for their endless source of entertainment and friendship. Most of all, I want to thank Teodor "Teo" Herman for being a great friend, staying up and meeting late to help me when I needed it, and continuously pushing me through towards the end.

Table of Contents

Table of Figures

Glossary of Terms

Capacity: The number of customers or volume a business can accommodate. In a physical service business, this could be seats in a restaurant or a time slot for an activity.

Capacity Utilization: How much capacity a business is using at a time. An airplane may have one hundred seats but if only sixty are occupied, the airlines capacity utilization is sixty percent.

Congestion: When capacity is nearing full or volume exceeds capacity and it becomes crowded. Congestion of a service puts strain on the service and could lead to a decrease in quality or performance.

Congestion Pricing: Changing prices with the goal of reducing congestion and moving excess demand to areas of lower demand.

Demand Pricing: Changing prices relative to demand. The higher demand is, the higher prices will be. The lower the demand, the lower the prices.

Dynamic Pricing: Changing prices continuously relative to demand. Prices change much more frequently and adapt to real-time market conditions.

Fences/Fencing: Customers are segmented based on their willingness to pay. The purpose is to try and sell first to those who are willing to pay more.

Real-Time Pricing: Changing prices in real-time based on market conditions.

Revenue Management: The process of allocating the right type of capacity to the right kind of customer at the right price at the right time (Kimes, 1989) through the right distribution channel (Basak Denizci Guillet & Ibrahim, 2015) so as to maximize revenue or yield.

Surge Pricing: A term popularized by Uber. Similar to dynamic pricing with the goal of increasing prices to lower demand and keep supply in line with demand.

Time of Use (ToU) Pricing: Prices change based on what time a service is being used. Prices change less frequently than real-time pricing.

Yield Management: Similar to revenue management but a less frequently used term.

Demand Discount Principles			
#	Principle	Reasoning	Sources
1	Decrease prices as demand decreases.	Lowering prices during off-peak demand can be used to increase capacity utilization.	(Cleophas et al., 2017; Deksnyte et al., 2014; Jones & Hamilton, 1992; Ortega, 2016; Zheng & Forgacs, 2017) Figures **3**, **4**, **5**, and **6** Sections: **4.5**
2	Increase prices as demand increases.	Prices do not necessarily have to go above the regular price but should increase once demand begins increasing from a lower point.	(Chen & Sheldon, 2016; Cleophas et al., 2017; Deksnyte et al., 2014; Shapiro & Drayer, 2012) Figures **3**, **4**, **5**, and **6** Sections: **4.5**
3	When a service is perishable and capacity is limited, inventory allocation and price setting should be optimized.	Customers who are willing to pay more should be the focus. Prices should be set so that customers are paying the price they are willing to pay rather than anything less.	(Baker & Collier, 2003; Cleophas et al., 2017; Cross, 1997; Elmaghraby & Keskinocak, 2003; Kimes, 1989; Ng et al., 2018; Rania El Haddad, 2015; Yeoman et al., 2001, 2001)
4	Businesses need a valid reason for increasing prices more than for the sake of increasing revenue.	Without a "positive" reason for increasing prices, customers may deem the business practice unfair which could lead to a decrease in revenue.	(Bolton et al., 2003; Dixit et al., 2014; Kimes & Wirtz, 2002, 2003; Suklabaidya & Singh, 2017) Section: **4.3**
5	When fencing customers, businesses need to manage relationships with customers to avoid being perceived as unfair.	Businesses can manage relationships by providing customers more transparent information or provide additional benefit to offset any booking restrictions or reasoning for price differences.	(Campbell, 1999; Dixit et al., 2014; Gibbs et al., 2018; Xia & Monroe, 2017) Sections: **4.3**; **4.5.2.2**
6	Lowering prices during off-peak business hours can move customers from on-peak demand to off-peak demand	By moving customers from on-peak demand to off-peak demand can mitigate congestion and excess demand during on-peak periods.	(Gao et al., 2019; Halvorsen et al., 2016; Honkapuro et al., 2014; Norford et al., 1998) Sections: **4.5.1.3**; **4.5.3**

7	Strictly dynamic discount methods are not a solution for all businesses.	When there is a need for a service and customers are willing to pay more, increasing prices beyond normal prices may be a more beneficial model.	(Elmaghraby & Keskinocak, 2003; Ng et al., 2018; Pergler et al., 2015) Sections: **4.2**; **4.5.1**; **4.5.2**; **4.5.4.2**
8	Businesses must be wary of customers who seek discounts strategically.	Business can lose out on a full-price sale if customer behaviour is not targeted. Certain customers may only utilize a service when a discount is available.	(Cachon & Swinney, 2009; Gönsch et al., 2013; Silverstein & Butman, 2006) Section: **4.3**
9	Information is key when trying to develop a dynamic pricing and forecasting model	Information on customer behaviour, competitor behaviour, and environmental influences should be collected on a broad and continual bases. This data should be analyzed systematically and be used in future pricing decisions.	(Aktas & Meng, 2017; Bouchet et al., 2016; Boyd & Bilegan, 2003; Burger & Fuchs, 2005; Cleophas et al., 2017; Elmaghraby & Keskinocak, 2003; Norford et al., 1998; Weatherford et al., 2001; Yeoman et al., 2001) Figure **7** Section: **4.4**

1. Introduction

Many service businesses go through ebbs and flows of demand. A problem many brick-and-mortar service businesses have is their inability to run at full capacity at all times. Capacity is the number of customers a business can service at one time. In the service industry, businesses can use seats, or time as a unit of inventory to measure their capacity utilization (Yeoman, McMahon-Beattie, & Sutherland, 2001). With a brick-and-mortar service industry business, capacity is fixed and perishable meaning it cannot be stored over time. If a restaurant or salon for example does not have every seat filled at a particular hour of the day, that time where any seat is empty is revenue that is lost forever. If a business can fill every seat, they are maximizing revenue. Demand patterns can often be uncertain in the service industry, causing management to struggle with capacity management (Klassen & Rohleder, 2001). Through a simple economics supply and demand curve, we see that the more supply there is, the lower prices go, if there is a shortage of supply, we can see prices increase. A more detailed look can be seen in **Figure 3** to **Figure 6**.

A direct result of oversupply of service, or lack of demand, is businesses offering discounts to encourage customers to purchase during off-peak business hours. We can see examples of this through hotel booking sites like Hotels.com, airline booking sites like flighthub.com, Groupon which promotes discounts of smaller retail and service companies, or even the business itself offering discounts like "happy hour" or limited time coupons. These discounts may be time restricted, meaning they can only be redeemed during these typically off-peak hours. This method can potentially lead to greater demand, and while larger companies like hotels or airlines have more robust systems, when handled in house, self-promoted discounts may lack the timeliness and effective data collection and analysis to maximize revenue (Bouchet, Troilo, & Walkup, 2016). In-house discounts may be planned days or weeks in advance, but demand may shift and a business may see itself busier than usual, giving away discount when in reality they should not (Ng, Cui, & Harrison, 2018). When there is unfilled capacity, a business experiences a decrease in revenue and profit.

To target these loses of revenue during these off-peak hours, several industries have been using what is known as dynamic pricing. Dynamic pricing is the idea that businesses frequently change prices based on demand or supply conditions at certain times (Hanna, Smith, & Lemon, 2015). Airlines and hotels were two of the first industries that began using this method (Elmaghraby & Keskinocak, 2003). If an airline is unable to sell a seat before the plane flies, or a hotel is unable to sell a room (Aziz, Saleh, Rasmy, & ElShishiny, 2011), both will still incur costs. To fill seats or rooms during off-peak times, hotels and airlines have used dynamic pricing to minimize losses. More recently, companies like Uber and Lyft have used dynamic pricing, or what they call “surge pricing”, to increase prices when demand is higher than usual (Chen & Sheldon, 2016). Hotels and airlines can also increase costs during high demand to maximize revenue. Many smaller service businesses lack the technology or knowledge to provide dynamic pricing let alone accurate forecasting (Burger & Fuchs, 2005; Elmaghraby & Keskinocak, 2003; Yeoman et al., 2001) to mitigate losses from unsold service hours.

If a small business could access substantial amounts of data on customer demand, could they change their prices frequently and accurately enough to maximize revenue? Would customers be willing to pay a price increase from a small business, especially if there are many nearby alternatives or substitutes for a customer to choose from? The purpose of this paper is to summarize the affect dynamic pricing has in the market and synthesize demand discount principals and then applying those principals to small-sized service business, more specifically with the idea of prices that can only change between a standard price and a discounted rate. This is done through a qualitative analysis of research related to dynamic pricing in the service industry where the business has a physical location which enforces a maximum capacity.

The paper is organized as follows. Section 2 discusses the problems that warrant the need for this study. It will discuss the hypothesis and clarify the scope of the research. Section 3 will discuss the methodology for this research. Typically, methodology comes after the literature review, but the literature review and synthesis are the research, so understanding how the literature review is being done is of importance. Section 4 is the literature review which is the metasynthesis. The research will synthesize different terms related to dynamic pricing, the history of dynamic pricing, and a case analysis of prolific companies and industries that use dynamic pricing and their relation to the hypothesis. Concluding remarks will follow in section 5 as well as future implications and a discussion of a potential solution.

2. The Problem

2.1. Rationale

Research on dynamic pricing with relation to the service industry has often been limited to businesses that lack hard capacity limits or businesses where the players are large with high barriers to entry (Deksnyte, Lydeka, & Pukeliene, 2014). The effects of dynamic pricing on revenue are very apparent in certain industries where the players are capable of gathering and processing the data. Hotels, airlines, and utility companies are among some of the few industries that have been using dynamic pricing for the past several decades (Cross, 1997; Weatherford, 1998).

Where there is a lack of research available on the effects of dynamic pricing, is on small to midsize brick-and-mortar service businesses (Debely, Dubosson, & Fragniere, 2008;

Elmaghraby & Keskinocak, 2003). These include for example, restaurants, salons, entertainment facilities, auto shops, and more. While there are some examples of smaller businesses utilizing dynamic pricing, it is often theoretical (Aktas & Meng, 2017; Deksnyte et al., 2014; Schlosser, 2015), and has often been limited to services that utilize both price increases and decreases (Dixit, Hall, & Dutta, 2014), with discounts often being limited to specifically goods (Cachon & Swinney, 2009; Schlosser, 2015). In addition, there is also a lack of apparent research on using dynamic pricing, strictly through discounts by targeting off-peak hours to increase revenue.

The paper will look at several themes, including dynamic pricing, congestion pricing, capacity smoothing and discount methods across different service industries where the business requires a physical space that constrains capacity.

2.2. Problem to be Investigated

This research paper intends to examine the history of dynamic pricing in the brick-and-mortar service industry and how it is currently used today. Through a line-of-argument metasynthesis, this project intends to compare and contrast the use of flexible pricing through history as well as in today's physical service environment and then forming interpretations based on that data. This paper will then argue the feasibility of a small to midsize brick-and-mortar service businesses using dynamic pricing to target off-peak business hours to increase revenue strictly using discounts rather that the increasing and decreasing of a base price. This paper will also analyze the effect dynamic pricing has on shifting on-peak demand towards off-peak demand. Finally, this paper will contribute to addressing the literature gaps mention in section **2.1**.

2.3. Research Questions to be Investigated

The goal of this paper is to review existing material on dynamic pricing and fill the literature gap of dynamic pricing applicability to small brick-and-mortar service businesses. By selecting, appraising, summarizing, and combining qualitative evidence through a qualitative metasynthesis this research looks to address the impact dynamic pricing has on revenue and congestion. This will be analyzed through two research questions.

RQ1. How can the existing research on dynamic pricing be applied to a small brick and mortar service business with limited capacity as a way to maximize revenue?

RQ2. What impact might dynamic pricing through discounts have on small brick-and-mortar service businesses with limited capacity?

2.4. Scope of Research

This research is limited in scope to effectively target the research questions and come to a more logical conclusion. This research is on service businesses and does not analyze research done on business that strictly sell goods. Services such as restaurants that sell a combined good and service are included. The purpose for this is many goods can be stored over time and can be sold at a later date while services do not have the ability to be stored and are lost at time of creation.

This paper will also not be looking at research on service businesses that do not have a physical capacity limitation. If the company can change capacity without altering their physical space, they are not included.

2.5. Summary

Dynamic pricing is the idea that pricing is flexible, and prices can be changed based on demand at a certain point of time. Many industries and large companies such as airlines, hotels, and uber utilize dynamic pricing in some form as a way to increase revenue by delivering the right service, to the right people, at the right time (Kimes, 1989).

Currently, there is a lack of research in the area of dynamic pricing as it relates to small to midsize service businesses that require a brick-and-mortar location and their lack of ability to scale capacity (Debely et al., 2008; Elmaghraby & Keskinocak, 2003).

The objective of this research project is to:

- Lay the groundwork for a more complete research study in the future.
- Analyze existing qualitative research and interpreting any overarching themes on dynamic pricing and the service industry.
- Understand the similarities and differences of the existing research and how it can be drawn together to form new interpretations.
- Applying the analysis data to real-world case examples and inferring the probability of success of:
    - Dynamic pricing in small to midsized service businesses that require a brick-and-mortar location that limits capacity.
    - Dynamic pricing strictly through discounts to minimize lost capacity and increase revenue.
    - Targeting off-peak business hours to increase revenue and smooth capacity utilization.

3. Research Procedures

3.1. Research Methodology

Due to the lack of apparent specific research, to provide a study on the history of dynamic pricing in the service industry and the relation on small to midsize brick-and-mortar services businesses, this study adopted a qualitative research method.

A qualitative research method requires a systematic approach to collecting, analyzing, and interpreting results across studies. The systematic process involved locating, evaluating and selecting existing studies relevant to this area of study. The research is analyzed, compared and contrasted, then synthesized in a way that shows any results and findings in a clear and logical manner (Toye et al., 2014).

This specific qualitative research method is known as a line-of-argument metasynthesis. A metasynthesis largely relies on interpretations of other primary studies and involves extending beyond the findings of any individual research papers. The goal is to develop an interpretation whose whole is greater than the sum of its individual parts. That interpretation is then used to make an argument about a specific point which in this case is the research question listed in section **2.3**.

3.2. Specific Procedures

To locate research articles relevant to this study, a keyword search was performed on two online databases. The first is ProQuest., a database that included many business focused research articles. The second is Ryerson University Library and Archive (RULA). The keywords focused on terms related to dynamic pricing, the service industry, and qualitative research studies. Several limiters were also placed on the results. The search criteria for ProQuest is as follows:

Search Terms:

"dynamic pricing" **OR** "real-time pricing" **OR** "real time pricing" **OR** "flexible pricing" **OR** "flexible prices" **OR** "congestion pricing" **OR** "congestion smoothing" **OR** "demand pricing" **OR** "time-based pricing" **OR** "surge pricing" **OR** "surge-price"

AND

"qualitative" **OR** "qualitative study" **OR** "qualitative method" **OR** "qualitative analysis"

AND

"service" **OR** "service business" **OR** "service industry”

Limiters: English, Peer Reviewed, Full Text

Results: 627

The search terms for Ryerson University Library and Archives (RULA) were the exact same. The limiters on the search were modified to narrow down the scope.

Limiters: English, Online Items Only, Scholarly and Peer Reviewed, Include Business and Economics Discipline, Exclude all other Disciplines

Results: 740

Due to RULA's inability to export multiple sources at once to a reference manager, the first 200 sources sorted by relevance. These 200 sources were screened based on article title and abstract using the inclusion/exclusion criteria below. 25 articles were extracted from the RULA.

In addition, after narrowing down the papers through the criterion in the following section, any citations from these papers that occurred frequently or made relevant points were studied and analyzed using the inclusion/exclusion criterion. This led to an additional 40 papers

The resulting articles of this search included a broad range of topics, many which were outside the scope of this paper or were irrelevant. The papers were analyzed systematically, first based on their title, then based on their abstract, then finally based on the content of the paper

Inclusion Exclusion Criteria

The criteria for the papers were based on six conditions.

First, the article needed to be a full-text research paper. Book reviews and annotated listings were removed as they did not contribute any new knowledge and were often irrelevant to the research topic.

The second criterion was that the article had to be specifically about a service business of a mixed service good business. The goal of this research paper is to determine the effectiveness of dynamic pricing for small to midsize service businesses. If a paper was only about dynamic pricing for goods, it was excluded. Mixed service and good businesses (such as restaurants) were included as the information provided may be relevant to a business that is exclusively service oriented.

The third criterion was that the article had to specifically talk to an impact on revenue or costs. As one search term included "congestion", many articles about traffic congestion appeared which are not relevant in the context of this study.

The fourth criterion was the business required some form of physical limitation on size or capacity, similar to the limitation of capacity of a brick-and-mortar service business. Online businesses that have near limitless capacity were excluded. Energy companies were not excluded as there is a limit on output capacity as well as the fact that energy companies were one of the first industries to utilize dynamic pricing, which was deemed important enough for this study.

The fifth criterion was that the article had to discuss the selling of a service to another party. This included, business to business (B2B) and business to consumer (B2C). Any articles that only focused internally and discussed supply chain management were excluded.

The sixth criterion was that the article needed to have an adequate portion of the data discussing some sort of flexible pricing method. If any of the search terms regarding pricing listed above were only mentioned once and occupied less than a full paragraph, it was excluded.

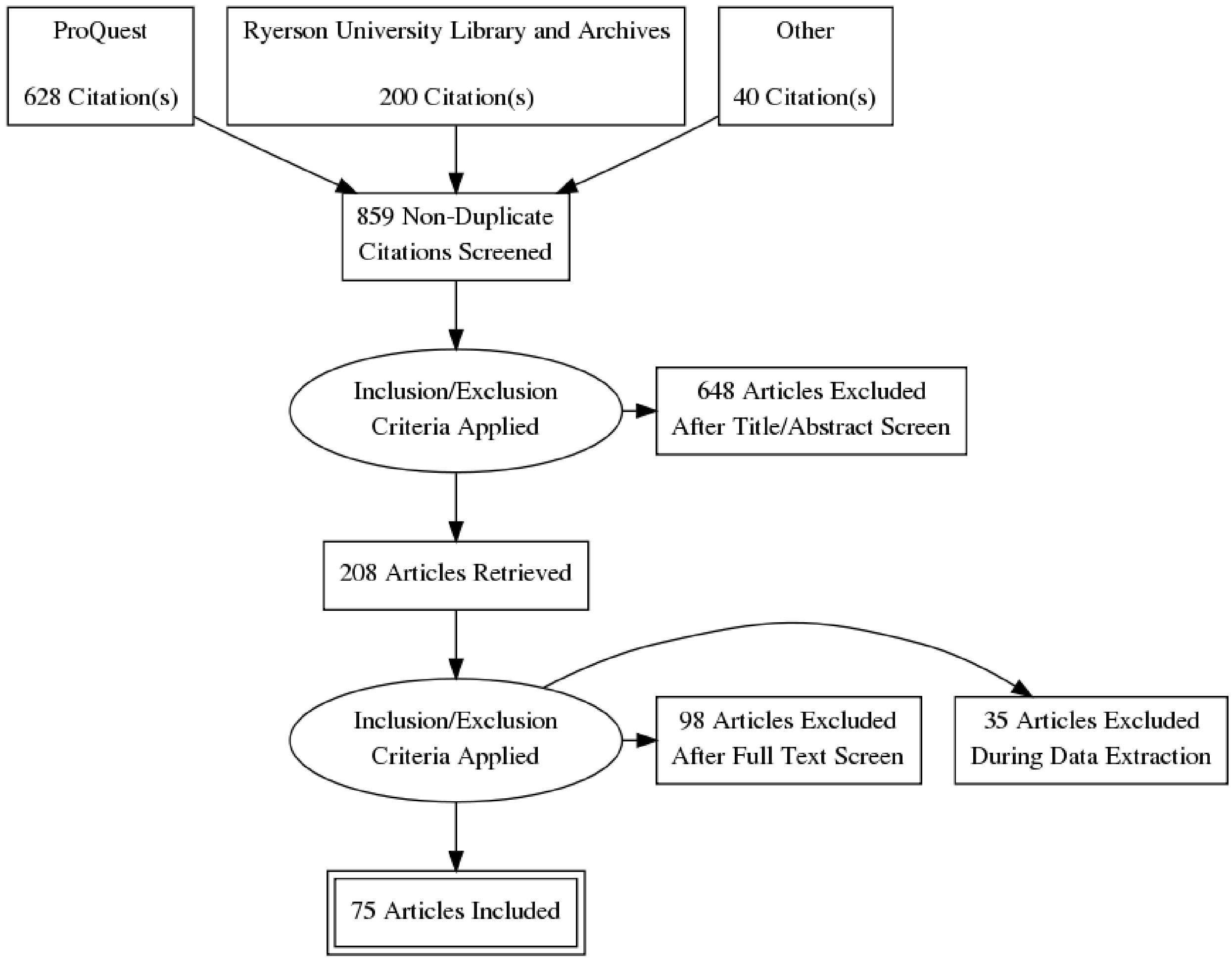

Figure 1 - PRISMA flow chart of systematic research

Figure 1 is the breakdown of the articles that were gathered over the course of this systematic review and how many papers made it through each election of the screening process.

4. Review of the Literature

4.1. Dynamic Pricing and Like Terms

Although dynamic pricing is the term used most frequently in this research, it goes by other names and can include other pricing strategies. The literature in this field in very heterogeneous and is difficult to compare directly. The aim is to present related research and normalize the definition of dynamic pricing and like terms and understand all the pricing strategies and theories that it is comprised of.

Dynamic Pricing

To begin, we need to understand how dynamic pricing is typically defined by others. Appropriate price setting is a challenging task that requires the organization's knowledge on their operating costs as well as the dynamic price based on the product demand and supply parameters (Deksnyte et al., 2014).

Dynamic pricing is the idea that businesses frequently change prices based on demand or supply conditions at certain times to maximize profit (Burger & Fuchs, 2005; Hanna et al., 2015).(Burger & Fuchs, 2005; Kimes, 1989) Prices are adjusted in a timely manner to get the right service to the right customer at the right time (Burger & Fuchs, 2005; Kimes, 1989). This flexible pricing structure against demand that varies based on time allows businesses to make decisions against off-peak and on-peak service hours (Yeoman et al., 2001)**.** There has been an increased use of dynamic pricing recently in the retail sector where capacity is fixed and is sold over a limited time (Deksnyte et al., 2014). The customer and business bargain over a lack of demand or over excessive demand leading to an outcome that leaves both satisfied (Deksnyte et al., 2014).

Customers can often be divided into classes or fences, where each class has different demand and willingness to pay (Ng et al., 2018). Airlines, car rental agencies, and hotels typically use quantity-based revenue management techniques by controlling the quantity of services sold to different customer classes. Airlines have customers divided into leisure and business travelers and limit the number of leisure seats to earn revenue from business travelers who are willing to pay higher fees (Elmaghraby & Keskinocak, 2003). Retailers on the other hand use price-based techniques (Mookherjee & Friesz, 2008).

Service activities use what is known as the IHIP paradigm (Intangibility, Heterogeneity, Instantaneity and Perishability) to be described, where they often show most of the 4 IHIP traits (Debely et al., 2008). Perishability features 3 characteristics according to Burger & Fuchs (2005). They are:

1) Quantity is fixed and cannot be reordered once perished.

2) The service has a deadline for when it can be sold.

3) The marginal cost of selling to an additional customer is low.

Research	DP testing area/organization	DP effect on sales revenue
A. Andersen, 1997	Carlton Beach Hotel	20%↑
S. Goksen, 2011	British Airways	X%* 1↑
R. Cross, 1997	Austrian Airlines	X%* ↑
R. Cross, 2010	Delta Airlines	+$300 mln. ↑
J.V. Marriot, 2000	Marriot Hotel	+$150–$200 mln ↑
J. Peyton, 2009	Starwood	X%* ↑
C. Neville, 2007	Ford Motors	+$100 mln.↑
W. Elmaghraby & P. Keskinocak, 2003	Amazon.com	X%* ↑
R. Cross, 2010	PeoplExpress	+$1bl. ↑
R. Cross, 2010	American Airlines	14.5% ↑
R. Cross, 2010	KLM	+1.4 bl. ↑
R. Cross, 2010	UPS	+>100 mln. ↑
R. Cross, 2010	Ford Motor	+100 mln. ↑
K. Larson, 2009	Chicago Symphony	1.5–2% ↑
K.Larson, 2009	Pacific Northwest Ballet, Palm Beach Opera, San Diego Opera	1.5–2% ↑

Figure 2- Dynamic Pricing application areas and results (Deksnyte et al., 2014)

Some organizations do not provide exact numbers, rather they indicate a direction of trend. They are marked with an "X".

The above **Figure 2** shows the effect dynamic pricing has had on revenue on different companies. Although the level of success varies, we can see an increase in revenue in many industries where it has been implemented. “Although one important goal for retailers is to maximize profits through optimal pricing, there are other, sometimes conflicting goals to consider. For instance, retailers may wish to peg their prices to competition, or set prices to maintain a certain image. How do these conflicting goals impact their customers or profits?” (Grewal & Levy, 2007).

Implementing dynamic pricing is an expensive proposition in terms of both technical and human cost. Companies spend millions of dollars developing systems which can collect and analyze data to recommend pricing in real time (Gibbs, Guttentag, Gretzel, Yao, & Morton, 2018) but often humans need to set and approve price recommendations (Koschat, Srinagesh, & Ulher, 1995)(Baker & Collier, 2003)

Real-Time Pricing (RTP) and Time-of-Use (ToU) Pricing

Real-time pricing (RTP) and Time-of-Use (ToU) pricing often go hand in hand. Both pricing models change prices based on time. ToU pricing is when prices change during specific time periods at a fixed rate (Koolen, Sadat-Razavi, & Ketter, 2017). For example, electricity rates may be cheaper between 6pm and 6am where the price remains steady then from 6am-6pm the prices increase. RTP is a more frequent implementation of ToU where prices can change much more frequently, and often over a larger range (Norford, Englander, & Wiseley, 1998). The actual pricing levels, both high and low, and when they are activated both for RTP and ToU are determined by the company and are used to maximize revenue (Koschat et al., 1995). An additional outcome of these two pricing methods is the strategy of shifting demand from high-priced or on-peak hours to low-priced off-peak hours (Norford et al., 1998). When limited by capacity, if demand begins to exceed capacity, a strain can be placed on the business, so moving demand towards off-peak hours by raising prices during peak demand helps normalize business capacity.

Congestion Pricing

Congestion pricing is the idea that when a business is experiencing demand that reaches or exceeds capacity, prices increase to alleviate congestion. When congestion dissipates, prices return to a normal level. This method of pricing is one of the most widely known methods to alleviate congestion and is often used by the transportation industry to alleviate traffic on roads or passengers on public transit systems (Gao et al., 2019). The solution of congestion pricing is to reduce the concentrations of peak travel, which causes problems such as over-crowding, dissatisfied customers, low capacity utilization, and low revenue (Li, Van Heck, & Vervest, 2009).

Demand Pricing

As the term implies, prices change based on demand. The higher the demand, the greater the cost. The lower the demand, the lower the cost.

With demand pricing comes the idea of "smoothing demand". The goal of smoothing demand is to shift demand from on-peak and moving it towards off-peak demand. This assists in preventing demand that exceeds capacity or preventing demand that severely underutilizes capacity. Instead of having highs and lows, smoothing demand aims to keep demand consistent.

Surge Pricing

This term was popularized by Uber and is the term conveyed to customers when demand is higher than usual, to show that prices have increased (Chen & Sheldon, 2016). Trip prices can change in almost real time and vary from one area to another (Noulas, Salnikov, Lambiotte, &

Mascolo, 2015). Using an algorithm, Uber adds a “multiplier” to increase the base fare during times of high demand (Hall, Kendrick, & Nosko, 2015). The purpose explained by Uber was allocating rides to people who value them most and are willing to pay the increased fare (Gurley, 2014).

Yield Management

Yield management combines the issues of supply, demand and price in the context of capacity with the goal of optimizing revenue (Yeoman et al., 2001). The most notable examples of yield management are in the travel and hospitality industry. It began in the airline industry in the 1970s where airlines aimed to maximizing revenue yield per available seat (Cross, Higbie, & Cross, 2009), (Donaghy, McMahon, & McDowell, 1995). Overbooking, demand forecasting, willingness to pay, optimizing the mix of fare products, and doing so dynamically are all practices used for yield management (Cross, 1997)

On the other hand Cross (1997) mentions there are debates on the yield management in the service industry and others (Donaghy, McMahon-Beattie, Yeoman, & Ingold, 1998) show some concern over the applicability of RM to different capacity-constrained firms. According to (Debely et al., 2008), yield management requires predictability of paths of demand and inventory over time. Services in general are inherently variable, therefore, yield management cannot be applied to professional services.

Revenue Management

Revenue management is synonymous with yield management but is a more frequently used and refined term in research of the service industry. Revenue management is also a large bulk of this research as it utilizes many of the prior techniques and is often used synonymously with dynamic pricing but there are differences between the two.

The relationship between revenue management and dynamic pricing is often misunderstood (Boyd & Bilegan, 2003). If a customer can buy a flight today for $500, but tomorrow the price increases to $1000, most would stand to believe "the ticket price has doubled." In actuality, the ticket price never changed, rather, the class selling for $500 has stopped being sold and the business is selling a higher-class ticket. Certain customers are willing to pay more for a service than others. Certain customers are willing to pay more for a service than others. Some businesses charge a premium as a result (Yeoman et al., 2001). Some examples of companies that have adopted revenue management include restaurants, spas, conference facilities and function spaces, golf courses, casinos and theme parks (Basak Denizci Guillet & Ibrahim, 2015).

(Kimes, 1989) defined revenue management in the hospitality industry as “the process of allocating the right type of capacity to the right kind of customer at the right price so as to maximize revenue or yield”. This definition is still widely cited but has been modified through subsequent research to include “at the right time” and “through the right distribution channel” (Basak Denizci Guillet & Ibrahim, 2015).

Revenue management involves planning under uncertainty. Any revenue model relies on assumptions, including the accuracy of the demand forecast. Revenue management’s objective is to maximize revenue given uncertain market conditions, capacity, and even prices (Cleophas, Kadatz, & Vock, 2017). Revenue management has to match an estimated demand with a perishable product to a set of finite resources while taking customer’s value and profitability into account (Cross, 1997; Rania El Haddad, 2015) and optimizing inventory allocation and price setting for to maximize profit (Rania El Haddad, 2015). Revenue management fails when selling too much too cheaply (spill) or when selling too little too expensively (spoilage) (Cleophas et al., 2017).

Revenue management uses historical demand to establish future availability through forecasts in an effort to maximize revenue (Boyd & Bilegan, 2003). It must set price levels according to forecasts while balancing it with perishable supply (Yeoman et al., 2001)**.** A Revenue Management System (RMS) forecasts demand by class through dynamic methods (Boyd & Bilegan, 2003), and allocate perishable assets across these classes. It decides when to overbook and by how much, and what price to charge different rate classes (Baker & Collier, 2003).

"A perishable asset might be a hotel room, an airline seat, or broadcast advertising space. Physical capacity is about bedrooms, number of seats or exhibition space. But capacity can also be thought of as time-based (non-physical) -- for example, tee-off times in golf, time slots for airplane departures and landings etc. Therefore, time becomes the unit of inventory which is also a constraint on capacity"(Baker & Collier, 2003). The capacity is perishable because it becomes unable to generate revenue after a certain point in time—right after the sales period ends. For example, once a night has expired, the lost revenue from an empty hotel room is lost forever (Baker & Collier, 2003).

Businesses that have capacity constraints must make decisions regarding unpredictable duration and a fixed time slot. They must control the length of the experience each user has while also taking into consideration the possibility of no-shows or late comers as these individuals lose the opportunity for a business to sell to someone else. In hotels and airlines, overbooking have been used to deal with no shows or late comers. With research management, inventory should be classified as fixed or variable. Businesses may sell a fixed two-hour time slot, or a self-chosen time-limit experience. Uncertainty of duration requires extra planning when gauging business levels with capacity constraints. By minimizing service time and the space between service, a business can sell more time slots (Yeoman et al., 2001).

According to many researchers the firms that can implement revenue management strategies in their business are those that have the following characteristics.

1. The higher the customer diversity, the higher the potential to strategically exploit that diversity to increase revenue (Li et al., 2009; Weatherford, 1998; Weatherford & Bodily, 1992)
2. Demand should vary in some form. This could be based on weather, time of day or year or some other reason (Li et al., 2009)
3. The business should have a fixed and inflexible capacity that cannot be expanded without significant cost. They may potentially be unable to cope with variations in demand (Li et al., 2009; Weatherford, 1998; Weatherford & Bodily, 1992; Yeoman et al., 2001).
4. The product or service being offered should be perishable, unable to be held in inventory, and cannot be replenished (Li et al., 2009; Weatherford, 1998; Weatherford & Bodily, 1992; Xu & Chao, 2009).
5. The business should have relatively high fixed costs but low marginal costs. This means initial costs are high but the contribution to profit for serving each additional customer is high (Baker & Collier, 2003; Li et al., 2009; Yeoman et al., 2001).
6. The business should be using an advanced IT infrastructure to capture significant amounts of customer data and automate pricing decisions (Li et al., 2009)

Although revenue management has proven to be profitable in many industries, the solution is not a one-size-fits-all approach. Following the practices of revenue management from different industries can be dangerous as each industry must identify its own unique characteristics. They must choose principles that fit their needs (Yeoman et al., 2001).

4.2. How to Price

Without applicable tools and methods to support companies in pricing their services appropriately, smaller companies can often become insecure when setting their prices (Pergler, Weitlaner, Liu, Höber, & Loidolt, 2015).

The three basic types of pricing methods mentioned (Debely et al., 2008; Pergler et al., 2015):

- Cost-based pricing. This is when businesses add a markup on the cost to provide the service. The price of the service should cover the costs to supply it and provide a source of revenue. This gives the idea to a “price floor” which is the lowest price a business can offer, this can be seen in **Figure 3**. The cost-based method is found to be effective for products with high competitive intensity (Ingenbleek, Debruyne, Frambach, & Theo M. M. Verhallen, 2003). In practice companies often choose this method but due to the intangibility and heterogeneity of some services, outputs can still be challenging to evaluate (Debely et al., 2008)**.**
- Competition-based pricing. This involves observing the competitor’s price and making a decision based on the competitive price. Competition-based pricing is useful when there is little difference to distinguish between competitors and customers will use prices as reference (Monroe, 1979).
- Value-based pricing. This method seeks the value each customer attaches to the service. Businesses can determine the perceived value customers place on their distinguishable

service. The higher the perceived value compared to cost of offering the service, the more flexible a business can be in choosing their prices and their ability to make profit (Pergler et al., 2018). Value-based pricing is the most effective pricing strategy when used for new products (Ingenbleek et al., 2003). This method could also be the most appropriate strategy for service firms to study their customers' needs and provide them with a personalized experience as services are very context-sensitive by nature (Pergler et al., 2015).

When it comes to having a price that fluctuates based on demand, the concept of elasticity of demand is a good framework.

The elasticity of demand analyses the change in demand based on the change in price. There are two terms related to elasticity of demand, elastic demand and inelastic demand. Both represent the change in demand as a response to price changes. Elastic demand sees a bigger change in demand if prices changes vs inelastic demand which sees a smaller change in demand over bigger price changes. With dynamic pricing, changing the price point has the goal of getting the right customers to pay the amount they are willing to pay rather than allowing all customers to pay the same price. Services like eBay and Priceline is rooted in their ability to connect consumers who are seeking to pay as little as they can for a product or service with sellers who are willing to sell to these consumers at the price they seek(A. Majid, Bryant, & A. Rau, 2014).

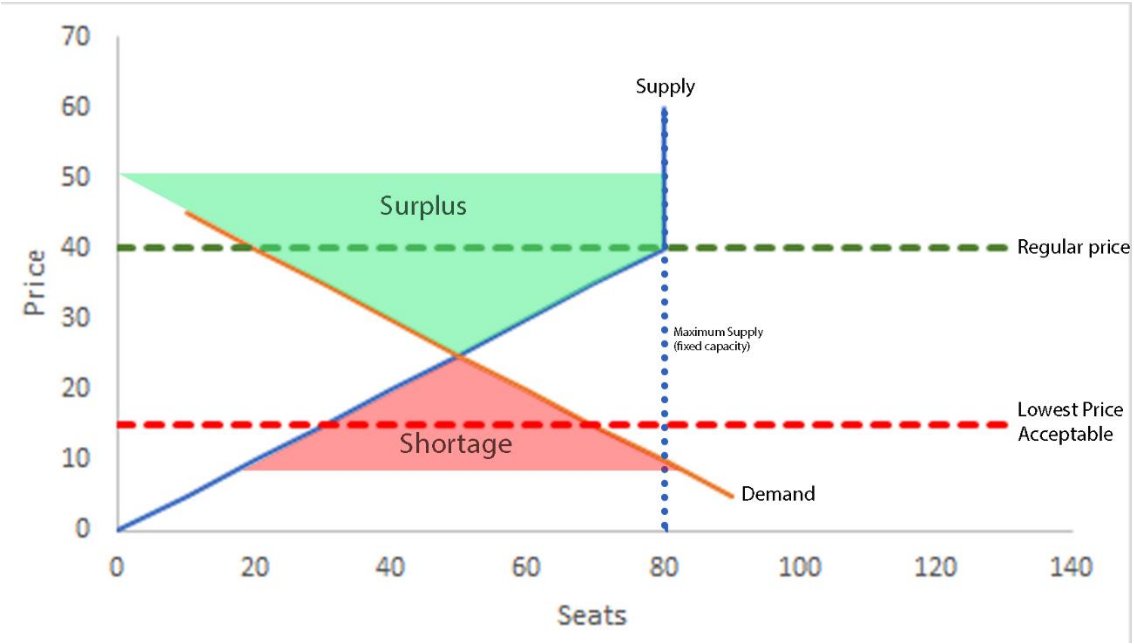

Figure 3 - A demand/supply curve for a fixed capacity business. (Constructed by author)

In **Figure 3**, we see a typical demand/supply graph where a business has a certain supply that when offered at a certain price leads to different demand from customers. The to the right upward sloping line is the supply or capacity. At certain price levels, a business is only willing to sell a certain number of slots. This is similar to rate classes or fences mentioned earlier where a business will only sell a limited number or spots at a lower rate and leave higher rates for those willing to pay. The right downward sloping curve is the demand of customers and how many are willing to pay at each price level. In this graph, the vertical dotted line represents the maximum capacity the business can hold. While there may be demand greater than capacity at certain prices, the business cannot exceed the maximum supply. In the upper horizontal dotted line is the regular price for a service while the bottom dotted line represents the lowest price the business will offer their service at. This lowest price may be a break-even cost to service each customer or may be an arbitrary goal price a business does not want to go below. When the supply of a service exceeds the demand, there is what is known as a surplus. These are seats or timeslots that are not being sold and are lost sources of revenue. When demand exceeds capacity, this is what is known as a shortage. The business cannot provide enough seats or timeslots to accommodate everyone at their current price. The angle of the slope indicates how sensitive people are to price. A slight slope indicates a small price change could lead to a significant change in demand while a steep slope means price changes will not have a significant impact on customers willingness to purchase. Each type of business has a different slope that is based on customer behaviour and the need relative to want the business generates.

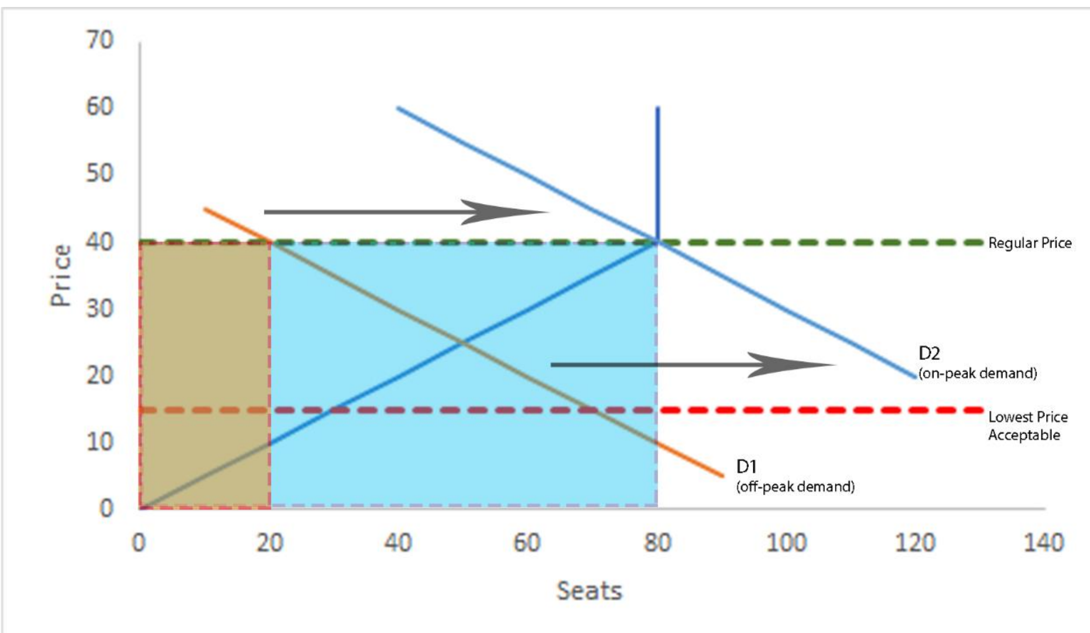

Figure 4 - A demand/supply curve for a fixed capacity business where demand shifts from off-peak to on-peak business hours. (Constructed by author)

In **Figure 4** we see what is known as a shift in demand. Demand can shift for various reasons, including based on time of day or year. The left side, downward sloping line represents a business during off peak hours. Very few customers are willing to pay full price for a service. To bring in more customers, the prices need to be lowered. The right, downward sloping line represents on-peak demand where the full capacity of a business is willing to pay full price.

Using the numbers in **Figure 4,** if charging full price of $40 during off-peak hours, a business would only fill 20 out of a maximum of 80 seats. The revenue generated is shown with the orange dotted box. During on-peak hours, by charging full price, a business would fill all seats. The revenue shown during on-peak hours is represented by combining the blue and orange dotted boxes.

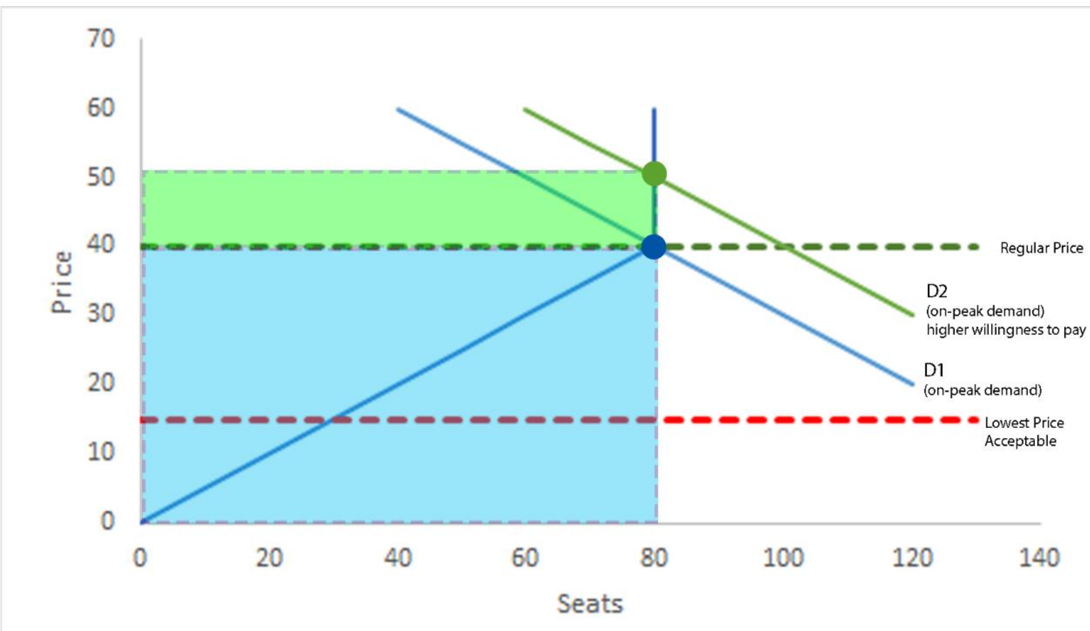

Figure 5 - A demand/supply curve for a fixed capacity business, showing the difference in revenue from charging regular price to increasing price for those willing to pay. (Constructed by author)

In **Figure 5**, we see an example where a business can use dynamic pricing to increase prices. Similar to the previous graph, the left side downward sloping line represents maximum capacity where customers are willing to pay full price. The right-side sloping line shows a demand where enough customers to fill capacity are willing to pay more than the regular price for the service. This may be someone like a business traveler on an airline who is willing to pay more because they have a need. By increasing the price of a service, a business can increase their revenue by the amount equal to the green box.

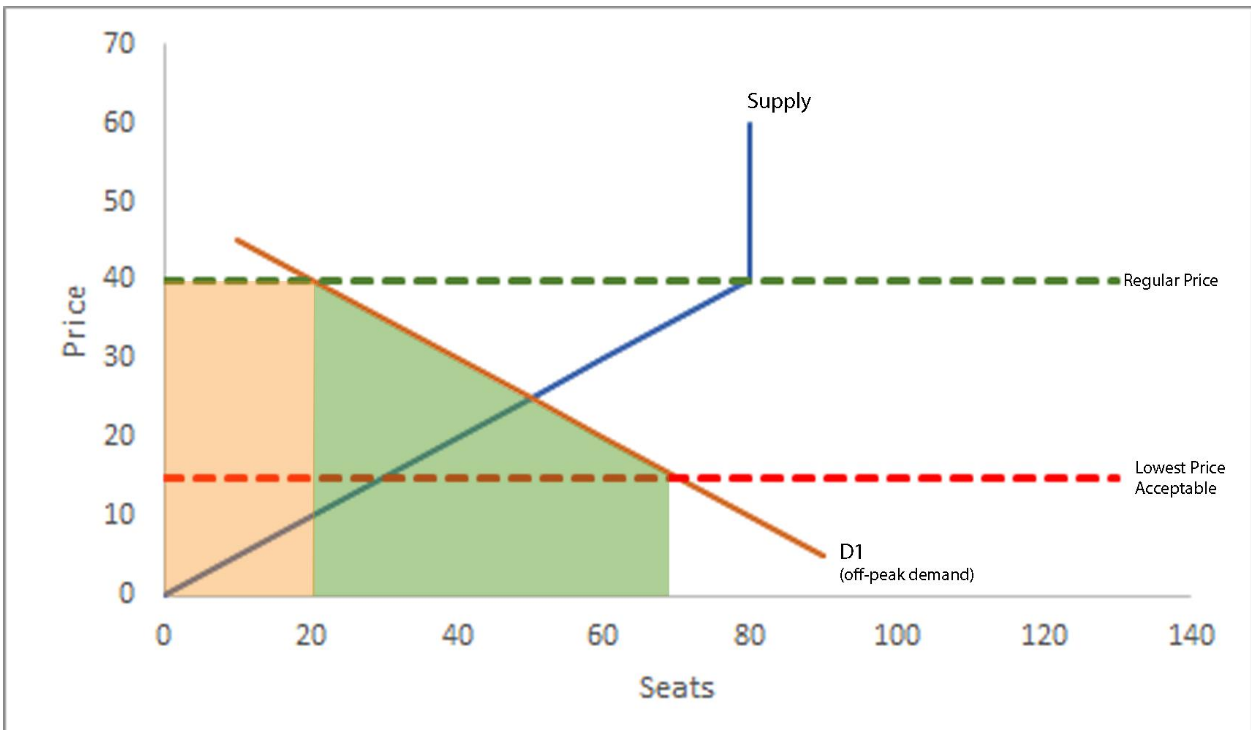

Figure 6 - A demand/supply curve for a fixed capacity business showing the additional revenue from capacity utilization by offering dynamic discounts. (Constructed by author)

In **Figure 6** we see an example of if a business dynamically lowered prices to increase capacity utilization. If charging $40, the business will see 20 guests. By lowering the price slightly, another customer purchases a seat, lowering it again adds another customer. By offering the right customers the right discount at the right time (Kimes, 1989), a business can potentially increase revenue equal to the green shape. How far that shape extends depends on the lowest price accepted and the maximum capacity of a business while the effectiveness of offering the right prices at the right time indicates how close that green shape is to the downward slowing orange line. If prices were offered in batches, we would see little steps taken away from the green shape which is potential lost revenue for a business.

In many applications, the price elasticity of demand is time dependent. Some examples provided by Schlosser (2015) include fashion goods where demand typically decreases over time compared to airline or hotel tickets where prices increase closer to the date. Schlosser also goes on to discuss how most dynamic pricing optimization models consider specific demand functions with constant elasticities and the need for a dynamic pricing model with general time varying demand.

4.3. Customer Perceptions on Dynamic Pricing

Prices in the retail and service industry were adjusted infrequently due to the excessive costs involved in price changes. There was a huge investment needed in both effort costs for hardware and software to automate price changes. There was also a lack of knowledge of actual customer purchase behaviour when prices changes (Elmaghraby & Keskinocak, 2003). Past research on dynamic pricing thought of customers as near sighted and not privy to price changes meaning customers would make a purchase if the price is below their personal valuation of that service and that future price trends would not influence purchasing decision. A seller could therefore set a price without worrying about any disadvantages, such as if prices reduced further (Elmaghraby & Keskinocak, 2003).

This way of thinking has shifted dramatically as customers have become increasingly strategic. Retailers are becoming more aware that consumers are strategic and willing to go to great lengths to purchase at the lowest price possible (Silverstein & Butman, 2006). Customers include future price trends as part of their decision making and can delay making a purchase if necessary in order to achieve a better result (Gönsch, Klein, Neugebauer, & Steinhardt, 2013). If a customer believes the seller will lower the price of something desirable in the near future, they may wait until the price is lowered before purchasing. Consumers often follow seasonal patterns in demand and wait to purchase when there is a sale (Cachon & Swinney, 2009). If a customer waits to purchase at a lower price, a business misses out on selling at full price and maximizing revenue. According to (Gönsch et al., 2013), businesses utilizing dynamic pricing that fail to consider this behaviour and assumes customers are naïve to price changes have seen losses of profit of between 7 - 50%.

When a consumer considers purchasing something at a higher than "normal" price, even if the higher price is to indent a higher quality, it may appear as a larger sacrifice and of greater risk. When framing that same higher price as a discount from a higher price, it can appear as a gain, or benefit to consumers (Dixit et al., 2014). How customers perceive price is important as a business could lose customers if prices are perceived to be unfair. (Dixit et al., 2014).

When a business increases prices to increase profit rather than a result of increased costs, customer's reference price and reference profit become violated and lead to a greater perception of unfairness (Bolton, Warlop, & Alba, 2003). Customers may question the motive behind the increase as unfair (Campbell, 1999). The more unfair a customer perceives price, the more likely they are to resist paying (Bolton et al., 2003). Campbell (1999) suggests business can face fewer negative consequences if they can offer a "positive" explanation for an increase in price compared to a “negative” rationale like the goal of increasing profits. The reputation of a business also influences how customer perceive a price increase. When a business has a higher reputation, consumers give increased prices the benefit of the doubt while lower reputations are not offered the same affordance. Managers should consider transparency in dynamic pricing, particularly when the price change is outside the control of the firm (Dixit et al., 2014).

With regards to targeted promotions where different customers are presented different prices, these are often considered unfair more so because of the damage to relational identity rather than the economics of reduced perceived value (Xia & Monroe, 2017). How unfair the targeted promotion in perceived is also influenced by whether the buyer-discovered the promotion compared to the seller delivering it. If a company adopts dynamic pricing through targeted promotion, it is important to manage the relationship with their consumers. By reducing the visibility of the companies role they can reduce the potential damage of targeted promotion on relational identity (Xia & Monroe, 2017). Given the expanded use of social networks, smart phone apps and various other forms of communications, it is not difficult for disadvantaged consumers to learn others have paid a lower price (Xia & Monroe, 2017).

4.4. The Need for Data

Determining what price to charge a customer is a complex task. A company must have a wealth of information about its customers to charge the right price and change prices at minimal cost (Elmaghraby & Keskinocak, 2003). Being able to forecast demand accurately is a crucial step in determining the right price. Knowing customers habits, likes and dislikes, and their movements allows for a more accurate estimation on their willingness to pay for a service. The better the forecast the better the business decisions and the better the profits (Yeoman et al., 2001).

The ability to offer dynamic pricing requires the gathering and processing of data. If a business overestimates demand they see lower profit than anticipated where as if they underestimate demand, they may underprice the available inventory (Boyd & Bilegan, 2003). Forecasting future bookings and 'on-demand' situations by gathering information on reservations, walk-ins, customers' time periods and service duration are all important to ensuring a more accurate demand estimate (Yeoman et al., 2001).

Most common approaches to demand forecasting rely on historical booking data. When this is not available in sufficient quantity and quality, forecasting becomes difficult. This issue is particularly relevant for revenue management in new markets or industries. (Cleophas et al., 2017). When implementing a revenue management system, without initial demand estimates, the system can begin to function with less dependency on historical booking data. This can be extremely helpful when there is no historical data or when a marketplace has shifted enough to render existing data irrelevant (Cleophas et al., 2017). Without precise market information, a system needs a certain number of observations to estimate and forecast demand at each price level for different rate classes to optimize total revenue (Burger & Fuchs, 2005). When first beginning, with a lack of information, the dynamic pricing model is highly likely to start at incorrect pricing levels. As sales begin, the pricing model accesses actual market dates and is modifies its estimate over time with each sale, resulting in a more accurate estimation. The system is getting better as more customers are observed. Market research of historical data is helpful to increase the performance of the dynamic pricing methodology (Burger & Fuchs, 2005). Historical sales data and loyalty program can be scraped for customer insights to assist with operational planning, but granular sales data can also benefit availability and assortment decisions (Aktas & Meng, 2017). External data such as competitors’ prices, weather conditions, local events, historical data, booking patterns including cancellation and no-show data are all important things to consider when forecasting to determine prices (Yeoman et al., 2001). Today, in both Internet and brick-and-mortar stores, recent technology allows retailers to collect information not only about the sales, but also about demographic data and customer preferences. Due to the ease of making price changes on the Internet, dynamic pricing strategies, especially in the form of price markdowns, are now frequently used in B2C as well as B2B commerce by numerous companies. (Elmaghraby & Keskinocak, 2003).

In a study by Weatherford, Kimes, & Scott (2001), they showed that “purely disaggregate forecasts strongly outperform even the best aggregate forecasts, concluding that ‘even though forecasting larger numbers may be more accurate in itself, the process required to [disaggregate these forecasts] resulted in lower accuracy than just forecasting at the more detailed level in the first place." (Boyd & Bilegan, 2003). This implies that forecasting should focus on an individual businesses component rather than using data from many sources.

With increased information to take into consideration when trying to maximize revenue generation, there are problems that arise. The first is a shortage of people with the right set of skills to make use of the data. There is the lack of support from suppliers, issues in IT integration, managerial concerns including information sharing and process integration, and physical capability of the supply chain to respond to real-time changes captured by big data (Aktas & Meng, 2017). The use of artificial intelligence (Al) has enormous potential for handling the complexities of revenue management because of its abilities in complex problem solving, reasoning, perception, planning and analysis of extensive data. (Yeoman et al., 2001)

A simple representation of a revenue management system is shown in **Figure 7**. Airline revenue management systems use historical data and inventory controls to estimate future demand. Demand forecast, capacity, and fares are considered in the model, which calculates inventory controls. Inventory controls allocate space to match real demand in the airline's reservation system. This data and the resulting bookings are used to develop the next demand forecast, creating a feedback loop.

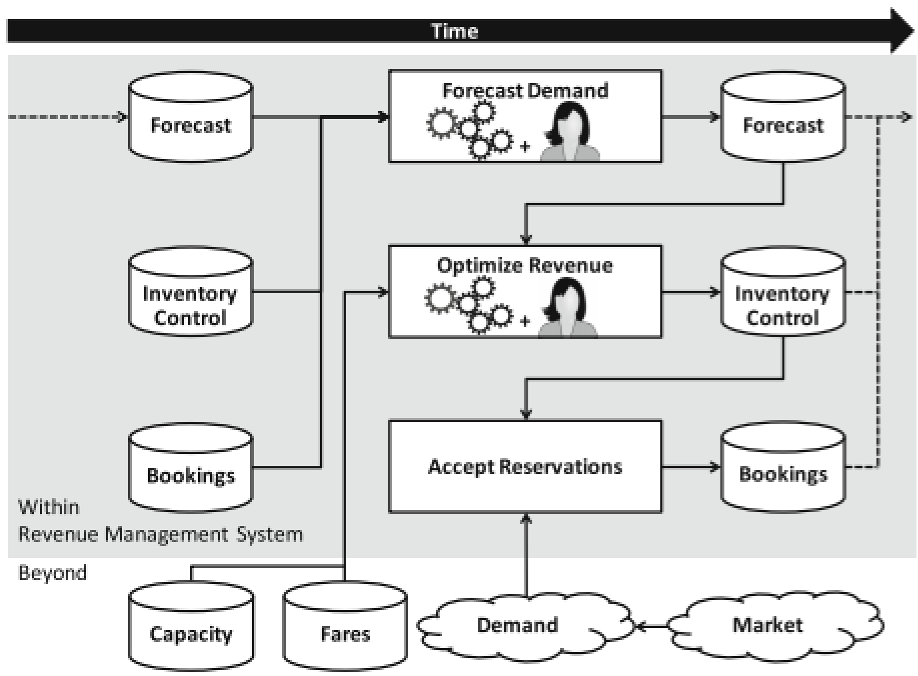

Figure 7 - Revenue Management System for forecasting quantity (Cleophas et al., 2017)

4.5. Case Analysis

To effectively analyze how dynamic pricing is being used by companies today and the effects it has, four industries were selected that actively use some form of dynamic pricing. The industries selected include, transportation, hospitality, energy, and entertainment. The transportation analysis focuses on airlines, Uber, and the Hong Kong Mass Transit Railway. The hospitality industry analysis is comprised of hotels and Airbnb. The energy industry is comprised of itself and the entertainment industry includes sport and restaurants.

These cases were chosen because the analysis of these businesses and industries can provide insight that can be used alongside the research questions outlined in **section 2.3**. By analyzing these cases, we can see what similarities and differences there are for dynamic pricing between industries and even businesses in the industry. Elements that make up a company's dynamic pricing method can be compared and contrasted to determine what elements could potentially be applied to a small sized brick-and-mortar service business in order to maximize revenue, and which elements cannot be applied. In addition, some of these elements can be used to determine how a strictly dynamic discount pricing method might impact these small businesses.

The cases were systematically analyzed based on the inclusion and exclusion criteria outlined in **section 3.2**. All cases were of companies or industries where the businesses are limited by capacity and use some form of flexible pricing or discuss the use of dynamic pricing. In addition, these companies or industries were present in multiple papers, proving they offer value to research on the topic at large. After systematically reviewing the papers, the research from these different industries offered insights that could be applicable in many other businesses or industries independent of the businesses size.

4.5.1 Transportation

4.5.1.1 Airlines

Dynamic pricing for airlines was chosen due to the rich history and the most in depth literature. Even today airline revenue management continues to pave the way in revenue management (Boyd & Bilegan, 2003).

Dynamic pricing originated with the deregulation of the US airline industry in the 1970s (Cross, 1997), when several airlines used a capacity management strategy in order to compete with a new low priced airline that offered customers a low-priced and no-frills service (Mookherjee & Friesz, 2008). American Airlines competed by offering a few seats at an even lower price but maintained capacity at higher fares for higher-paying passengers (Yeoman et al., 2001). American attracted the budget passengers who would book flights well in advance away from the low cost provider but maintained higher-spending passengers who booked flights one or two days before departure (Yeoman et al., 2001).. American's was the first revenue management system deployed. Within the first year of its usage, revenue increased by 14.5%, along with a 48% increase in profit leading to quick adoption by many industries, and ultimately leading to the bankruptcy of the new airline (Mookherjee & Friesz, 2008).

Airlines have two major customer segments, leisure travelers and business travelers. Leisure travelers typically make travel plans months in advance of departure, because they frequently must coordinate their vacation travel with other arrangements, like accommodations, taking time off work, etc. Business travelers on the other hand may not know of their need to travel until a few days in advance of departure (Vulcano, Garrett van Ryzin, & Maglaras, 2002) and do not mind paying higher prices only a few days before departure (Cross, 1997; Elmaghraby & Keskinocak, 2003; Yeoman et al., 2001). Airlines hold capacity to sell to these customers rather than selling the capacity in advance to budget travelers(Burger & Fuchs, 2005). By holding capacity available, airlines risk not selling the capacity but understand the opportunity of selling to a higher-yielding passengers (Yeoman et al., 2001). If an airline were to sell tickets at a single point, months in advance of departure, they would likely lose many business travelers; and if they conducted a single sale a week from flight time, they would probably lose many leisure travelers. This incentivizes the idea of sales at multiple times, where buyers are effectively separated in time (Vulcano et al., 2002). By conducting multiple auctions over time, the seller can reach a larger pool of buyers (Vulcano et al., 2002).

As mentioned under dynamic pricing in section **4.1**, perishable products feature certain characteristics. In context of the travel industry may show that a seat on a specific flight is also a typical perishable good (Lin, 2006). Once an aircraft is defined for a specific flight, the quantity of seats is fixed. When the plane leaves, an empty seat is valueless and can no longer be sold. In the air travel industry, marginal sales cost is very low. It is obvious that a seat on a specific flight can be dynamically priced. High capacity and low demand will immediately lead to reduced prices as shown in **Figure 4**. Inversely, high demand on specific flights will increase fares immediately to protect seats for passengers booking closer to departure with a higher willingness to pay, demonstrated in **Figure 5**.

4.5.1.2 Uber

Uber's prices can change dynamically in almost real time and vary geographically from one area to another in a city, a strategy known as surge pricing. In a study on Uber's pricing, it was shown that surge pricing is enabled very frequently, with minute to minute changes based on supply and demand balance at the origin and possibly at the destination (Noulas et al., 2015). The authors showed how it was possible to estimate customer demand with high accuracy using publicly available data from a cab company and Foursquare data to then implement their own surge pricing, showcasing the need for data from **section 4.4** and how with enough historical data, an accurate forecast can be reached.

The number of service providers is low in case of traditional cabs in times of day that are inconvenient for the drivers, such as late night hours, and their numbers stay below real demand, resulting in some potential customers getting no service (Szabó, 2017). At the same time, Uber offers services in these periods as well. While traditional cabs operate usually on fixed prices, Uber prices can go up to an extent, in busy periods depends on the level of demand or congestion of the service. When prices rise, demand reduces due to a decrease in customers willing to pay a certain price. This way the service will only be used by those customers for whom it is so important that they are ready to pay the higher prices (Szabó, 2017; Vulcano et al., 2002) similar to airlines and business customers. As an added benefit, this also leads to increased profit for drivers.

4.5.1.3 Hong Kong's Mass Transit Railway (MTR) System

The Hong Kong Mass Transit Railway (MTR) services one of the most densely populated cities on earth. The MTR handles nearly 1.8 billion trips per year. Serving that many trips showcases the outstanding operations performance of the MTR, but concerns about crowding and congestion have increased in recent years (Halvorsen, Koutsopoulos, Lau, Au, & Zhao, 2016).

Congestion pricing policies encourage demand to spread more evenly throughout the network or over the day. In many cases, policies that tackle excess demand are quicker and less expensive than adding capacity with new vehicles or rail infrastructure. Facing exceeding loading standards in the morning rush, MTR introduced an early rider discount that incentivized riders with a 25% discount if they took a pre-rush train. Though onboard congestion motivated the promotion, the discount was linked to particular stations as it was found that 80% of the trips that traveled over a congested area ended at these stations (Halvorsen et al., 2016).

The results of the discount had a small impact on demand patterns. The proportion of peak hour trips decreased by about 3% although certain station links with higher levels of crowding where the discount was aimed saw larger changes. Although with ridership increases the promotion may have helped slow peak congestion rather than actually reversing it. It was also observed that customers with commuter-like characteristics both took a majority of a.m. peak trips and responded to the promotion at higher rates, along with customers that are regular but low-frequency (Halvorsen et al., 2016). This shows that certain classes of groups are more receptive of pricing changes or look for the lowest price, while others are willing to pay higher prices. As a means of lowering congestions, targeting the two groups who were most receptive to switching would be key.

A recommendation from Halvorsen et al., (2016) suggested tapering fares, giving a higher discount farther from the peak period. This action could better discriminate between time and cost sensitive users and encourage more shifting from the peak to the-off peak period. By using station or user-specific marketing, more detailed journey planners, or direct communication, an agency could better convey specific benefits of off-peak travel, such as price, comfort, and reliability. The costs and lost revenue of such a program could be a major barrier for agencies on tight budgets. In addition, the long-term benefits of the program must still be investigated because people may have reverted to prior behavior or taken more time to adjust their travel habits (Halvorsen et al., 2016).

4.5.1.4 Application of Cases to Research Questions

The transportation industry provides some unique insights into the research questions on the impact dynamic pricing can have. There are some differences between the listed examples and the purpose of this research, making direct comparisons to probability of success difficult [**RQ2**].

Airlines, Uber and the MTR are much larger companies than the small or midsize businesses talked about in the research questions. They have more resources to develop a dynamic pricing system and they can test decisions in certain areas as they are not limited a single geographic location. Unless the business had several stores or was supported by a franchise, testing may have a severe impact on revenue [**RQ1**].

As mentioned in the MTR case, the implementation of such a system can be a huge barriers and discounting can impact budgets, even more so for a small business which may lack funds or a safety net [**RQ1**, **RQ2**]. In addition, all three of these examples can increase capacity to some degree by adding extra carts or vehicles into circulation while certain smaller service businesses may be unable to do the same. These companies also serve both time and cost-conscious customers which allows for increased prices as there are customers who will pay an increased fee, or will forego discounts in the case of MTR, because there is a need. Businesses like restaurants or salons do not have a similar ability to increase capacity, and not all service businesses service a need where customers are willing to pay more.

Some of the results appear reassuring. In the case of MTR, discounts can minimize congestions to a degree [**RQ2**]. By providing better communication on benefits for off-peak hours and the available discount and tapering discounts customers may be willing to switch to off-peak hours. Moving enough customers from on-peak to off peak could help businesses serve more people. With demand that exceeded capacity, there was a shortage of supply (**Figure 3**), and by encouraging customers to attend off-peak hours in exchange for a price cut, a business can potentially serve more customers overall and increase revenue [**RQ1**]. In all three examples, to stimulate demand, prices were lowered in off-peak hours. This gives credibility to the idea of lowering prices to maximize capacity [**RQ2**]. If lowering cost was not beneficial, we would not be seeing these businesses do it. If the lowest price is higher than the cost to serve a customer, more revenue will be generated even if the revenue per person is not as high as when they are charged full price.

Another point that was common between all three examples was the need for data. Gathering data on business cycles and customer habits are necessary to forecast demand as well as compare results [**RQ1**] as discussed in **section 4.4**.

4.5.2 Hospitality

4.5.2.1 Hotels

In the hotel industry, during low-demand period, inventory becomes accessible to all channels of distribution and customers approaching directly at a discounted rate. In other words, the use of rate fences is eliminated or reduced, allowing everyone to get the lowest price. On the other hand, during peak demand rooms are segmented with the highest demand rooms reserved for customers who are in need and are willing to pay a higher room rate (Zheng & Forgacs, 2017). Prices may also vary according to the moment of demand, occupancy degree, distribution channel, booking moment, payment method, etc. (Ţierean, 2018).

Two metrics to consider for hotels is the average daily room rate (ADR) and room occupancy (RO). In high-demand periods, a high ADR can be achieved with high levels of occupancy; however, in low-demand periods, the ADR would be lower, and thus, the aim would be to improve occupancy(Jones & Hamilton, 1992; Ortega, 2016). The focus of hotels is primarily on revenue maximization because once a night has expired, the lost revenue from an empty hotel room is lost forever (Baker & Collier, 2003). For example, the fixed cost of running a hotel is high, and once the hotel occupancy rate is above the break-even occupancy rate, the contribution to profit and overhead per incremental customer is high (Baker & Collier, 2003). In Ortega's (2016) research, he talks about how hotel revenue management systems are more effective at improving occupancy than in achieving higher rates.

Hotels could charge as many different rates for different customer fences as they want, but if customers view the pricing policies as unfair, they are unlikely to remain customers of the hotel in future as perception of price fairness play an important role in customer satisfaction and their behavior (Suklabaidya & Singh, 2017). This is especially valid for price discrimination and overbooking techniques. Customers feel cheated if they have to pay more for the same room or if they have to be relocated to another hotel that is not overbooked (Suklabaidya & Singh, 2017).

4.5.2.2 Airbnb

In a study that took sales information from 39,837 Airbnb listings and hotel data from 1,025 hotels across five markets Gibbs et al. (2018) explored the extent to which Airbnb hosts use dynamic pricing and how their pricing strategies compare to those of hotels. Gibbs et al. found hosts rarely use dynamic pricing strategies, especially when compared to hotels.

Airbnb reportedly represents five percent of all tourism accommodation revenue although Airbnb hosts are missing out on up to 46 percent additional revenue due to an inability to optimize prices (Gibbs et al., 2018). A focus group indicated hosts become confused when trying to set their prices (Hill, 2015). Unlike the hotels which have pricing specialists, industry benchmarking reports and technical tools to help set pricing for rooms, Airbnb’s are often managed by regular people with limited pricing knowledge or support of pricing tools (Gibbs et al., 2018; Wang, Yoonjoung Heo, Schwartz, Legohérel, & Specklin, 2015). The findings indicate that Airbnb listing prices overall fluctuate according to seasons and day of week, and there is additional evidence of some special holidays taken into account. Gibbs results show that across all markets, over half of the listings do not change in price while less than one fifth have different prices on over 25 per cent of the active listing days (Gibbs et al., 2018).

Pricing Airbnb listings is difficult because of so many factors such as seasonal changes, local events and location as well as each Airbnb having its own unique characteristics (Hill, 2015). Airbnb created a dynamic pricing tool that uses machine learning to provide hosts with a new pricing suggestion for each date a listing is available. Hosts can go with the suggestion or increase or lower their pricing unlike Uber who controls the price for every drive (Gibbs et al., 2018). As mentioned in **section 4.3** dynamic pricing may portray the host as a profit-maximizing provider which may cause customers to perceive hosts in a negative way. By following an Uber model and taking pricing decisions away from hosts, Airbnb can divert those negative feelings away from hosts and towards themselves. Airbnb could also set rate limits as well as be transparent with reasoning for rate changes to avoid negative press (Gibbs et al., 2018)

4.5.2.3 Application of Cases to Research Questions

Analyzing hotels and Airbnb shows some interesting comparisons between competing players in the hospitality industry. After airlines, hotels were the next big industry to adopt revenue management systems that use dynamic pricing. Airbnb has been a rapid growth company that often offers a more affordable and local option compared to hotels. Airbnb's are properties that are managed by individuals or property managers and are much more spread out compared to hotels.

Comparing this to our research questions, hotels are much larger while Airbnb's are individual owned and priced by each owner. We can see from the results of the Airbnb study that hosts are much less adapt at implementing dynamic prices compared to hotels and because of this, hosts and Airbnb are missing out on significant profit opportunities [**RQ1**]. The reason we see host of Airbnb's being less dynamic with their pricing is due the lack of knowledge and tools to forecast demand and suggest prices. With the new implementation of dynamic pricing tools, both hosts and Airbnb could see a significant increase in revenue [**RQ1**].

As mention in **section 4.3** increasing prices can be seen as unfair by the customer [**RQ2**]. Specifically for hotels, if a customer feels they are treated unfairly, they are unlike to return. Airbnb has the option of taking price control out of the hands of the host to direct the resentment towards Airbnb rather than the host, thereby making customers more likely to return because there is no resentment towards the host. A small business if implementing their own system would have to be cognizant of perceived unfairness. A potential solution could be a third-party platform that chooses the price of the service for the business and takes the blame out of the business's hands [**RQ1**].

One point brought up by Jones & Hamilton (1992) is that of the two metrics regarding room costs and room occupancy levels. They talk about how during high demand, the focus is on increasing revenue while low demand is focused on maximizing occupancy. Along with Ortega's (2016) research that hotels are better at increasing occupancy than increasing revenue, this gives insight to research questions 1 and 2 . Filling occupancy during low demand is easier than increasing average revenue. The revenue associated with increasing occupancy must be greater than leaving occupancy as is. So the goal for a small business may be maximizing occupancy and by targeting off-peak demand through lower prices [**RQ2**], a business could see potential revenue increase, as long as the revenue earned is greater than the cost of serving that customer [**RQ1**].

4.5.3 Energy

4.5.3.1 Energy

In the 1980s, US electricity suppliers began setting electricity prices based on demand. The best way of doing so was through a time-of-use pricing plan as mention in **section 4.1**. This allowed the energy company to pass the variation in prices on to customers, decreasing demand when capacity was tightest (Burger & Fuchs, 2005). Technological improvements (i.e. computer systems and data-handling software) have allowed electric utilities to provide customers with information that more accurately represents the cost of providing the electricity (Norford et al., 1998). This work is intended to support energy suppliers and policy makers with strategies that target behaviors of energy consumers, with the aim to make a more efficient use of energy (Allegra De Filippo, Lombardi, & Milano, 2017). With technological advancement came the adoption of real-time pricing (RTP) which is more frequent, thus more dynamic, than TOU pricing (Norford et al., 1998). For TOU rates, several hours are combined into classes where a customer pays the same rate for each hour in that class despite demand changes. Under a RTP rate, the rates change with demand. If a customer takes advantage of the more detailed pricing, the utility company's costs will drop along with the customer's bill (Norford et al., 1998). The changes in prices are similar to congestion pricing, where customers are encouraged to cut their total energy consumption through a lower price incentive (Honkapuro, Tuunanen, Valtonen, & Partanen, 2014).

Due to the inelastic nature of energy, getting customers to be more aware of the incentive of off-peak usage has had difficulties. When customers use the energy vs when they are billed has sometimes been the blame for the lack of awareness (Pon, 2017). Engaging customers to participate in demand shifting requires systematic communication and interaction between the utility provider and the people it serves (Koolen et al., 2017).

The Smart Meter (SM) is a tool that can measure the flow of energy and send information to a central system (Pitì, Verticale, Rottondi, Capone, & Luca Lo Schiavo, 2017). Smart Meters must be able to send the same data to customer devices in near-real-time conditions, enabling new services such as instant energy awareness and home automation (Pitì et al., 2017) inspiring energy consumers to use less energy overall or at least during peak demand periods (Levenda, Mahmoudi, & Sussman, 2015).

4.5.3.2 Application of Case to Research Questions

Energy is one of the more unique services in this research study as it is not a service that customers actively seek out on a continual basis, rather it is one that customers have a complete need for. Energy is a service that is inelastic meaning price changes do not have a significant impact on demand. Energy companies have few competitors, if any, and they are not a small business. They do provide a wealth of research on shifting demand from on-peak to off-peak hours which can assist in answering research questions 1 and 2.

Since energy companies have to generate power for customers, they want customers to use energy when it is cheapest to generate (Pon, 2017). During on-peak hours, there are possibilities for the system to be overloaded and not be able to keep up with demand, leading to power loss for customers (Hledik, Faruqui, & Harris, 2010). By shifting demand from on-peak to off-peak, they are smoothing demand and making the entire system more stable. For a small service business with an inelastic demand, a goal may be to deal with congestion during on-peak hours [**RQ2**]. By offering discounts as well as real-time information to customers, a small service business could divert customers to using the service when it is cheaper to run, thereby earning more revenue for the business [**RQ1**].

4.5.4 Leisure

4.5.4.1 Restaurant

Restaurant revenue management is the process of maximizing revenue earned at a restaurant when dealing with fixed capacity over a period of time. Restaurant revenue management is a recent practice compared to revenue management applications in other industries (Kimes, 1999; Ng et al., 2018)

According to the literature review of Kimes (2004) revenue management for restaurants focuses on two strategies to increase revenue. These include variable pricing and ensuring predictable meal duration. Having a predictable duration allows businesses to better plan for capacity management which can be used to forecast overall demand (Ng et al, 2017). Customers who take longer for their meal interfere with other customers being able to get a seat, thereby lowering a business's potential revenue. According to Thompson (2010), duration control makes up the majority of research for restaurant revenue management while there has been little focus on the use of variable pricing and segmenting customers. Some hospitality researchers have found success in implementing variable pricing with rate fences (Kimes, 1999), whereas others find that these practices are seen as unacceptable (Bujisic, Bilgihan, & Hutchinson, 2014).

When providing discounts for these services, restrictions often come into play to prevent people from taking advantage of a discount. Research from Ng et al., (2018) looked at terms and condition data from 200 deals in the United States and New Zealand, and examined how they impact promotional outcomes. While restrictions risk reducing a deal's appeal, shorter redemption periods, new customer restrictions, and time restrictions were found to improve outcomes in particular settings. Booking and menu restrictions were found to have a negative impact on deal outcomes. For lower-end restaurants, deal outcomes were positively associated with the discount percentage and new customer restrictions, but negatively associated with booking restrictions. For higher-end restaurants, deal outcomes were positively associated with the number of stores and time restrictions, but negatively associated with menu restrictions. e deal to be valid for use but this practice was nowadays less frequent. Boon et al. (2012) mentions an ideal deal has the minimum amount of restrictions and greater flexibility will increase the chance that people accept the offer, but limitations are often necessary to protect vendors.

Daily deals are examples of rate fences (Zhanga & Bell, 2012) where a restaurant can sell the same product to different customers at different prices, ensuring that customers willing to pay a higher price do not buy at the discounted price. This is similar to the airline and hotel model where leisure travelers and business travelers are sold different spots. With daily deals, restaurants run the risk of revenue leakage, where customers who would normally pay full price instead buy at a discount price (Cleophas et al., 2017). Restaurateurs should therefore be cautious when utilizing daily deals and there is a need for research into how best to configure a deal to ensure success. In a series of surveys on restaurant customers, Kimes & Wirtz (2002, 2003) found that time-of-day, and lunch-versus-dinner pricing were considered relatively fair.

Research suggests restaurants need to employ clear and understandable rules when setting different prices; the discount should reflect the level of restrictions applied in the deal (Ng et al., 2018). Restrictions on discounted prices may make a higher price seem fair but too many restrictions may be perceived as unfair by customers.

4.5.4.2 Sports

Large-scale sports and entertainment events create enormous challenges for venue management. Dynamic pricing and revenue management can play a key role. Sports and entertainment have become an important part of daily life for many. Prices of sporting events are highly differentiated based on the seats and dates (Yang, Shi, Xiao, & Feng, 2009) and can even vary based on the challenging team (Bouchet et al., 2016).

Compared to airlines or public transportation, which can reduce capacity by storing vehicles, capacity for a stadium is fixed. The goal for a sporting venue is to maximize ticket revenue for best case scenarios, leading to excess capacity during less impactful games (Bouchet et al., 2016). Teams use high ticket prices for high stake games rather than let people purchase at a lower price and resell at a higher price to other customers through an online ticket service (Shapiro & Drayer, 2012). Secondary markets like Stubhub, and SeatGeek do not exist in other service industries like they do in sports and entertainment. These secondary markets provide the end consumer with additional information and removes some of the information advantage from the team. Teams could also use the information from these secondary markets as supplementary data to assist in the pricing of future events. (Bouchet et al., 2016)

In a study by Bouchet et al., (2016), they interviewed management from major sporting teams and found that a significant portion lack dynamic pricing. Nearly 70 percent believed their organizations frequently or always apply business analytics to dynamic pricing when in actuality 70 percent only update their prices on a weekly or greater basis. 50 percent updated prices manually rather than through an automated system. The higher up in a company the person was, the greater the belief of using analytics to determine prices (Bouchet et al., 2016). The fact that a large percentage of the respondents are modifying their prices rather infrequently may signify that some survey respondents are classifying what is actually variable pricing as a form a dynamic pricing (Bouchet et al., 2016)

4.5.4.3 Application of Cases to Research Questions

Leisure services are what inspired this research to come about from a place of personal interest. When seats or timeslots are not filled to capacity, a business is losing potential revenue they will never get the change to make back.

Looking at sports venues, although on the larger side of businesses, we can see that many are not using dynamic pricing and the few that do are not all effective at it (Bouchet et al., 2016). The managers of these teams and facilities believe they are taking various data points into consideration and actively changing their prices to meet demand, when in reality most change prices fewer than once a week. The venues focus on filling seats during premium games and charging higher revenue to fans who are willing to attend, similar to airlines and hotels with business customers, but they avoid trying to fill capacity during off-peak hours as are the goals of airlines and hotels as mentioned in **sections 4.5.1.1** and **4.5.2.1.** While targeting excess demand can increase revenue, ignoring the off-peak demand could lead to significant loss of revenue opportunity. Keeping ticket prices high prevent certain customers from attending and potentially becoming high willingness to pay fans or even prevent guests from spending extra on merchandise or snacks, thereby lowering the average revenue per guest during low stake games. When all seats are not full, a team could push to increase revenue in other ways by taking a hit at entrance costs.

With restaurants, we can see that there are several factors that can impact revenue generation. The conditions that come along with discounts, such as daily deals, can lead to negative associations. The more restrictions that are placed on a deal, the less appeal there is for that restaurant. From the research, it can also be observed that offering discounts could lead to a decrease in revenue if customers are offered a deal when they would have paid full price (Cleophas et al., 2017). With dynamic pricing this could potentially be mitigated since not every guest has access to that discount and the more people trying to get a discount at a specific time, the higher the prices will go, minimizing loss but still encouraging those that may not have come in the first place. **Figure 6** shows a representation of a scenario where a business does not increase prices, but they ensure each customer pays the amount they are willing to rather than offering a wide range, non-dynamic discount.

For both these examples, another clear point that comes up is the need for data to make accurate decisions. Making gut decisions rather using data can lead to excess loss from offering discounts when they are not needed (Cleophas et al., 2017).

4.6 Summary

Section 4 sought to normalize all the different terms, pricing methodologies that center around dynamic pricing, the components that assist with dynamic pricing, dynamic pricing decisions and real-world examples of these elements and understand the relation between each.

The components that make up dynamic pricing were compared along side the case examples to see when businesses or industries used certain components and what similarities and differences there were between the cases. The cases were further analyzed and compared to the research questions listed in **section 2.3** and see how the existing dynamic research methods could be applied to small brick-and-mortar service businesses, and what impact could a purely dynamic discount model have on these small service businesses.

5 Conclusions

5.1 Conclusions to be drawn based on the findings

Dynamic pricing can often be a highly effective way for service businesses to increase revenue. Airlines, hotels, utility companies, Uber, Airbnb and more are all examples of businesses that use dynamic pricing with remarkable success. Although it has typically been utilized by larger businesses, there are possibilities for smaller businesses to take advantage of dynamic pricing. With access to recent technologies for gathering data and third-party companies specializing in data analysis, the ability to implement dynamic pricing for smaller businesses is becoming more of a reality.

The purpose of this research paper was to determine what is known about dynamic pricing and address what literature gaps still exist, to develop a potential solution that addresses dynamic pricing in small sized brick and mortar service businesses. The results of the metasynthesis does not provide a clear answer to either of the research questions but there is evidence to support each research question. With such a wide variety of services, it cannot be said that dynamic pricing through discounts would work for everyone, but it can be argued that it would work for some as seen in **section 4.5.1.4** and **4.5.2.3**, both the hospitality industry and travel industry utilize dynamic pricing to increase revenue. While they may both increase and decrease pricing, the fact that they do discounts as a way to maximize capacity is an indicator that even though a discount is being provided, additional customers brought in provide more value than if none had come in. In the case where a business fulfils a need for certain customers, dynamic discounts may not be the ideal choice, because as determined in **section 4.1** under revenue management, **section 4.5.4** and in **Figure 5**, certain customers are willing to pay more, and by not increasing rates, a business could potentially miss out on additional profit. Businesses need to be wary of perceived unfairness though from increase prices. Businesses that have more dramatic changes in capacity utilization and have significant competition where customers have a low switching cost could see the benefit of dynamic discounts.

Some of the biggest hurdles of implementing dynamic pricing is the time and monetary costs. Implementing a dynamic pricing system is an expensive undertaking that requires significant amount of knowledge, both the business and customers as well as the external environment. Businesses must also be cognizant of customers price sensitivity (**see section 4.4**) as frequent changes in price can lead to distrust, although this seems more focused on raising prices rather than lowering them. To combat distrust from customers, businesses must be transparent and have a valid reason for customers paying different prices that are more than just increasing profits. When prices are lowered though, businesses must also be concerned about customers that specifically search for discounts by analyzing patterns rather than paying full price. There is the opportunity those customers can be beneficial if they may have been pushed out from a customer surplus during on-peak business hours.

All the above variables would need to be identified for each different business and would need to be tested on a continuous basis to determine the aggregate effect on revenue. This is something that could be tested further through a more narrowed qualitative analysis or a quantitative analysis for specific businesses.

5.2 Limitations

This study has some limitations within which the findings need to be interpreted carefully. The first limitation has to do with the research method. A metasynthesis utilizes quantitative data which inherently relies on the researcher's interpretation of the data, making the research highly subjective. There is a researcher interpretation bias which could potentially lead to different analysis for different researchers. This synthesis and application are one possible interpretation of the data. In addition, a systematic review should have two authors to minimize bias when selecting research.

Second, with a lack of previous research on the topic at hand, inferences were made that cannot be verified without further testing. This analysis involved exploratory research on topics with similarities but not specific to the research question. There is a need for future research on dynamic discounts as well as dynamic pricing as it relates to small to midsize businesses.

Third, is the databases the research was selected from. Many of the research papers came from one database which could induce bias based on the availability of research in that database. Using multiple databases to gather research can minimize any bias a single database might have.

Fourth, this project suffered from time constraints and therefore could have benefited from a more thorough analysis of qualitative data. Only 3 months have been dedicated to the whole project, including problem ideation, the collection, analysis and interpretation of data, and the development of a solution in tandem that could be used for further testing.

Finally, only services were considered for this research as the research questions focused on the impact of dynamic pricing for service businesses. There is a significant amount of information available on dynamic pricing for goods which may contain a plethora of research that could also be applicable to the service industry. Give the time constraint limitation, not enough time was placed on considering goods as an option of research and is something that could be analyzed in future research and how it can transfer to the service industry.

5.3 Implications

There are many possible implications from the research that could be used in decision making. Due to the lack of research available, specific to small to midsize brick-and-mortar service businesses, much of the applicability is hard to determine. In addition, with such a wide variety of service businesses, there is no option that is applicable to every business.

Through the metasynthesis, several reoccurring themes were discussed across the research. Similarities across key topics as well as different industries and businesses were apparent and discussed in some form or other in most or all the services. Nine demand discount principles were derived from the literature review. These principles were found to be widely applicable when a service business is looking to offer dynamic pricing options.

Demand Discount Principles			
#	Principle	Reasoning	Sources

1	Decrease prices as demand decreases.	Lowering prices during off-peak demand can be used to increase capacity utilization.	(Cleophas et al., 2017; Deksnyte et al., 2014; Jones & Hamilton, 1992; Ortega, 2016; Zheng & Forgacs, 2017) Figures **3**, **4**, **5**, and **6** Sections: **4.5**
2	Increase prices as demand increases.	Prices do not necessarily have to go above the regular price but should increase once demand begins increasing from a lower point.	(Chen & Sheldon, 2016; Cleophas et al., 2017; Deksnyte et al., 2014; Shapiro & Drayer, 2012) Figures **3**, **4**, **5**, and **6** Sections: **4.5**
3	When a service is perishable and capacity is limited, inventory allocation and price setting should be optimized.	Customers who are willing to pay more should be the focus. Prices should be set so that customers are paying the price they are willing to pay rather than anything less.	(Baker & Collier, 2003; Cleophas et al., 2017; Cross, 1997; Elmaghraby & Keskinocak, 2003; Kimes, 1989; Ng et al., 2018; Rania El Haddad, 2015; Yeoman et al., 2001, 2001)
4	Businesses need a valid reason for increasing prices more than for the sake of increasing revenue.	Without a "positive" reason for increasing prices, customers may deem the business practice unfair which could lead to a decrease in revenue.	(Bolton et al., 2003; Dixit et al., 2014; Kimes & Wirtz, 2002, 2003; Suklabaidya & Singh, 2017) Section: **4.3**
5	When fencing customers, businesses need to manage relationships with customers to avoid being perceived as unfair.	Businesses can manage relationships by providing customers more transparent information or provide additional benefit to offset any booking restrictions or reasoning for price differences.	(Campbell, 1999; Dixit et al., 2014; Gibbs et al., 2018; Xia & Monroe, 2017) Sections: **4.3**; **4.5.2.2**
6	Lowering prices during off-peak business hours can move customers from on-peak demand to off-peak demand	By moving customers from on-peak demand to off-peak demand can mitigate congestion and excess demand during on-peak periods.	(Gao et al., 2019; Halvorsen et al., 2016; Honkapuro et al., 2014; Norford et al., 1998) Sections: **4.5.1.3**; **4.5.3**
7	Strictly dynamic discount methods are not a solution for all businesses.	When there is a need for a service and customers are willing to pay more, increasing prices beyond normal prices may be a more beneficial model.	(Elmaghraby & Keskinocak, 2003; Ng et al., 2018; Pergler et al., 2015) Sections: **4.2**; **4.5.1**; **4.5.2**; **4.5.4.2**

8	Businesses must be wary of customers who seek discounts strategically.	Business can lose out on a full-price sale if customer behaviour is not targeted. Certain customers may only utilize a service when a discount is available.	(Cachon & Swinney, 2009; Gönsch et al., 2013; Silverstein & Butman, 2006) Section: **4.3**
9	Information is key when trying to develop a dynamic pricing and forecasting model	Information on customer behaviour, competitor behaviour, and environmental influences should be collected on a broad and continual bases. This data should be analyzed systematically and be used in future pricing decisions.	(Aktas & Meng, 2017; Bouchet et al., 2016; Boyd & Bilegan, 2003; Burger & Fuchs, 2005; Cleophas et al., 2017; Elmaghraby & Keskinocak, 2003; Norford et al., 1998; Weatherford et al., 2001; Yeoman et al., 2001) Figure **7** Section: **4.4**

5.4 Recommendations for Further Research

This paper sets a framework which can rapidly be built upon as there are many directions future research could take. As this is a qualitative research paper, the next logical step is to either narrow down this qualitative research to a specific industry, analyzing the differences in business and customer dynamics and the sensitivity to price. Alternatively, quantitative data can be gathered from real world testing to determine if there is validity to the idea of dynamic pricing through discounts in a smaller business setting.

By analyzing how dynamic pricing has been used over time and the slight variations in how it is used can provide insight on some of the differences a researcher will need to take when developing a dynamic pricing model.

If a researcher plans to approach this from a quantitative perspective, the next step is to gather quantitative data on the use of dynamic pricing for small to midsized brick-and-mortar service businesses. The quantitative data should prove that dynamic pricing through discounts with these specific businesses in mind, should minimize lost revenue from unfilled capacity and ideally lead to increased revenue. The quantitative data should also determine whether congestion smoothing is a direct result of the dynamic pricing discounts and what impact that has on revenue.

A proposed method to gather this data is a platform that provides dynamic discounts and is accessible to small and midsized brick and mortar service businesses. The platform is divided into two customer segments, the businesses and the end consumers.

From a business's perspective, the platform would recommend discounts to the business's customers and potential customers during off-peak service hours, where the businesses capacity is being underutilized. With a limited initial rollout, the platform could suggest discounts to the business owner who could then tailor the discounts, such as the total number of discounts available or the maximum discount available at specific times. Over time, the platform could utilize an algorithm that would learn to recognize patterns in demand, using data from similar businesses on the platform and businesses in the surrounding area to provide a more accurate and timelier discount that could further minimize loss and potentially increase revenue. The analysis of data would recognize when the business will likely be at full capacity and provide no discounts so the business can maximize revenue. When capacity is not expected to be maximized, the system will offer discounts to customers to encourage them to purchase for specific times.

From an end user perspective, the platform would show the user discounted activities or services that are available at certain times and locations. The user could search for activities or services utilizing several filters such as:

- the type of service
- day of the week
- time of the day

- the size of the discount
- the size of the group using the service

Like many other discount or service finding platforms, users can see ratings of businesses, locations and contact details of the business, look at purchases/bookings, and share on social media. In the event that someone is looking to go out to a business but the business is busy and the wait to use the service is too long, they can use the platform to find a similar business nearby that may be less busy and save money while the business who was not at capacity has earned another revenue source.

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