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DEPARTMENT OF SUPPLY CHAIN AND INFORMATION SYSTEMS

INCREASING EFFICIENCY IN THE PENNSYLVANIA ALCOHOL INDUSTRY:
HOME DELIVERY OF PRODUCT

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Abstract

Pennsylvania maintains one of the most regulated, some even say “prohibitionist,” alcohol industries in the United States, namely due to the fact that beer, wine, and spirits are sold separately, and only in licensed stores. Consequently, it can be inconvenient for consumers to purchase product, as an alcohol run including both beer and liquor stops is very time consuming, creating a high barrier and opportunity cost to consumption. There are two facets at the core of this inconvenience: 1) fractionalized markets between liquor and beer, and 2) sub-optimal store locations, creating a high barrier to consumption. Consequently, the PLCB and its licensed retailers lose sales when consumers choose to save time by: a) not purchasing, or b) purchasing either beer or liquor (but not both). It is estimated that the Pennsylvania Liquor Control Board loses about fifteen percent of sales, amassing to \$360 million annually. This paper asserts that home delivery of product to consumers’ homes would remove this crippling barrier, and employing a third-party delivery company in particular would be more effective and efficient to operate and scale. Given some of the unique regulations in Pennsylvania and differences in consumer profiles, a proposed distribution system and transaction process is discussed to lower this consumption barrier that places a glass ceiling over the Pennsylvania alcohol industry.

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Chapter 1: Introduction

1.1 Consumption Barrier in Pennsylvania

The state of Pennsylvania maintains one of the most regulated, some even say “prohibitionist,” alcohol industries in the United States, resulting in a high barrier and opportunity cost to purchasing alcohol.

There are two root causes of this barrier to consumption: 1) fractionalized markets, and 2) sub-optimal locations and supply of stores.

1.1.1 Fractionalized Markets

Pennsylvania is one of thirteen states where liquor and wine are not sold in grocery stores, and beer may only be sold in a grocery store if that store has an established restaurant option with separate entrances. These stores may acquire restaurant liquor licensing allowing for sale of alcohol by-the-glass for on-premises consumption as well as sale of no more than two six packs of beer to go (Scheller, 2014). As result there is no single location at which liquor, wine, and beer may be purchased together, and an alcohol run for consumers can be very time consuming. In addition, seasonal and periodical product specials play a critical role in the marketing strategy of the Pennsylvania Liquor Control Board (PLCB), licensed retailers such as beer distributors and bottle shops, and even producers of alcohol products, but the fractionalization of markets makes it difficult for consumers to access this information. This difficulty not only causes a lack of awareness for the seasonal specials being offered to consumers, but causes consumers to overlook these products and compromises the effectiveness of these campaigns. Section 4.2.3 discusses in more detail the limited presence of retailers in the current system.

1.1.2 Sub-optimal Location and Supply of Stores

Pennsylvania operates with a privatized system for sale of beer, but the PLCB holds a monopoly on sale of liquor and wine through a system of state-owned and operated Wine and Spirits Stores. As result the PLCB is responsible in full for all costs of opening, maintaining, and operating over 600 liquor stores, rather than allowing individual owners and investors to take on the associated costs and risks. The Control Board Operates much like a business – it is not publicly funded or subsidized, which requires minimizing financial downside and operational costs. The PLCB operating more like a business, initiated in 2007, has since led to the closing of twenty stores throughout the state. The state consequently has a less than optimal amount of stores given its population. The average liquor store to population ratio for the entire United States is 1 to 7,426 – that is, one liquor store for every 7,426 people. In Pennsylvania, however, each liquor store corresponds to, or serves, 20,662 people – the ratio is nearly three times smaller due to the limited provision of stores (Census, IBISWorld, PLCB, 2013). This, combined with the fact that alcohol is generally not served in Pennsylvania grocery stores, increases the average distance to a liquor store for Pennsylvanians and contributes to the high barrier to purchasing alcohol. Section 2 will discuss how sub-optimal store locations also contribute to this barrier with reference to research by Seim and Waldfogel.

1.1.3 Effects of Consumption Barrier

These high barriers to purchase cause consumers' purchasing frequency to be less than optimal. It sometimes may result in consumers choosing to purchase either beer or wine/spirits, but not both, or alternatively to not purchase at all – in either case, the PLCB and/or its retailers lose potential sales. If the consumption barrier in Pennsylvania was lower, people would purchase alcohol more often. It is estimated that the State of Pennsylvania is missing out on about fifteen

percent of potential revenue, or about \$360 million annually, due to this high barrier (Seim and Waldfoegel, 2013). This research is designed to offer a solution to lower the consumption barrier through delivery of product to consumers.

1.2 Home Delivery of Alcohol

Alcohol retailers lose sales when consumers choose to purchase either liquor or beer, but not both, and when they choose to not purchase alcohol at all due to a lack of time. Delivering alcohol to these consumers would close these sales by removing the consumption barrier and allowing them to purchase alcohol at no opportunity cost. This solution eliminates a large time commitment for consumers and closes previously lost sales for retailers – a win-win.

Furthermore, while consumers indicate that they would pay a premium for their alcohol to be delivered to their home, which could subsidize the cost of delivery, this research will prove that it is more efficient to employ a third-party delivery and sales company. For the same reason that the PLCB cannot effectively afford the provision of a more optimal number of liquor stores, individual retailers likely cannot effectively execute the number of demanded delivery orders by the population. In addition, consolidating all products – wine, liquor, and beer – at a single location, a website in this case, would consolidate these fractioned segments into a single accessible marketplace. Third-party home delivery would solve both problems contributing to Pennsylvania’s alcohol consumption barrier. Section 5.2.3 discusses in detail, why third-party delivery companies are more efficient than, and superior to, “in-house” delivery services run out of individual store locations.

1.3 Structure of Paper

This paper will proceed in order of the following chapters: 2) Literature Review, 3) Background, 4) Methodology, 5) Analysis, and 6) Conclusion.

The Literature Review focuses on a research paper published in the American Economic Review by Seim and Waldfogel in 2013, which inspects monopolistic entry decisions with regards to the Pennsylvania Liquor Control Board in order to identify whether the system in Pennsylvania is effective and optimal. The Background chapter describes the unique liquor control system in Pennsylvania, the evolution of home delivery and eCommerce, and regulations that have hindered the advancement of these evolutions in the Pennsylvania alcohol industry. Hundreds of consumers were surveyed in an attempt to identify the level of consumer demand for such a service, and the results, described in Chapter 4: Methodology, were staggeringly in favor of alcohol delivery. The Analysis chapter will explain why third-party delivery maximizes efficiency and minimizes costs, as well as the processes necessary to operate legally and within regulatory boundaries. Finally, the Conclusion will discuss the benefits, monetary and social, that the PLCB can expect to see by offering home delivery of alcohol.

Chapter 2: Literature Review

2.1 Seim and Waldfogel: PLCB Store Inefficiencies

Home delivery of alcohol, an extremely new industry in Pennsylvania, is rather unexplored both commercially and academically. Given this, there is a limited amount of research specializing in the alcohol industry with respect to Pennsylvania. There is one specific article by Seim and Waldfogel, however, which articulates the exact issue of the consumption barrier with respect to limited provision of stores. In particular, Seim and Waldfogel inspect the Pennsylvania Liquor Control Board as a monopolist in the industry and evaluate its performance in maximizing producer, social (consumer), and total welfare in the Pennsylvania alcohol industry by studying its entry decisions.

They assert that an economic system may leave entry decisions, or opening of new locations, to either private markets or government – in this case, a governmental entity oversees entry decisions. They then evaluate the performance or effectiveness of PLCB stores with respect to producer, social, and total welfare; these each correspond to PLCB profits, benefit to society, and combined economic benefit, respectively. Private market and government controlled industries each have unique advantages and disadvantages in performance and efficiency (Seim and Waldfogel, 2013).

2.1.1 Private Market Entry

Private market action can result in insufficient entry when social benefit covers the cost of entry, but revenue does not. Similarly, if revenues cover costs, the private market can experience excessive entry despite there being no social benefit to additional entrances. In addition to an inefficient quantity of entries, even with a limitation on the number of outlets, such as the

licenses per capita limitation, private entry can result in choice of sub-optimal locations due to a lack of accessible information and/or private enterprise competitive measures (Seim and Waldfogel, 2013).

2.1.2 Government Executed Entry

Conceptually, a government planner can avoid the aforementioned challenges with respect to sub-optimal location and quantity of entries by optimizing to maximize total welfare.

Unfortunately, government planners in reality face alternative issues when executing store entries – these entities may have political pressures affecting location and resource allocation that compromise economic efficiency and welfare. In the case of the PLCB, a further complication is presented, in which the government entity is in effect a for-profit monopolist, which must focus on attaining sufficient profits, while also providing significant social benefit.

This is the case because the Liquor Control Board is a revenue source for the Pennsylvania government, contributing annually hundreds of millions of dollars in taxes and sales revenue.

Due to this focus on profit, the PLCB is unable to truly maximize total welfare, and therefore experiences inherent structural inefficiency. Exacerbating this issue is the fact that

Pennsylvania’s centralized controlled system results in a higher cost per store than in a private system. The PLCB currently spends \$1,110 per day to operate a store, which could be as low as \$549 per store per day in a strictly competitive private system (Seim and Waldfogel, 2013).

2.1.3 Research Methods and Findings

Inspecting consumer demand based on demographics, pricing and selection, labor costs, and PLCB store’s sales, Seim and Waldfogel sought to identify how “store configurations and resulting welfare under the PLCB compare with plausible [privatized] alternatives” and “what implicit motives underlie the government-operated system,” for instance, profit or welfare based

incentives or political influence (Seim and Waldfogel, 2013). Seim and Waldfogel create models for government executed and privately executed store entries, optimizing the number of stores and their locations to maximize total welfare based on their demand estimations. They test each configuration to find the pareto-efficient allocation of stores, such that no store benefits from a change in locations, and total welfare is not increased by a change in the number of stores.

The results indicate three primary effects of the current PLCB system. Firstly, the system leads to operation of fewer than half the number of stores that would exist in a private system – the PLCB currently operates 621 stores, but given consumer demand, 1,531 would be socially optimal. This limitation of stores reduces consumer or social welfare by about \$300,000 per day, but raises producer welfare; this backs up the notion that the PLCB is profit focused rather than welfare focused. The second result is a reduction in consumption of alcohol by about fifteen percent; that is, the PLCB misses about fifteen percent of potential revenues due to the inefficiencies of the system. Based on the 2014-15 PLCB Annual Sales Report, this could amass to about \$360 million of missed revenues (PLCB, 2015). Finally, the PLCB system results in a higher labor surplus in wages that does not exist in private systems. No significant political influence was found in the location of stores, though the current store configuration throughout the state is not optimal according to their tests (Seim and Waldfogel, 2013).

2.2 Application of Seim and Waldfogel

These store configuration inefficiencies contribute directly to both factors in the consumption barrier. Further fractionalization of the beer and liquor markets thus occurs, as the locations of Fine Wine and Good Spirits stores are not optimized with the locations of beer distributors and/or bottle shops, adding to the inconvenience of purchase. Similarly, sub-optimal locations result in some consumers needing to travel further to purchase product. In this case, higher costs

associated with travel will negatively affect consumers' demand for product and contributes to the annual loss of roughly fifteen percent of potential PLCB revenue uncovered by Seim and Waldfogel.

Chapter 3: Background

3.1 Pennsylvania Alcohol Beverage Control

According to the National Alcohol Beverage Control Association (NABCA), seventeen states have adopted forms of the “Control” model, in which states hold a monopoly over certain segments of the alcohol market, most notably with respect to liquor. Of these seventeen states, thirteen of them also control retail sales for off-premises consumption, through either government-owned and operated stores or designated licensed agents. Twenty-eight states in the U.S. feature an ‘open license’ system, in which the state oversees nothing more than the provision and issuance of various licenses to alcohol-related businesses to authorize their operation (NABCA, 2016).

The regulatory nature of Alcohol Beverage Control States dates back to the end of prohibition, and it is important to consider the grounds on which many of these systems were created.

Prohibition in the United States was repealed on December 5th, 1933, when ratification of the 21st Constitutional Amendment repealed the 18th Amendment, which previously illegalized the sale of alcohol in the United States. Four days later, Pennsylvania Governor Gifford Pinchot called the Pennsylvania Grand Assembly into session to debate alcohol regulations (The Joint Committee of the States to Study Alcohol Beverage Laws, 1950). This session led to the establishment of the Pennsylvania Liquor Control Board and its then mission to discourage the purchase of alcoholic beverages by making it “as inconvenient and expensive as possible” (The Pennsylvania House Liquor Control Committee, 2011).

Possibly as result of these initial values, the state of Pennsylvania takes a different approach to liquor retailing. Pennsylvania operates with a privatized industry for beer sale, but has a full

monopoly on the sale, wholesale, and retail of wine and spirits. Pennsylvania and Utah are the only two states in the country that exercise such a monopoly.

These structural differences in power and authority between the Pennsylvania Liquor Control System and that of other states combined with the highly regulated nature of the PLCB has resulted in a very slow and outdated industry, which has managed to defy the evolutions of modern day retail, primarily eCommerce.

3.2 Changes in Home Delivery and eCommerce

In this technological era, a website's primary purpose is to enable consumers to operate more efficiently. Consequently, the technological movement surrounding retail has drastically changed peoples' shopping preferences. ShopperTrak, a market research company, helps retailers worldwide learn about their customers. In a 2013 study spanning December 2nd – 8th, ShopperTrak revealed that foot-traffic in stores plummeted over twenty-one percent since the same period in 2012. Conversely, e-commerce skyrocketed nearly seventy-one percent since the previous year, breaking \$1.6 Billion in six days (Tuttle, 2013). People prefer shopping online, which has even become popular with grocery delivery.

Grocery delivery emerged a few years ago when Amazon and Walmart began selling and delivering to homes (Butler,2014). Not too long after, third-party companies such as Peapod and Instacart began to emerge. These third-party delivery startups had no problem competing with powerhouses like Amazon Fresh and Walmart despite the differences in size, finances, and publicity (Punakivi and Saranen, 2001).

In addition to groceries, home delivery of prepared meals has become a multibillion dollar industry in recent years. With nearly \$1.2 Billion invested in food delivery companies in the past three years, the valuation of the industry reached nearly \$70 Billion in 2015. Similar to the phenomenon evident in the grocery delivery industry, third-party companies have taken over the market share with respect to food delivery as well. Companies such as GrubHub, Seamless, and OrderUp have made online ordering in particular extremely popular due to its convenience – consumers even submit to paying higher fees to order online rather than over the phone (Kim, 2015).

3.3 Pennsylvania Home Delivery Regulations

Alcohol home delivery is an extremely new and emerging industry – the oldest company in the space is only a few years old. Drizly was the first company to offer the service, initially launching in Boston, Massachusetts. Since then it has become a highly demanded industry, with new companies attempting to enter every month. From San Francisco to New York City, the market has become extremely attractive for new companies looking to break in, but Pennsylvania is yet to see similar activity.

Why hasn't home delivery of alcohol happened yet in Pennsylvania? The simple answer is because it has been illegal for years and is still highly regulated. In March of 2015, however, the PLCB authorized the provision of a Transporter-for-Hire license to allow a third-party to fulfill the delivery of alcohol. The majority of applicants and recipients of the license include restaurants to deliver alcohol, primarily beer, with peoples' food orders. Standard couriers such as FedEx and UPS have also attained the license, but it is yet to appear like it did in other places, especially large cities.

Instacart, a grocery delivery company based in San Francisco, was the first to attain the Transporter-for-Hire license and enter the Pennsylvania alcohol delivery market in 2014 when they launched wine and spirits delivery in Philadelphia. In 2016, however, they were investigated for violating the law by operating outside of the scope of their license, and their alcohol delivery service was then shut down. The difference in Pennsylvania regulations that raises the barrier to entry is that despite the authorization of third-party transportation, the sale must still occur on the licensed premise of a distributor, bottle shop, or liquor store – Transporter-for-Hires are not authorized to *sell* product. Virtually every third-party delivery service outside of Pennsylvania accepts orders and processes transactions on their own website, which is not legal in Pennsylvania because only the retailer may accept orders and facilitate transactions. Similarly, nobody is authorized to *resell* any product, in which case a delivery driver would receive payment from a customer to enter the store and purchase the alcohol themselves to then provide to the customer – this was the system through which Instacart serviced and is why it was halted. Section 5.3 will present the necessary and proper transaction process that is legal, within regulatory boundaries, and therefore must be followed.

The following chapter will discuss the consumer market in Pennsylvania to highlight the demand for such a service through survey data and identify consumer profiles for different tiers of service.

Chapter 4: Methodology

4.1 Directly Lowering Consumption Barrier: Feasibility Challenges

At the core of the high consumption barrier in the Pennsylvania alcohol industry are these issues of fractionalized markets between liquor and beer, and sub-optimal store quantities and locations. Solutions to either of these present major feasibility challenges.

For example, while the beer and liquor markets could be combined into single stores to solve the issue of fractionalized markets, this would have a significant negative impact on industry, small business, and regulation. This is an impact that, furthermore, would exacerbate the issue of sub-optimal store locations by forcing many current retailers out of business to make way for fewer larger retail outlets carrying wider selections.

Similarly, it is unfeasible to attempt a relocation of PLCB stores for many reasons, including limited real estate availability, confusion amongst consumers, and a costly transitional period.

4.2 Testing Home Delivery as a Solution

In order to test the feasibility and effectiveness of home delivery as a solution to lowering this consumption barrier, surveys were used to capture consumer profiles for hundreds of college students at The Pennsylvania State University, as well as consumers in the city of Philadelphia, PA. The intention of these surveys was to understand the shopping habits of the average alcohol consumer in Pennsylvania, with respect to State College in particular. State College, Pennsylvania was targeted due to its status as a “College Town,” home of Penn State University, making it a very feasible test-site.

4.2.1 Targeting College Towns: State College Data

College towns of large universities are a very feasible location for delivery services, especially on-demand delivery services, for example, food and groceries. State College in particular is a great location for on-demand delivery services due to the high concentration of consumers in a small radius. For example, downtown State College houses thousands of college students in less than 1.5 square miles, and over sixty percent of these students report not having cars at school, which raises their barrier to consumption even higher. Resulting delivery distances are minimized in these locations and routing can be easily optimized due to the commonality of one-way roads, and demand for such a service would be extremely high. Section 4.2.3 discusses the demand for alcohol delivery through interpretation of survey results.

4.2.2 Targeting Cities: Philadelphia

Cities are another lucrative market for on-demand delivery services, housing 1.5 million people, over thirty percent of which do not own cars. Similar to college towns, the high population density is beneficial to delivery services, with the only downside being city traffic and lower fuel economy. Philadelphia in particular, however, bolsters a large niche market – popularity of craft and microbreweries. Pennsylvania leads the nation in barrels of craft beer produced annually at 4.05 million, and Philadelphia is renowned for its craft beer selection, listed as one of the “Best Beer Towns in the USA” (Burchette and Passell, 2013). While there are breweries in the city of Philadelphia, they are very scattered, with the distance between breweries being no less than three miles, and most located on the outskirts of the city. Most Philadelphia residents indicate interest in exploring products of local craft and microbrews, but this familiar barrier makes these products inaccessible.

4.2.3 Consumer Profiles: Alcohol Shopping Habits

Hundreds of Penn State students and Philadelphia residents were surveyed on their alcohol shopping habits, answering primarily about reasons for purchasing, preferences, and presence of retailers' websites in their shopping experiences.

Results (Figure 1) indicated that over seventy-five percent of respondents admitted to sometimes wanting to purchase alcohol, but not having time to do so. In response to online resource questions, over two thirds said they had never once visited a beer or liquor store's website. Furthermore, despite seasonal and periodical specials being a significant marketing strategy among alcohol retailers, eighty-three percent of drinkers were not aware of discounts and specials at their local beer and liquor stores. An even larger portion of those surveyed, eighty-seven percent, reported that they would take advantage of local discounts and specials if they were accessible at a single location, or one website. Retailers could therefore expect a one hundred percent conversion rate for those who were formally unaware of specials – all and more would take advantage of these specials if information was consolidated on one website. Finally,

Figure 1

Are there times you want to purchase alcohol, but do not have time to do so?

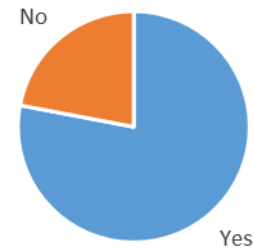
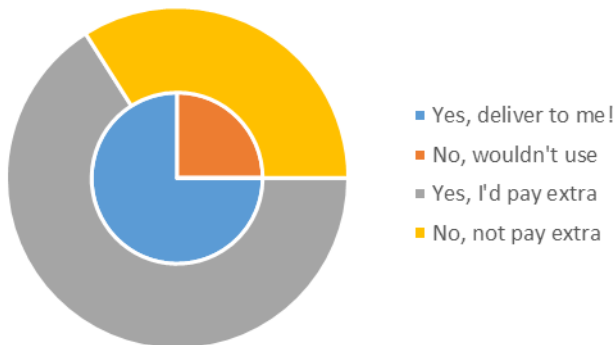


Figure 2

**Would you like your alcohol delivered?
Would you pay a fee for convenience?**



as shown in Figure 2, when explicitly asked, more than seventy-five percent stated that they would use an alcohol delivery service, and over sixty-six percent would pay a premium for the convenience.

Chapter 5: Analysis

The Pennsylvania Liquor Control Board, in order to lower the consumption barrier, increase sales to optimal levels, and attain up to \$360 million in additional revenue, can see most opportunity in the unexplored market of alcohol home delivery. Survey results show that there is indeed a consumer market for home delivery, as respondents indicate a rather high demand. In addition, consumers display a high elasticity with regards to alcohol prices, or in other words, are less sensitive to changes in prices (Babor, 2010) – this means that an extra fee for delivery or a markup could be charged for convenience without a significant loss of sales.

5.1 Inefficiencies in PLCB Facilitated Delivery

Section 2.1.2 established that the Pennsylvania Liquor Control Board assumes higher fixed and marginal operation costs – a direct result of the state monopoly. In order to implement a service for home delivery, the PLCB would be forced to extend and inflate marginal costs even further. Costs of delivery include those associated with vehicles, drivers, and most importantly routing. Routing efficiency is paramount to minimizing costs and route optimization is the most valuable tool to do so. The simplest way for the PLCB to facilitate deliveries would be to employ a driver at each individual Wine and Spirits store to minimize time of delivery, but unfortunately, this is the most inefficient way to do it for two reasons:

- 1) Drivers would be forced to waste valuable time and gas returning to the same liquor store for deliveries.
- 2) The PLCB cannot efficiently deliver products of privatized beer retail and wholesale licensees, such as distributors and bottle shops, which would exacerbate the market fractionalization.

5.1.1 Driver Stationed at Individual Stores

Drivers returning to the same store for each delivery not only over-consumes time and energy, but also it would fall victim to the costs associated with the store's sub-optimal locations. As shown in the research by Seim and Waldfogel, back-and-forth transportation between sub-optimally placed stores already costs the PLCB about fifteen percent of annual revenue, and although some of the revenue could possibly be made up, it does not truly assess the root of the problem..

5.1.2 Excluding Privatized Beer Retailers

By stationing drivers at individual stores, it would be next to impossible to also deliver from beer retailers – the costs of delivery and route inefficiencies would outweigh the revenue gained from entering this market. These private beer retailers could potentially provide their own delivery services to consumers in their area, but as shown by the survey results and consumer profiles, demand would be limited due to fractionalization. Survey respondents indicated that they would utilize these services most if all products and information were aggregated or consolidated at a single location – one company or service provider.

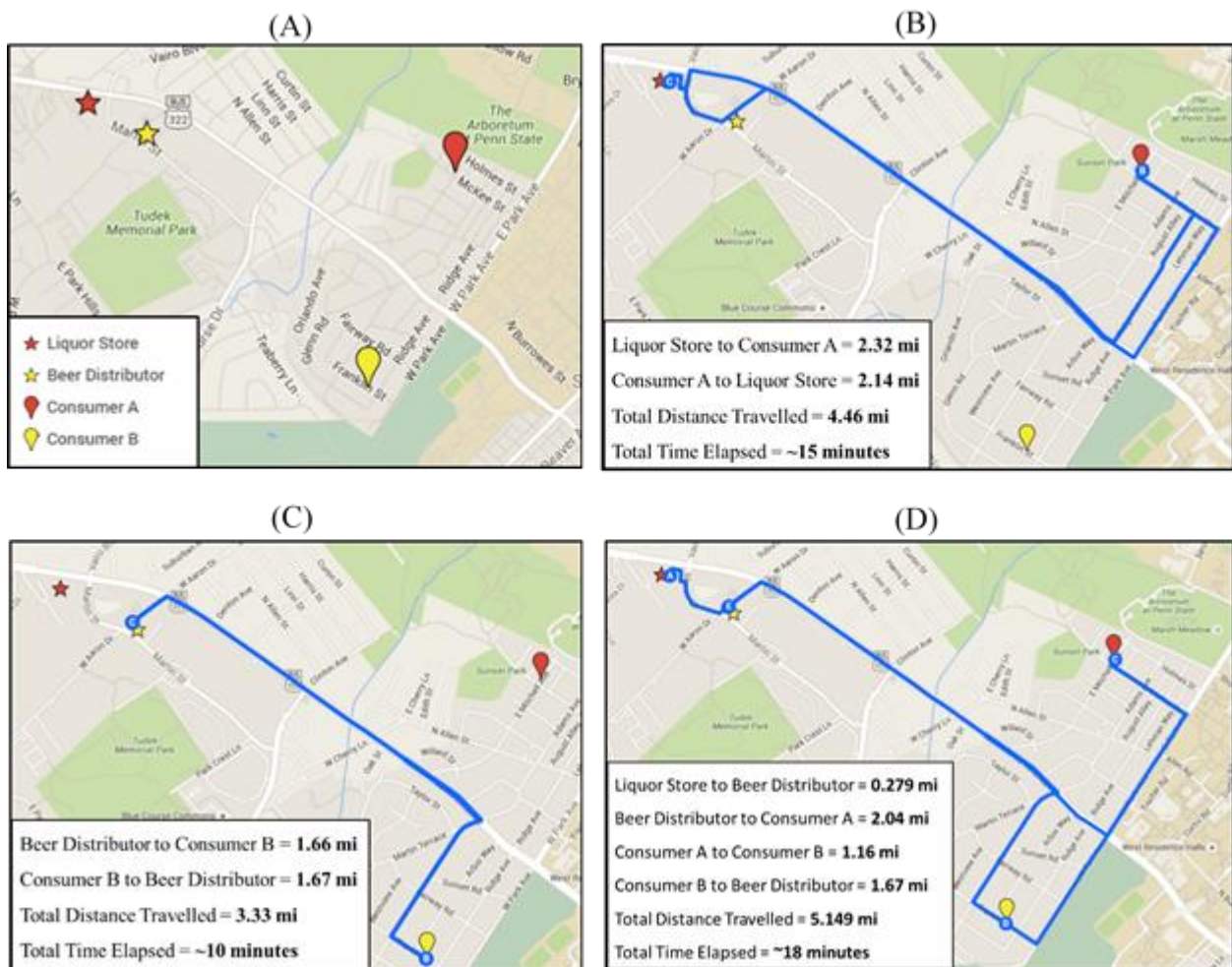
5.2 Efficiency in Third-Party Facilitated Delivery

A third-party transportation company could solve both caveats to PLCB provided delivery. This company would not be tied to any single individual store, and could still employ a network of drivers that service an entire area at a lower cost. Fewer drivers would be necessary to provide a fully operational service because they would not be tied to a single store, and this flexibility would allow for the consolidation of the beer and liquor markets to overcome the fractionalization. Despite the sub-optimal locations of stores, a third-party can route by assigning each driver a radius or zone that optimizes for the established locations of stores.

5.2.1 Store Provided Vs. Third-Party Delivery: Cost Comparison

This model is shown in Figure 5.1, which displays a town with two stores – one beer distributor and one liquor store – and two consumers. Choosing random locations for the consumers, Consumer A orders liquor and Consumer B orders beer. Consumers are indicated with a location pin, color coded to match the store they ordered from, while stores are marked with a star, again color coded to match the consumer they are serving.

Figure 3



Within Figure 5.1, image (A), top left, simply displays the locations of the stores and consumers.

Images (B), top right, and (C), bottom left, display the routes if each store were to provide their

own delivery service. They show the optimal routes that an individual driver would take from the liquor store to the liquor customer (B) and the beer distributor to the beer customer (C), including distances (miles) and time (minutes) of each *round trip*. Because drivers in (B) and (C) are assumed to be employed by individual stores, they subsequently return to the store they came from. Finally, image (D), bottom left, displays the route taken by a single driver employed by a third-party company, serving the entire area. After the deliveries are made, the driver returns to the beer distributor in order to fairly represent the round trip.

Comparing the distances and time travelled between (B) and (C) against those of (D), it is clear that third-party facilitated delivery is much more efficient. While (B) and (C) individually have lower distances and time travelled, their individual costs are not an accurate estimate of the total costs of serving the area – they must be combined to see the true economic costs. Combined, (B) and (C) travel 7.9 miles to facilitate these two deliveries and about twenty-five minutes from departure to arrival (this model ignores extra time elapsed during product pick-up and actual delivery). Inspecting (D) by itself, in contrast, is a fair representation of the economic cost of serving the area with this model because it takes on all deliveries. The total round trip distance travelled by the driver in image (D) is just under 5.15 miles, over thirty-three percent lower than the total costs of (B) and (C). Likewise, the travel time is eighteen minutes for the (D) round trip, saving over one fourth of the time spent by the (B) and (C) round trip drivers.

5.2.2 Cost Function Comparison

It is clear that (D) is much more efficient than (B) and (C), and that it would minimize marginal costs per delivery. An equally large benefit, however, comes from the fact that only a single driver is employed in (D), while two drivers are employed between (B) and (C), reducing fixed costs as well. Let drivers make an average wage of w per hour, over travel time, t , in minutes,

with gas costing an average of g per mile; we can create the following models for the costs of delivery for (B) and (C) against (D).

$$C_{BC} = 2\left(\frac{t}{60}\right)w + 7.9g$$

$$C_D = \left(\frac{t}{60}\right)w + 5.15g$$

The equations above accurately represent the costs of delivery for each model. $\left(\frac{t}{60}\right)$ provides a measure for the amount of time that was spent on the delivery, multiplied by w wage, resulting in the exact amount the driver(s) cost for that particular trip in wages. As shown above, time, t , was about twenty-five minutes for (B) and (C), and was eighteen minutes for (D). Estimating gas costs, g , at roughly \$0.12 per mile and wage, w , at \$10 per hour provides the following results.

$$C_{BC} = 2\left(\frac{25}{60}\right)\$10 + 7.9(\$0.12)$$
$$C_{BC} = \$9.29$$

$$C_D = \left(\frac{18}{60}\right)\$10 + 5.15(\$0.12)$$
$$C_D = \$3.62$$

As shown above, the costs of delivery for (D), when including number of drivers, time spent on deliveries, total distance travelled, and gas costs, are incredibly low compared to those of (B) and (C). In fact, just by employing one third-party driver, costs were minimized by over sixty percent. A large portion of this is due to the wage of the driver based on time elapsed, which came out to \$3 for (D) and \$8.34 for (B) and (C). All of these inefficiencies compound one another, which is especially seen in this stark contrast in wages paid to drivers. The distribution model demonstrated in image (D) is so much more efficient that drivers could be paid double

(\$20 per hour) and it would still be significantly, over twenty-five percent, cheaper than executing the distribution model demonstrated in images (B) and (C).

5.2.3 Profit Function Comparison

The cost of delivery is significantly lower for distribution model (D), utilizing a third-party delivery company, and the models below show its effect on the PLCB's profits. Profit, π , is calculated as a function of q , the quantity of beer purchased (in pints) multiplied by one cent, which is the tax rate on beer, and p , the price of Consumer B's liquor order, minus C the cost which was calculated in the aforementioned cost functions.

$$\pi_B = q(\$0.01) + p(31.2\% + 18\%) - C_B$$

$$\pi_D = q(\$0.01) + p(31.2\% + 18\%) - (C_D + m)$$

The equations above accurately represent the total profit the PLCB would see for models (B) and (D), respectively, based on sales information from the 2014-2015 annual sales report. These include the state tax on beer, which is one cent per pint purchased, the average gross margin on liquor of 31.2%, and the PLCB liquor tax of 18% (PLCB, 2015). The second equation, π_D , which represents the PLCB profits if utilizing a third-party deliverer, includes the cost of a payment, m , made to the third-party in return for its services.

In the equations below, which calculate profits, π , if the PLCB facilitates delivery against employing a third-party. The quantity of pints purchased, q , is set at 9, the amount of pints provided in a twelve-pack of beer, which determines the beer tax collected by the PLCB when multiplied by one cent. The price of the order, p , of \$30.44 is the average debit-card order in a Pennsylvania Wine and Spirits Store, which determines the marginal profit and liquor tax collected when multiplied by the reported average gross margin and liquor tax percentage (PLCB, 2015). Utilizing the cost functions described in section 5.2.2 yields total costs of \$5.54 for PLCB facilitated delivery of liquor, and \$3.62 for third-party facilitated delivery.

$$\pi_B = 9(\$0.01) + \$30.44(31.2\% + 18\%) - \$5.54$$

$$\pi_B = \$7.70$$

$$\pi_D = 9(\$0.01) + 30.44(31.2\% + 18\%) - (\$3.62 + m)$$

$$\pi_D = \$11.44 - m$$

Excluding cost of the payment to the third-party, the PLCB profit on the sale is nearly fifty percent higher for third-party facilitated delivery. When including third-party compensation, m , calculated as a commission or percentage of the sale, any payment less than \$3.74 would be profitable for the PLCB. Therefore, the PLCB would profit at any profit-based commission rate under 32.69%, at which point the cost of m is below the breakeven level of \$3.74.

5.3 PLCB Regulations: Transaction Processing

Section 3.3 discussed the regulatory barriers that make it extremely difficult for companies of this kind to enter the market – one of the most challenging barriers is technological: establishing a legal transaction process.

As mentioned, a third-party alcohol delivery company would be required to purchase and maintain a Transporter-for-Hire license; Class C is required for delivery of both liquor and beer. The technological and procedural challenge, is that this license is not a retail or sales license – under no circumstance may a Transporter-for-Hire sell or resell alcohol to consumers or licensees. Therefore, the transaction must occur on the licensed premise of the licensed retailer prior to delivery of the product.

5.3.1 The Proper Transaction Process

In order to ensure that sale occurs on the licensed premise, the third-party must build out a platform in which the transaction does not occur (1) immediately on their own website, (2) until the retailer accepts the order. This language, “accept the order,” is the key to the process.

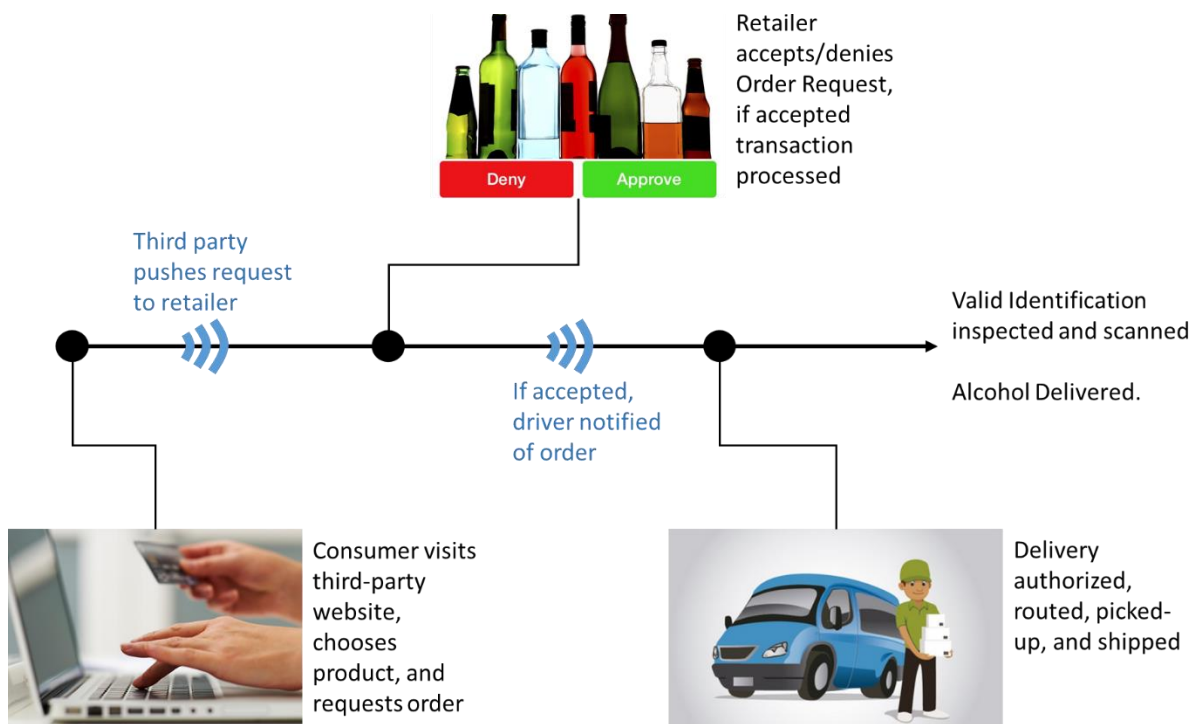
On the third-party’s website the consumer would choose their product, checkout their cart, put in their credit card information and submit their order. Generally, in most other industries, upon submittal of the order, the transaction is immediately processed, but the Transporter-for-Hire must postpone the transaction until the licensed premise accepts the order and authorizes the transaction.

Therefore, consumers will not *submit* orders via the third-party – they will *request* orders. The consumer will select their desired products, provide their credit/debit card, billing, and shipping information, and at this point will *request* this order. The third-party is now responsible for connecting the consumer to the correct retailer to facilitate this order and optimize delivery routes. Once identified, the third-party will need to push an Order Request to the licensed retailer – the transaction has still not yet been facilitated. The retailer will only need a device that is internet or wifi enabled so that they can log onto their website account, and view their dashboard of order requests, where they must be able to view all of the information about the order (name,

date of birth, address, price, time, contact, etc.). The retailer will not have the option to accept or reject this order – if they accept the order they will authorize and facilitate the transaction; if they reject the order, the transaction does not go through and the consumer is notified.

If and when the retailer accepts an order, the third-party delivery driver for their delivery zone is notified immediately, and makes way for pick-up as soon as all current shipping deliveries are complete. Figure 4, below, visually displays the transaction process.

Figure 4



5.3.2 The Identification/Verification Process

Consumers are required to present valid Identification at the time of delivery, and the person whose name is on the order must be present at the time of delivery to accept the product. If said person is not available, the alcohol will not be delivered. Even in the case that a different of-age twenty-one-year-old with a valid form of Identification attempts to receive the order, the delivery

will be cancelled – only the person whose name is on the order may receive the product. This is important in case a minor should attempt to order using an of-age parent's, sibling's, or friend's credit card.

In addition to checking and scanning ID's at the door, it would be beneficial to authorize consumers before the order is even processed. In order to do this, another third-party credit card and fraud verification company could verify that the person ordering is twenty-one and not fraudulently impersonating someone else before the Order Request is sent to the retailer. This is significantly more expensive, but would result in a very concrete verification process with very little error.

Finally, when the consumer signs for the product, the delivery driver's phone should capture a picture of the recipient of the alcohol. This is a liability protection in case that recipient orders alcohol to give to a minor.

In Pennsylvania, liability is a serious concern for licensees throughout the state due to the severity of violation sanctions by the PLCB. If the above process is meticulously followed, however, there is no doubt that liability will be minimized and safety maximized. Some companies in the past, such as Instacart, were ignorant to the regulations and laws that were in place. Outside of Pennsylvania, there are much lower regulatory barriers, and companies often do not realize the importance of adhering to these standards. Once a company gets shut down once, it is incredibly difficult to successfully return to the market and regain presence, so these processes are paramount to success and longevity.

Chapter 6: Conclusion

The Pennsylvania Liquor Control Board is faced with a unique set of challenges with regards to efficiency. On one hand, it is a regulatory agency that must limit the negative externalities of alcohol, but on the other it is a for-profit organization that funds a significant portion of the Pennsylvania government's budget. Fractionalization of the beer and liquor markets is established as a result of the state's monopoly over wine and spirits along with a privatized system for beer. The sub-optimal location setting of stores is unavoidable; it is impossible to truly optimize location across the state due to real estate barriers – some locations are unavailable, real estate is taken, or it may be physically impossible to establish a store in some locations.

Nevertheless, the PLCB, with its interest in budget allocation, must face these issues to remove the inevitably resulting glass ceiling. This paper has established home delivery of alcohol as a medium to achieve that goal. Consumers' demand for alcohol is relatively inelastic, proven in the work of Seim and Waldfogel as well as Babor, making people willing to pay extra to save time and transportation costs. Delivery would remove the issue of sub-optimally located stores by eliminating the effect of transportation costs on consumers' demand. PLCB home delivery on its own, however, is not enough to fix the equally large problem of market fractionalization, which adds significantly to the consumption barrier.

The only way to successfully eliminate this fractionalization is to offer home delivery of beer, wine, and liquor by one service, consolidated at one easily accessible online website.

Furthermore, testing has proven that third-party delivery is the best model for maximizing efficiency due to its flexibility and robustness. A third-party company can spend nearly three

times less on transportation by optimizing routes and driver radii based on beer and liquor store locations, while still facilitating deliveries at a faster rate with fewer drivers.

6.1 Positive Externalities of Home Delivery

As a regulatory agency, the PLCB may hold concern with making the barrier to purchasing alcohol *too* low. One may assume that offering delivery and giving consumers more access to alcohol may result in more binge drinking and more alcohol related injuries. This, however, is simply not true. The National Institute on Alcohol Abuse and Alcoholism (NIAAA), a branch of the National Institutes of Health (NIH), found in a 2016 study that binge drinking rates, when controlled for frequency of consumption, were highest among underage drinkers from ages twelve to twenty. This means that “although [underage drinkers] drink less often than adults do, when they do drink they drink more” (NIAAA, 2016). Underage drinkers consume ninety percent of their alcohol by binge drinking, but upon turning twenty-one binge drinking becomes a less common practice in their alcohol consumption – they drink more casually, and therefore safely. A similar phenomenon can be expected with respect to home delivery of alcoholic beverages. If alcohol is more readily accessible in the home, people may choose to stay home, which results in more casual drinking. Furthermore, consuming alcohol at home lowers the probability that the individual would attempt to drive under the influence – sixty-six percent of survey respondents believe that this service would result in fewer alcohol-related car accidents and injuries by decreasing driving under the influence.

By engaging in third-party delivery of product to consumers, The Pennsylvania Liquor Control Board can overcome crippling market inefficiencies, increase annual revenues by nearly \$400 million, and provide a great deal of social benefit to Pennsylvania residents through a lower consumption barrier and the positive externalities that result.

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Academic Vita

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EDUCATION

The Pennsylvania State University

Bachelor of Arts: Economics
Bachelor of Arts: International Politics (Political Economy Concentration)
Schreyer Honors College; Paterno Fellows Program

University Park, PA, 16802
Graduation: May 2016

EXPERIENCE

Aqua Vitae Technologies, Inc.

President and Founder

State College, PA

Jan 2015 – Present

- Founded on-line ordering and delivery service for adult beverages using advanced Supply Chain and Logistics
- Work directly with PA State Government and the PA Liquor Control Board
- Negotiate business and legal terms with clients and has established 20+ client/expert relationships
- Quarterback a 7-person team with two interns, while ensuring quality in experience

Lion Launch Pad

Executive Director

University Park, PA

Aug 2014 – May 2014

- Directed a startup incubator, giving over 30 local startups versatile expertise and guidance
- Mentored 16 upper level ventures, which went on to receive \$30,000+ in funding from various sources

Tunetap Music

General Manager

State College, PA

May 2013 – Jan 2015

- Managed operations and a 4-person team at Penn State University
- Built and maintained relationships with 25+ artists and venues
- Promoted events via social media and guerilla marketing in State College and Philadelphia with 100% success rate

Reed Smith, LLP

Summer Intern, Corporate Real Estate

Philadelphia, PA

June 2013 – Aug 2013

- Collaborated with attorneys on 40 complex and time-sensitive capital market transactions
- Created an inventory system to increase efficiency in compiling and tracking deal documents, adopted by firm

ORGANIZATIONS & ACTIVITIES

Penn State Marching Blue Band

Captain, Member

Penn State

Aug 2012 – Present

- Selected by peers to be captain of the drumline for the 2014/15 and 2015/16 seasons
- Lead and motivated 36 diverse and competitive musicians to always maintain a high standard
- Established goals to perform successfully with strict deadlines, learning a new show every week

The Presidential Leadership Academy

Student Council, Member

Penn State

Feb 2013 – Present

- One of 90 Penn State students selected for a critical thinking academy taught by the President of the University
- Connect with distinguished leaders in diverse disciplines and practice leadership in and outside the classroom
- In 2014, served on a 9-member student council as liaison between academy directors and members

SKILLS

Microsoft Office Suite
Excel Macro

Stata, Statistical Data Client
Written and Oral Spanish

HONORS

- National Society of Collegiate Scholars
- National Honors Society of Leadership and Success