

**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Economics**



**Diploma Thesis**

**Brewing industry in the United States of America**

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**Department of Economics**

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## DIPLOMA THESIS ASSIGNMENT

Bc. Vyacheslav Yeremetko

Economics and Management

Thesis title

**Brewing industry in the United States of America**

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### **Objectives of thesis**

Evaluation of position of beer in the United States, beer production, local market, assess contribution of beer production and export to US economy, conduct prediction of potential future scenarios related to beer production of the country, impact various variables such as income or own price on beer consumption

### **Methodology**

Theoretical part: synthesis, abstraction, observation and deduction.

Practical part: qualitative and quantitative data analysis, econometric time series forecasting and regression models.

## The proposed extent of the thesis

60 pages

## Keywords

Brewing, production, export, beer consumption, alcohol.

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## Recommended information sources

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## **Declaration**

I declare that I have worked on my diploma thesis titled “Brewing industry in the United States of America” by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any third person.

In Prague on 29<sup>th</sup> March 2018

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Vyacheslav Yeremetko

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## **Brewing industry in the United States of America**

### **Abstract**

This diploma thesis is about brewing industry in the United States of America. Provided current general information of global beer market and in the domestic country. Explanation of structure on the global market, market segments, agricultural factors and aspects are done. Analysis of beer production in the United States, regional breweries, microbreweries and craft beer are performed in this thesis. The share of beer export and the country contribution to the global market. The first econometric model has been analyzed of ARIMA method and forecast of beer production in the United States. The second econometric model has been analyzed impact of various variables such as income or own beer price on beer consumption in the United States.

**Keywords:** Brewing, production, export, beer consumption, alcohol, United States;

## **Pivovarnický průmysl ve Spojených státech amerických**

### **Abstrakt**

Tato diplomová práce se zabývá pivovarským průmyslem ve Spojených státech amerických. Za předpokladu současných obecných informací o globálním trhu s pivem a v tuzemsku. Vysvětlení struktury na globálním trhu, segmenty trhu, zemědělské faktory a aspekty jsou prováděny. V této práci se provádí analýza výroby piva ve Spojených státech, regionálních pivovarech, minipivovarech a řemeslném pivu. Podíl vývozu piva a příspěvek země na světový trh. První ekonometrický model byl analyzován ARIMA funkcí a prognózou výroby piva ve Spojených státech. Druhý ekonometrický model analyzoval dopad různých proměnných, jako je příjem nebo cena piva na spotřebu piva ve Spojených státech.

**Klíčová slova:** Pivovarnictví, výroba, vývoz, piva, alkohol, Spojené státy;

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### **List of Abbreviations**

ACF	Autocorrelation Function
ADF	Augmented Dickey Fuller
ARIMA	Autoregressive Integrated Moving Average
CAGR	Compound Annual Growth Rate
IPA	India Pale Ale
OLSM	Ordinary Least Squares Method
PACF	Partial Autocorrelation Function
US	United States
USA	United States of America

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## 1 Introduction

At the beginning of the 20th century, there were many local breweries, as many cities only received their beer from local taverns. Although some larger breweries began to distribute their beer by this time, most sold their product on-site in the cabin, as settings (eh.net, 2010).

To suppress the excessive use of alcohol and the problems that it caused, the US went on a ban in the 1920s. All breweries, big and small, had to think about how long they would have to wait for the ban to last, and what they would do in the meantime. Many of the small breweries could not afford their brewing equipment and sold their facilities, non-giant losses. Nevertheless, large breweries could produce "near beer" or beer with alcohol under one percent in volumes that allowed them to remain on the market (eh.net, 2010).

When the country came out thirteen years later, the government passed restrictive laws to limit the saloon to such an atmosphere before. Since the breweries could not easily be sold on the spot, the larger breweries that supported and developed their distribution lines took advantage of the opportunity (eh.net, 2010).

In the 1950s and 1960s, the brewing industry experienced a sharp consolidation, since the main breweries dominated the market. The number of USA breweries reached a low level in 1983, when 51 breweries controlled only 80 breweries in the whole country. By the early 1980s, six of the largest breweries (Anheuser-Busch, Miller, Heileman, Stroh, Coors and Pabst) operated 92% of the entire brewing market (BeerAdvocate, 2011). These large beer manufacturers were able to build more large breweries with more automatic processes. This led in fact to that they made more automation in the whole commercial and provided more of a serial property control. What actually created it, allocated to these large breweries the main moments of the furore is that they actually had the opportunity to make high-quality beer inexpensively. The smallest brewers could not produce a huge number of beer with an unchanged taste, which actually led to a loss of market share. Adding to the predominance of large breweries was that, due to the brewing the greatest number of beer, they were able to start working with greater economies of scale. These "microbreweries" no longer needed to resell their own beer at the highest tariffs in order to increase profits as their size rises. After that they managed to enter into price wars with other breweries, knocking out more small ones and retaining their personal ascent.

## **2 Objectives and Methodology**

### **2.1 Objectives**

The purposes of the diploma thesis are to analyze brewing industry in the US, to evaluate position of micro-breweries and craft beers in the country, to analyze beer production, export and consumption of the country. A forecast of beer production in US for the next year will be done. To estimate and to calculate impact of various variables such as income, beer price on beer consumption in US market.

Hypotheses:

1. Relating to the fact that over the past fifteen years, beer consumption in the USA is decreasing, production of beer expects to be decreased for the next year.
2. People consume more beer if their annual income increases.
3. There is relationship between own price of beer and beer consumption.

### **2.2 Methodology**

To fulfill objectives of this thesis, in theoretical part have been taken methods such as abstraction, synthesis, observation and deduction from the proper books and articles for gathering data. Books by Ogle and Gammelgaard used to examine the history of American beer as it affected the social culture. The methods of qualitative and quantitative analysis such as observation and processing of blogs regional breweries in order to analyze brewing industry all over the world and in the United States. Determine volume of beer production, export and import of the country for the last ten years and to compare the share of the microbrewery and craft beer. The first econometric model using by estimate and calculate the beer production in a time series from 2004 to 2017 and ARIMA forecast production for the next year. All calculation and tables of the first model using by hand and Microsoft Excel program. The second econometric model using by estimate regression model of impact various variables such as income and beer price on beer consumption of the country. Calculation using by hand and Gretl program. For accuracy of determining the relationship between model variables, the time-period is taken from 2001 to 2015. Beer consumption was established as the dependent variable, income and price of beer as independent variables.

Software used: Microsoft Excel, Word and Gretl programs

### **3 Literature Review**

#### **3.1 Overview of brewing industry**

##### **3.1.1 A consolidation grown on U. S. markets**

This consolidation led to that, in fact, that the beer market became overloaded in the leading undifferentiated product: cheap, low taste, low alcoholic beverages. This desire led to that that the brewing industry of the USA more and more departed from a large number of types of beer found in the Atlantic.

These larger breweries worked with a broad, cheaper supplier strategy, flooding the market with similar products. They managed to grab people of all demography, because they had the resources to enter national markets and expand beyond the district store. Beer became so similar, in fact, that the buyers began not to worry about taste, as much as the lowest cost. Consolidation led to a rise in the beer market, because the number of barrels littered in the US increased from 55 million barrels in 1940 to 188.4 million barrels in 1980 (eh.net, 2010). Any South American barrel of beer has 31 gallons, and as a result, the huge build-up of barrels meant an important upswing. This progression showed a glimpse of the rise, which fueled itself, because the sheer size of the manufacture allowed the brewers to expire to fresh markets and realize more beer. Beer consumed per capita in the US doubled over this period from 12.5 gallons per person to 23.1 (eh.net, 2010). Consolidation was not satisfied with any resistance from buyers, because they began to drink more undifferentiated goods.

However, a number of years ago a large number of changes was made that would have adjusted the branch and sent it in a new direction. The movement of the microbrewery started on the west coast in the late 1970s (although Fritz Maytag opened Anchor Brewing Company, now considered the first craft brewery in the USA in 1965, it was a clear deviation of this time). In 1978, a year after the opening of the first brewery, the home was welded by the federal government for the first time since the ban (BeerAdvocate, 2011). This caused a lot of attention to the development of fresh kinds of beer with more strong smells and to different species outside the American light camp.

Almost all family brewers managed to buy high-quality beer and divide it into larger markets than their friends. Ken Grossman, the founder of the Sierra Nevada, the

west coast began to see a rise in artisan breweries. These breweries were confined to the study of more saturated species and other species. The pioneers, based on these initial microbreweries, did not work much more than their ingenuity, in order to make all the important equipment important for manufacturing. They quickly learned that they were brewing in the kitchen. They no longer had the opportunity to cook in a simple trunk or two; they need more equipment to allow them to keep pace with their own larger fresh markets. For these unique craft brewers took advantage of everything they could actually find, found dairy farms and waste for tanks and pipes, which they had the opportunity to weld together in order to make the desired setting of brewing (Ogle, 2006). They still used more old equipment, which could be closed in the 1970s.

Huge production batches have made more than an elementary difficulty with the machine; the brewers noticed that it was much more difficult to arrange stable high-quality ales. Successful breweries have quickly learned that this was usually fixed by an intense commitment to cleanliness and adjustment of their recipes. Recipes that they used for household brewing needed to be tweaked in order to allow the smells to flow in a measured manner in the huge brews. The heads of the beer created a bet to quit the camps that dominated the beer market, and instead they began to brew ales. Because they were eager to regain unity and purity, almost all used only 4 components: malt, hops, yeast and water (Ogle, 2006). More problems have arisen in connection with their fresh niche industry, because distributors often ignored them or charged immeasurable amounts in order to send their beer. Distributors were used for large breweries that paid the highest prices for their own cargo spaces and did not intend to lose the share of this business, in order to risk on fresh brewers that had not yet justified, in fact, that they have an important market. The new brewers often perceived the problem of dispersal into their own hands and gave out personal beer. Like the unique brewers from the United States, they will need to be trusted as to their ability to drink good ale, for example, and on their ability to implement it. This led to the fact that almost all handicraft breweries were then obliged to enter the district distribution areas, limiting their accessibility and impact.



### **3.1.2 The birth of the first modern brewpub in the United States**

Michael Layborne and Norman Franks, two young Bay Area home brewers, discovered a different method to solve the problem of distribution. They knew that resale of beer is as important as creating a high-quality beer. In order to guarantee, at least, the share of sales, they decided to use the state's fresh legislation, which made it legitimate again for the brewers to sell their beer on the space (Ogle, 2006). This spawned the Hopland brewery (now Mendocino), the 1st current brewery in the United States, recalling salons, taverns and beer gardens that made a huge share of the century's beer back. Brewpub gave artisans a brewery a fresh method to differentiate personal business. By selling their own personal premises, they gained a key success factor, without investing so much in the distribution. This allowed them to spend more of their own money on brewing. The nuance of the pub gave them another superiority, because he offered his patrons a more connected feeling with the firm, in effect, forming a real identity for their own product.

However, not every brewery managed to repeat personal success. For every successful new craft brewery in the late 1970s and early 80s, almost all others were in trouble. Which is not the least, not paying attention to these difficulties, the transition to commercial beer started, and this only gained momentum.

At that moment the new branch was in the leading brewers of the west coast, but by the mid-1980s, it began to find a personal road on the east coast, led by a man from many generations of brewers, Jim Koch. Koch was a successful business consultant, with business and legal degrees from Harvard, who found something else from his own life. When he noticed the new movement of the craft brewery, he promptly took it into his head that the bulk of the kinds of beer he tried were not a good kind of beer. He was disappointed that a precedent that almost all fresh breweries began to produce low-quality beer for the public, which elementary did not understand anything better. He decided to found his own personal company Boston Beer Company, the guardian of today's firms, these are like Samuel Adams. Unlike fresh breweries on the other side of the state, Koch decided to make absolute flavored beer. At this point, the bulk of brewers from the craft were avoided, most likely because of their connection with large breweries, but Koch knew, in fact, that he had the opportunity to demonstrate that the camps were a great taste, if everything was created correctly. He also brought a large number of other constructive

changes: in exchange, in order to acquire or build a personal personal brewery, in order to arrange his own beer, Koch was brewed under a contract with a regional brewer, which was brewed under force. This step, but also criticized by other pioneers of beer, decided the expensive costs of launching the brewery and undoubtedly helped it to avoid the traps of bad equipment and work under pressure (Ogle, 2006). Other craft brewers claimed that because Koch did not directly brew his beer, he was not a true brewer, but Koch knew that he was already trusted by an experienced master, and instead he concentrated more resources on his own marketing. He brought the handicraft beer industry to the first project on the east coast with absolutely some non-standard methods.

Like most of the craft breweries, which have grown beyond microbrewing, the Boston Beer Company was not afraid to take on extraordinary routes to establish its own business. Since that time, almost all other microbrewers have taken steps to expand, having analyzed what are the more effective methods of obtaining benefits, rather than taking on themselves the conclusions that would support the vision of the craft brewer's own product (Gammelgaard, 2013). Over the past several decades, more small breweries have agreed to allow more large breweries, such as Anheuser-Busch and Miller, to buy minority stakes in order to guarantee more extensive distribution. This allowed the smaller breweries to defend themselves from the levers of their suppliers' negotiations and avoid the need to pay higher profits to autonomous shipping companies.

Other microbrewers have acquired a contract for brewing, in order to guarantee more probabilities for recovery than their personal objects. However, unlike other sectors of the economy of the industry, in which large companies predominate, the craft brewing industry always allowed small breweries to be timidly successful, including at the district level. This is due to the fact that buyers of the craft brewing industry are generally considered to be people who care about where food and drinks are and will pay a little more to recognize. Just in consequence of this, from the 1980s to the early 2000s, there was a huge explosion of breweries with a staggering number of about 1,400 breweries, and sales grew at a rate of 40% per year (Ogle, 2006).

Meanwhile, the market, similarly, has achieved the significance of a steady rise, which is more similar in the 1980s than the boom of the 1990s over the past few years, with more steady rates of recovery (Brewers Association). Due to the nature and competition in the market, almost all fresh breweries are quick enough without the highest

quality or the next business model. But with every failed microbrewer comes once again an entrepreneurial house-brewer, in order to arrange a copy, trying to get a dream.

## **3.2 Analysis of current Craft Brewing Industry**

### **3.2.1 Economy & Industry Trends**

The impact of the recession on the branch of the brewery was significantly less noticeable than on the other economy of the state. Practically, from year to year the industry continues to grow as the size of beer sold, for example, and for bucks. Their rise slowed down in the direction of this period, but because of the nature of the maturing market it was still constant. The market is not considered a confirmation of the recession, but it is evidently resistant to a recession. Almost, the market is already recovering successfully, publishing the rise from 2009 to 2010, when the craft beer market saw their sales in volume increase by 11% and the rise in retail prices by 12% (Brewers Association, 2017). This has the opportunity to amaze those who value the craft brewing industry as luxury goods compared to cheap lagers provided by large breweries. However, not paying attention to the higher price, it is clear, in fact, that almost all buyers do not consider them as perfect substitutes. The craft brewers now have this powerful fan base, in fact that they no longer have a chance to shake the differentiation in the common market.

The craft brewery market is growing stronger despite an overall decline in the overall profitability of the beer industry. With the increased awareness of good beer led by beer writer Michael Jackson and others starting in the late 1970's, more people are appreciating higher quality beer. As this consumer education continues, the market will likely reflect even stronger growth in the craft beer sector against the larger breweries. Though the net growth of the number of new breweries has begun to level off over the last few years, this is more due to relatively similar number of breweries closing as opening. However, next year the Brewer's Association predicts to have twice as many craft breweries open as the year before, putting an added strain on the market (Brewers Association, 2017). This has the potential of cutting profits for craft breweries all over the market, both large and small, just like in the late 1990's.

The microbrewery market is slowly developing over the last decade after the market adjustments of the late 1990s. Subsequently, the boom of the beer of the 1980s and early 1990s, a number of fresh traders tried to benefit from the developing market. This has led to a large number of family brewers, with no idea how to handle business and a huge number of businessmen without knowing how to brew high-quality beer. Competitiveness in the market in the end result allowed to arrange the same conclusion, in fact that Koch, Grossman and others came back decades: without high-quality, sequential beer and the idea of how to profit, there was not the slightest method to make a business model that allowed would for a persistent success. In the end, more weak firms were weeded out, which actually led to a highly competitive but still expanding market.

Economic decline undoubtedly helped to avoid such a tremendous shock as the one that happened more than 10 years ago. Banks are more moderate with loans and are investing at the moment, and fresh start-ups are required to justify their own business model, before they manage to raise funds. During the last rout, there were a number of breweries receiving funds, including without having a market for implementation (Egelston, 2012). Lust desire is present, but it has not reached the point where "grocery stores intend to bore their own walls to put in an expanded section of beer" (Egelston, 2012).

The irony comes from such a precedent that the approval to start all fresh breweries happens from a prestigious trend that craft beer carries with it now. For example, Martha Stewart now has a show explaining the correct supplies and etiquette for parties on beer tasting, which introduce the product into an even wider audience (Egelston, 2012). Crafted beer was formed from the niche industry, which at one time was, and with this there are difficulties for breweries to maintain the highest quality, which has made them successful. This recovery will only last for this time, when craft beer will be a beer for the average buyer. Since generations grow up without taking into account the world of beer without Sam Adams or the Sierra Nevada, handicraft beer will be more common (Egelston, 2012).

Despite this growth, many predict another reduction, even if it is not the same size as the previous one. The reduction will be kept to a minimum, as beer awareness continues to grow, and people do not commit the same excessive mistakes as in the past (Throwback Brewery, 2017). As new breweries enter the market, they will better understand the realities that a crowded market will bring, mitigating unnecessary risks that could have

been taken earlier. For breweries entering the market today, flexibility is critical. Industry will change in the face of rising energy costs and competition, and those who are ready to make adjustments will be left (Egelston, 2012). The importance of consistent production of high-quality beer will grow only as the number of breweries can differ from others (Throwback Brewery, 2017). Suppliers will look for the highest quality product to put on a limited shelf space, and the strongest and most popular beer will be successful.

Because these breweries are looking for ways to differentiate themselves, each time there will be a specific number of "innovators" who want to be the first to try fresh handcraft beer on the shelf. However, if the firm does not have the opportunity to understand how to arrange a wonderful beer for tasting and still receive the benefits, they will not continue for quite a long time, so that the followers strengthen their own consumer base (Tremblay, 2009). More successful breweries are those who are not satisfied with the preservation of the status quo. These are those who, for example, or are otherwise tuned for a persistent triumph, whether through their own components, sales channels, or marketing channels. Another highlight of the success for a strong brewery is the ability to introduce innovations every day and invent their own products. As the bazaar begins to be saturated with normal beer styles, a particular beer authoritative person will start to find new brews. This innovation includes the study of rare and fresh styles of beer for communication with new markets.

Craft-beer is an industry that lends itself to crazy ideas and experiments leading to such innovations, but it's the trend industry (Egelston, 2012). Ten years ago, double IPAs were a radical idea, but now most breweries have tried to make their own changes. To be completely unique in this market is incredibly difficult, no matter what the brewery uses for the ingredients. Even the most ready-made ideas, as a rule, will be released only in large series of beer or in limited editions, since they will never have the opportunity to have a real impact on the final result (Egelston, 2012). Not being able to get the scale needed to change, innovative beer serves its purpose - to provide an opportunity for creativity, but often it is a struggle for breweries to find sustainable success; A notable exception is the Dogfish Head brewery.

Instead, the industry is heading towards greater specialization, rather than constant innovation (Egelston, 2012). As more and more breweries enter the market, looking for their niche, it will be seen that these breweries focus on a certain style of beer or a limited

number, as opposed to breweries that seek to appeal to everyone. As unique ideas become less frequent, limited editions will always have their place, but remaining successful breweries will have to focus on the styles and beers that they do best (Egelston, 2012). There are empirical data throughout the country that breweries already specialize and continue to work. The importance of flagship beers such as Smuttynose's and Redhook's IPAs, or Pale Ale Sierra Nevada, will be of paramount importance for success. This successful beer will allow breweries to take risks in other markets, as they have a stable source of income, while preserving the profitability of their company.

Another trend that contributes to the differentiation of the brewery industry is the move towards becoming green and sustainable. Throwback Brewery and other breweries have based their entire business model on this concept, and it has become a growth trend. Since sustainability, local food and caring for food have increased in our society, we saw that we switched to our beer. Consumers love the idea of beer brewed using ingredients from the street, and now larger breweries are looking for ways to capitalize on this. Many of these breweries already have different programs for donating used grains to local farms and participating in recycling programs, and their contribution to the environment will only grow (Tremblay, 2009).

This concern for local agriculture, coupled with the lack of jobs affecting our country, has focused on helping the local culture of agriculture. Farms now start working with breweries of all sizes to grow the necessary ingredients to make high-quality beer. Although demand and supply are relatively small, this market is definitely growing. A few years ago, there was a lack of hops, as the demand of brewers grew much faster than supply, and this brought many consequences for him in the industry. One of the most important was the need to create breweries contracts with their farmers, not so much to fix the price, but to block fixed demand (Egelston, 2012). After many years of unstable markets for their hops and other products, many farmers decided to leave the industry or even sell their farms. With the regular use of these contracts, many farmers are brought back to the market. Due to such obligations, farmers feel more comfortable investing in the necessary infrastructure and land needed for growing hops and barley (Egelston, 2012).

Since this dependence has caused great stability in the industry, the potential for larger breweries to use local ingredients has increased. However, there are still many obstacles, as the pure production of local hops remains for a number of reasons. The

largest of them is the cost of the necessary equipment necessary for sampling and shaking hop (Egelston, 2012). Many farmers are struggling to find the resources needed for machines, even with the obligations of local breweries. To combat this, states and private farms began to create cooperatives for hop processors, allowing a number of farmers to share the cost and utility of these machines (Egelston, 2012). Although it is still an imperfect method, since access to these machines is growing, so is the offer. For regional breweries, the volume needed for each batch still does not make enough sense to make the switch, but every year that passes in the industry, it is approaching a more stable market, as everything returns to buying and supporting local (Throwback Brewery, 2017).

Due to one of the biggest leaps in recent years, the brewery market has declined from 1% to almost 6% of the total beer market in the last fifteen years (Nason, 2012). Despite this, even the most optimistic beer fans understand that this will most likely not become the majority of consumed beer. Instead, the overall realistic goal is to ultimately achieve ten percent of the total market volume. It was an opinion that was laughed at just a few years ago, but as the financial market slowly returns, new breweries open, and others become better known, the goal is approaching reality (Egelston, 2012). Between traffic to significant food routes and local sustainability, the craft market will continue to grow and reach more consumers. Some brewers, including JT Thompson of Smuttynose, believe that craft beer will reach a state where it is no longer considered a craft beer, but simply a beer (Egelston, 2012).

“...(O)ne of the best litmus tests is going to be when you go into an Applebee’s or other corporate chain and instead of having Miller, Coors, and Bud, they will have only one or two and they will have a selection of craft beers on tap. They will have a light beer, because there will always be light beers, because there is a place for that. But you’ll have an IPA, and you’ll have a porter and a stout, and you’ll have a Guinness.” (Egelston, 2012).

Having opened a commercial world for beer production, there would be an opportunity for growth, which can even support all the smaller breweries entering the market. One of the biggest challenges facing the industry right now is that it faces many niche industries that are achieving success. Breweries must protect themselves from buying a concept that commercial success means "selling off" (Egelston, 2012). As our society

embraces handicraft beer, and the industry continues to excel in finding new customers, the steady growth for handicraft breweries becomes a reality.

### **3.2.2 Community Presence**

The role of society is not considered an incessant condition for a successful brewery, but it is an effective method of marketing and has the ability to arrange a difference between the trouble of starting and success. It contains a different value for every brewery, but it still stands such that it is possible to justify the value for their society and promote a good reputation. Sponsorship is one of the most simple methods to concrete influence on the regional markets. Breweries every day requires donating beer or money to all different organizations and banks to qualify which of them are worth the investment.

For a smaller brewery, such as Throwback, which gets at least one request a week, they have to be careful. If they agree with any wish, they quickly give away all the beer they make (Throwback Brewery, 2017). Instead, they choose the right organizations for this, in order to sponsor quite seriously and to see to it that their values are harmonized. They guarantee that they will sponsor district-based sustainable organizations, such as Seacoast Local, to post personal information in publications and help in other regional arenas (Throwback Brewery, 2017). These sponsorships are effective for Throwback, because they make it possible for their brewery to freeze visible to demographic groups that will become quite interested in their model, including if they do not necessarily consume beer. Almost all breweries take part in fundraisers who combine themselves and a personal product with district restaurants. These actions are a wonderful way to show casual guests how superbly efficient beer voyages can make food. This encourages buyers to purchase their beer not only during this time, when they go out for food, but also for dinner dwellings.

Almost all the smaller breweries are fighting for their ability to take part in other events. However, the largest breweries, such as the Redhook brewery, have every chance to resolve for themselves not only to support the regional organizations, but also to organize personal events for these groups. Their spaces in Woodinville, Washington and Portsmouth, New York, have a large number of events every year, forcing district residents and outside states to come, celebrate and enjoy their own beer (Mikesbrewreview.com,



2011). As a supporting marketing prize, a number of these events are charitable organizations that allow Redhook to look even more approving in its own neighborhoods. These actions, from performances and tastings to road racing, enable Redhook to reach its own district society and have a real impact.

Large brewing factories still see the importance of sponsorship and have somewhat more probabilities in the programs they support. With more high performance, they have every chance to amuse more requests for their beer. Smuttynose sponsors a number of non-profit and charitable events, as well as groups, these are the district softball teams (Egelston, 2012). In contrast to the more small-sized brewery, they do not have a well-coordinated intention relatively with which groups to work with. Without such an intention for the population, it becomes increasingly difficult to see everything not bad, in fact Smuttynose and other large uncoordinated breweries do for the district scene. However, the bulk of these breweries confirm the importance of supporting non-profit organizations, not paying attention to the inaccessibility of publicity. They feel, in fact, that whenever they sing out beer, they do direct advertising to a specific motivated group and get long-term buyers (Egelston, 2012). Smuttynose will definitely thank their district association and in tandem with their sister brewery, the Portsmouth brewery, they sponsor these events, like "Telluride at the Sea" and "The Music Hall" (Egelston, 2012). They show, in fact, that they are participating in their society.

However, these larger breweries have more sweeping coverage, which actually means that they still have all the chances to exist in societies for hundreds of miles from their own facilities. Smuttynose can help events up and down the East Coast and allocates the elasticity of the sales department in order to help in all areas. This allows one to observe their countless charitable endeavors and sponsorship, which cannot be measured literally. What is not the least, the need to give in all areas that they realize is principled as a method of expressing appreciation and exposing its name to buyers who probably did not hear about them (Egelston, 2012).

Beer weeks are another wonderful method for breweries to address district buyers and take a role. Because the bulk of these festivals do not pay for the beer served, the restriction is again placed on smaller breweries, which in the unpleasant case would like to participate. Because breweries grow, and they have every chance to solve time and auxiliary beer for themselves, these festivals are considered phenomenal promotional

events. They provide breweries of all sizes to get their product out to personal product in motivated demography and really increase their visibility. In addition they are considered to be a wonderful method of movement, they still give brewers. It is not easy to qualify, in fact, what everyone likes on the basis of impartial sales, but at these events, breweries have every chance to get a direct personal turnover association from their own customers. This is an invaluable resource for breweries of all sizes. These beer weeks and festivals grow and enter the new markets of any year. Not only is this creating more awareness for certain breweries, but the general civilization of the craft beer which was significant only 5 years ago (Egelston, 2012).

For breweries like Throwback, who work closely with district farmers, their role in society is much more direct than the elementary giving of beer and money. Working with district farmers and communities, they provide significant assistance to the regional economy, especially in agriculture. Thanks to their excessive demand for the components needed for brewing, they are giving the district farmers another option to use their own land to maximize the benefits. These funds are cyclized through the economy, forming a future recovery for these farmers, and even breweries. They expand this work outside the farm branch, trying to apply district skills when it is possible. Throwback's growlers are checked by a firm in New Hampshire, and all works made for the brewery are produced by the district artist (Throwback Brewery, 2017). The recruitment of the district brewery does not end with the distribution of beer.

### **3.2.3 Competition**

In the broad sense, the bulk of rivals for these little brewers happens outside the craft brewing industry. One of the most indisputable direct rivals in the brewing industry is the larger unrestricted brewers. These firms, like Miller and Anheuser-Busch, produce beer in sizes that exceed even the largest craft breweries, such as the Redhook and the Craft Beer Alliance, which flood the market with their own cheap light lagers. These beers are considered to be the best daily options for the vast majority of the consumer beer market due to their lower tariffs and often lower calories. These large breweries also began to enter the craft brewing industry, throwing their own important resources into becoming not only their own normal camps and marketing, as their products, similar to brewing beer

brews. Their value allows them to sell these beers at lower tariffs than firms, including the same ones as Redhook. In addition to beer, all kinds of products, such as wine and scotch, still have every chance to take away from the beer market (Krebs, 1998). These are drinks that are similar to craft beer, in that sense, in fact, that they matter as a solemn or special drink in the likeness of a drink, in contrast to the more inexpensive varieties mentioned above.

However, not paying attention to external pressure, competition plays a different role in the brewery market than in most other sectors of the economy. In practice, the bulk of brewers quickly dismiss the term "competitor" for other breweries. This does not mean, in fact, that these firms assume, in fact, that all accounts are acquired identically from any brewery, they still want to sell more than others. However, these breweries aren't going after each other, trying to exterminate their neighbors, engaging in advertising wars, similar to those that have all the chances to pass Anheuser-Busch, Miller and Coors (Egelston, 2012). Instead, as Annette Lee of Throwback talks, "the brewing association is considered cumulative and supportive" (Throwback Brewery, 2017). Instead, in order to block all beginners, other craft breweries confirm the importance of creating a strong brewing society.

When Throwback Brewery was revealed, the recommendations of other brewers were decisive for the founders in choosing the volume and ability of some equipment (Throwback Brewery, 2017). Everyone they called was as necessary as it was likely, providing them with legitimate support, never hiding recommendations from them that could help them. Apart from their discovery, the brewing association remains a constant resource for Throwback, because they continue to experience trying to increase pains. They had recommendations on where to arrest and how to clean the kegs, which protocols are available for the country, the best way to recruit support and help overcome almost all other difficulties (Throwback Brewery, 2017). For breweries made and, in particular, recent startups, the brewing industry is still considered an outstanding zone for consultations on beer that they brew. Almost all startups are headed by household brewers, who serve only their own friends and family, who will always talk to them, in fact, that their brews are considered the best. However, with skilled brewers trying their beer, they have all the chances to get a legitimate turnover association, which has the opportunity to help these start-ups to better their own processes and recipes to a similar extent that allows

for a real success (Throwback Brewery, 2017). In addition to constructive feedback, the usual courtesies from rivals have every chance to guarantee confidence that the fresh brewer is obliged to go with the plan of such volume.

Nano-firms are more exposed to the growing number of breweries than developed regional breweries, but they also suggest using other district breweries. They confirm that the precedent, in fact, that there is no impeccable peace, where they will be the only ones in this region, as a result they do everything possible to locate other breweries and offer the same support that they had as startups (Throwback Brewery, 2017). The bulk of small breweries will be able to sustain in the direction of a short period of time based on their novelty, but if they from time to time are hoping for a brewing association, they have all chances to be unable to stay in space for a long time.

This cooperation is made by the regional association, which benefits all involved breweries, an association that some experience a little later in comparison with a large market. Other areas of the state and Europe have already begun to develop this culture of adherents of beer and "geeks", and now New Hampshire begins to observe the direction (Egelston, 2012). Buyers in the state are beginning to plead for more variety in the styles and brands that they find. Because they see these states, like Massachusetts with various variations, they want to try it too. In order to meet this claim, vendors and bars are required to derive some diversity due to state boundaries, but they are also making a stronger demand for beer throughout the state, not just the fact that they have every chance to be found in a nearby town. This competition for the plans of rows and places on the shelves has the opportunity to freeze up the task for municipal breweries, but still makes more demand on the part of the buyer to see all that is out there (Egelston, 2012). When they find out what other flavors exist, they will be more likely to study and find other breweries in the state.

In order to represent a local brewery association of breweries in the state, a number of breweries try to make a guild. The group is still in its infancy and meets challenges when almost all of the breweries are not sufficiently staffed to freeze as beautiful as they would have wished. What is not the least, communication and cooperation, which are between all of them, have a decisive meaning for this, so that this thought would go and come out of the ground. But some of them do not make the decision to overdo, the bulk of breweries in the state embrace the idea of the guild and its outstanding qualities (Egelston,

2012). The New Hampshire brewers' guild will give a number of superiority to those who take part, covering a more powerful voice when the government determines the fresh legislative body. Distributors of beer contains quite a powerful lobbying capacity and they are working, so that laws that appear from the end of the prohibition intact. With a small lack of voice for microbreweries in the state, they do not have enough chances to change these laws, which are so prohibitive (Egelston, 2012). By forming a guild, these brewing factories will be able to chat just in fact that they are preparing them more capable of increasing awareness of their own side of the argumentation. Thanks to this and other lobbying efforts, they have every chance to work with distributors to create more constructive laws in the state that contribute to the recovery. As one of the only sectors of the industrial economy growing in the country, and one of which is used by an important number of people in the state, their impact has the opportunity to be important if they become connected. New Hampshire begins to take the significance of the aid of this movement, and in the present nature of the branch there was a rather large amount of cooperation.

The guild will still provide the only advertising voice for all breweries, ensuring important information. They will be able to publish publications reflecting the whole situation, and not just information collected from a brewery close to the state capitol (Egelston, 2012). The guild still allows more lightweight access to breweries from these groups like the state and interest groups. In addition to the publication, they will be able to consolidate the municipal events, these as a week of beer in New Hampshire, which will debut this year. All these efforts have every chance to help any brewery autonomously from its volume. What precedent, in fact, that these are individual breweries trying to collect this together, rather than a lobby group from DC, talk about cooperation, found, meanwhile, that foreigners call "competitors."

#### **3.2.4 Importance of Pricing**

“(Pricing) has to be important, especially in a brewery where you do have a fairly wide reach. Its importance will continue to grow as ingredients and resources become scarcer. Whether that’s fresh water or right quality of malt and barley, due to climate

change. We're starting to see these growing areas move north, especially for barley. Pricing will have to matter." JT Thompson (Egelston, 2012).

Not paying attention to impression that craft beer is still considered to be entirely a niche sector of the economy, which is resistant to cost, there are limitations on how far firms can stretch their own costs. As JT says, the changing environment will only continue to create a tariff estimate that is more needed in the branch, because breweries are required to find a method to balance the increasing costs of components, making their beer easily accessible to everyone. The constant task is to make sure, in fact, that the brewery does not impersonate the market (Egelston, 2012). Beer produced by the largest breweries is no longer considered commoditized, which is marketable, because handicraft beer is also being made at the moment. Including with the tasks of jumping a certain number of years back the constructive reel of tariffs was not, the breweries had to find internal ways to handle changes (Egelston, 2012). Some breweries, such as Sam Adams, are considered favorites of the branch, which have the right to make a price change, for which others will follow, but if other breweries enter the configuration, you will not see enough effect, not counting the fall in profits.

The balance, in order to find the right value, contains the decisive significance for breweries from hired factories. Everyone thinks that beer should be available, but it cannot be underestimated (Throwback Brewery, 2017). Breweries are obliged to find out what they really need to arrange their beer, compare their costs with conditional tariffs to other breweries and qualify which beers should be manufactured and at what retail price. Buyers pay a large number of bills outside their own beer tabs, and brewers understand this, making sure that their costs are within reach (Egelston, 2012). If the brewery increases its own cost very high, buyers will find in a different space, resulting in the size of the brewery, which will actually lead to an increase in their specific costs, forming a downward spiral for the brewery.

Niche breweries have some elasticity in their own value, for example, as each time there will be a limited number of buyers, in order to purchase this product. However, as a niche brewery, they will never be able to expand to a wider consumer base, without reducing costs and without losing benefits. The largest breweries will issue limited editions and gigantic lots of beer, which they promote with the highest quality Kevin Lapoint Microbrewing in the American packaging 24 properties and components that have every

chance of urgently asking for higher value, but these proposals work elementary to another niche market (Egelston, 2012). This beer is inadmissible for a huge brewery, in case this is all, in fact, what they are doing. Pricing in this branch is considered to be a moment that makes sense for the people who make it, and people who use it and find an important balance have a decisive meaning.

### **3.3 Beer Industry Overview**

#### **3.3.1 Beer Market Competitive Analysis by Type, Production, Category and Packaging and Industry Forecast**

The size of the beer industry market is unimaginable. The wholesale trade in the beer industry makes up \$ 413.7 billion. Almost 400,000 people work in the branch. The average worker is paid within \$ 188.27 per hour. As it is seen, this is a rather giant branch, which gives a large number of working spaces of American working power. The market is made from a number of rivals, some of which are rather gigantic, and some work on rather small scales. Competitive rivalry is divided into 3 sections: state, regional and microbrew. National competitors have a sweeping market coverage and, as a rule, a solid company. Regional rivals are smaller than the National ones, in fact, that they only spread only in specific areas. Microbrewers are considered to be the shortest of the 3, due to the fact that their magnitude and power limit their spread to only small geographical areas. The pace of the beer market's rise is confusing. In domestic brands from 2016 to 2017 there is a decrease in consumption by -1.2%. In the imported section it increased by 14.3%. The total industry as a whole fell by 7% from 2016 to 2017. As a result of the lowering of beer consumption, such a result in production happened with a decrease of 1.2%. The expected monitoring for 2018 will last for the same trends as in 2017. The long-term possibility for the branch is that the implementations will remain at the same level in the direction of the proper 10-20 years. There are a lot of companies in the branch. In the direction of many years, industry has somewhat decreased (Gammelgaard, 2013). The state market is made of 10 leading rivals. Opponents in this market are Anheuser-Busch, Miller, Stroh, G. Heileman, Adolphs Coors, Pabst, Genesee, C. Schmidt, Falstaff and Pittsburgh. National firms have 51 plants all over the land of the United States. The share of the market in the domestic market ranges from a low value of 0.5% to 34%. The Import market consists of

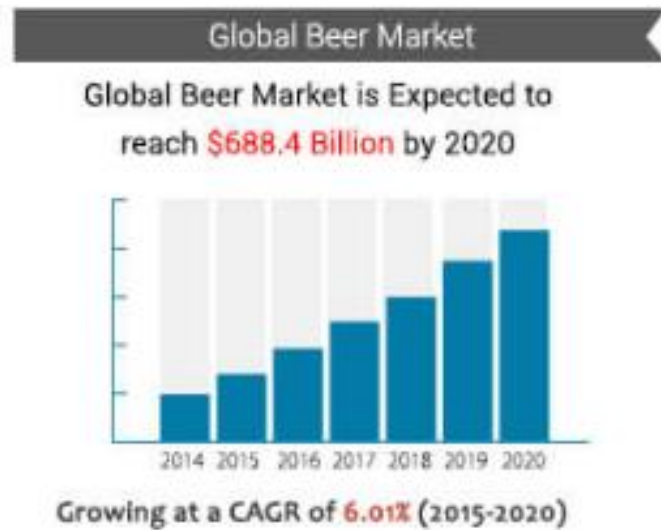
the 10 leading brands. They are Heineken (Netherlands), Molson (Canada), Beck (Germany), Muzhed (Canada), Labett (Canada), Girls Saint Pauli (Germany), Dos Equis (Mexico), Foster-Lager (Australia), Amstel-Light (Australia) Netherlands) and Venetz (Mexico). These 10 brands occupy up to 87% of the imported market. Individual firms occupy a market share with 34% down. A number of regional firms, and almost all small microbrewers make out other firms in the branch. The buyers of the beer industry are quite diverse. They range from highly educated to not intellectual, but from male to female. The range of profits for those who drink beer is still quite varied. Individual people consume more beer than are legally married in accordance with the demography of drinking beer in 2016. It is known that the doctors of the institute are still considered buyers. Due to the very shortage of information in the case, if the level of vertical integration between firms in the branch is not defined. In fact, a number of large firms began creating personal packaging (cans, bottles, etc.). It would be a technique to cut out the share of the suppliers' probabilities, if the firm did it. The ease of entry into the beer branch is segmented between 3 types of market coverage. In the state market, the ease of entry is not high (Gammelgaard, 2013). There are a lot of obstacles to enter the state market. Beer is regulated by 50 different methods in the United States. Giant requests to the state and distribution networks make it difficult to enter the state market. A regional market is a little easier to get because of the smallest number of rules due to the smallest market coverage. Requests for the state of the regional market are not too big. District or microbrewers have fewer barriers to entry. Inquiries to the state are small in comparison with the needs of the state or regional brewer. Microbrewers tend to work in a small geographic region, which is the most reducing almost all of the claims made by state and regional brewers. Product properties vary between markets. In the state market, beer is highly standardized and actively advertised. Beer is cheap. There is a specific differentiation of goods in the market with a wide supply of goods, which have all the chances to provide national brewers. ex. Light beer, Amber beer, Low Alcohol, And Malt Liquor. Import is perceived as one of the best quality: when in fact they really are not. Due to this perception, imported beer costs more than domestic beer. Import differs in taste and packaging. Small brewers offer super-premium product, which is not quite differentiated. The main differences can be related to the course of brewing, cost and packaging. Large economies are high among state-owned firms because of their huge volume. Their ability to distribute permanent losses is simply



done because of the huge size that is being met. There is also a scale effect in product expansion and brand distribution. Regional firms have little economies of scale. Regions do not produce as much as large national firms, but, not least, they have all the chances to distribute some of their own costs in comparison with their moderate sizes. District brewers have a low thrift on the scale. Creation is not enough, in fact, it's quite difficult to allocate costs. The local brewery does not have the ability to distribute the price of advertising to a personal product without an important increase in the cost of a personal product. The specific authority of application in the USA beer industry forms from 75% to 85%. The beer industry suffers from extra power. Not paying attention to this, a number of firms are still expanding, while others are closing some operations. Due to flat sales there is no need to overproduce. Industry Profitability is lowered due to strong taxation and a lowering of the market. Beer is considered one of the more at risk consumer products. There, an exceptionally gigantic cost in the price of beer is the tax levied on it by the district and municipal governments. The profitability of the economic sectors is still changing due to the configuration of the species of life, more stringent laws and a reduction in the age group of 18-34 years (Gammelgaard, 2013).

It is assumed, in fact, that by 2020, 688.4 billion will be delivered on a large beer market. \$ US, having registered a CAGR of 6% in the direction of the predictable period of 2015-2020. Apart from this, the aforementioned branch will probably register CAGR at the level of 6% in the direction of the predictable period of 2015-2017. It is expected that an important increase in the size of the volume of consumption contributes to the rise of the market in developing areas. Beer is a yeast alcoholic beverage made from malt, and flavored with the addition of hops (Figure 1).

**Figure 1: Global beer Market 2014-2020**



Source: Data from ([Allied Market Research](#), 2018)

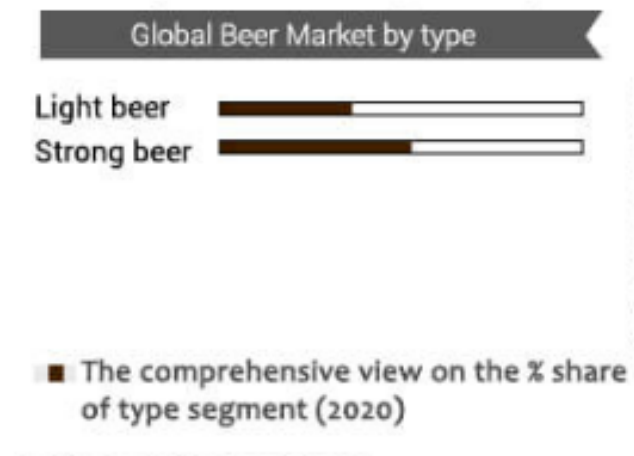
Known in Neolithic Europe, its creation dates back to 2050 BC. By the 7th century of our era, the alcoholic drink was produced and sold by several monasteries in Europe. This drink is keyly brewed from these ingredients, like yeast, water, hops and malted barley. Fermented carbohydrates, such as wheat, rice and corn, are added for making different styles, and even tastes. The manner of beer systematizes the given alcoholic beverage by the moments, embracing the incense, the production technique, the components, the paint and the origin, of which ale and lager are considered to be 2 commercially known types. Ales use the top fermenting yeast at room temperature, on the contrary lagers are made with bottom fermenting yeast below 10 ° C. Beverages imported from other countries and super premium beer continue to grow in terms of fame between buyers, taking into account the increasing disposable income. Apart from this, an increasing understanding of well-being between drinkers led to demand for non-alcoholic beer.

The universal characteristics of sales follow the footsteps of the upward trend. Almost all brands in real time feel great triumph due to the rise in disposable income and the configuration of the life style of buyers. Applying the niche sector, adult markets still witnessed a sharp configuration of trends in the market of high-calorie beer products and came up with a taste for low-calorie beer. Literally, for example, the constant popularity of craft beer paved the way for a fresh generation of manufacturers. Candidates for glass,

such as PET, makers are using durable yet ductile, affordable, and sustainable packaging solutions such as cans. The statistics of consumption still speaks of the rapid rise in the number of ladies drinking.

The largest universe brands uncorked and positioned a personal large portfolio of a strong and soft brew in the domestic and international market, which currently occupies a huge share of their joint business. It is assumed that the market of a strong brew will amount to \$ 464 billion by the year 2020. Apart from this, a powerful beer branch will probably register CAGR at 6.5% in the 2015-2020 period. In the western hemisphere, taste and sophistication are considered the leading reasons for drinkers. Just because of this, almost all customers like hard drinks because of the high alcohol content. In a cramped competition are the light brews, which have a low number of calories and alcohol. The mild gauntlets took advantage of the attraction of healthy drinkers to remain awake (Figure 2).

**Figure 2: Global Beer Market by type**

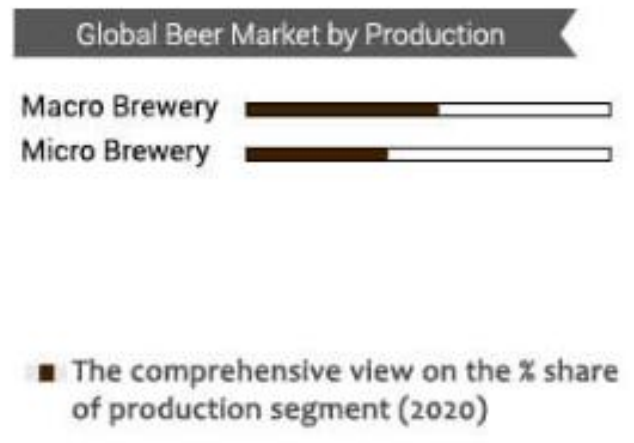


Source: Data from ([Allied Market Research](#), 2018)

Breweries are divided into macro-breweries and micro-breweries based on manufacturing volume or size. The official struggle between them lasts, and craft companies every day increase production capacity. Macro-breweries offer quality and strength for giant distances. At the same time, micro-breweries also benefit. Similarly, the emergence of breweries in the least saturated spaces in all directions is another welcome news. Not so long ago, the changes in the preferences for beverages have increased demand for micro-breweries, which are expected to register CAGR at 9.3% in the period of 2015-2020. In real time, a huge number of demanding customers are moving to craft beer

thanks to their own remarkable excellent taste and quality. In this way, with an abundance of taste, micro-breweries are steadily expanding due to the increasing demand for craft beer (Figure 3).

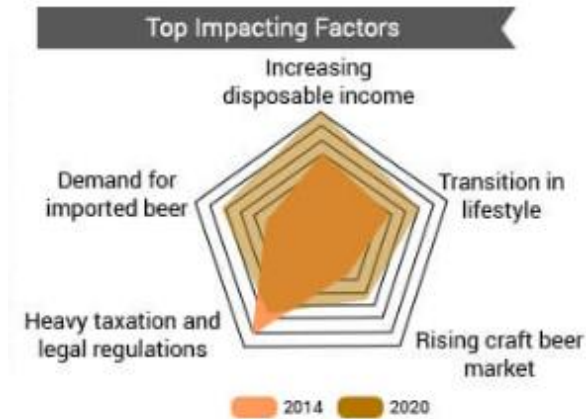
**Figure 3: Global Beer Market by Production**



Source: Data from ([Allied Market Research](#), 2018)

Rising sales of premium-class and super-premium types of beer has discarded all doubts about the fall in the size of use. Buyers increasingly like to conduct an experiment with locally produced premium and international types of beer. Most of the brewers now confirm that the industry of premium plants remains the most attractive sector. Premunization is principled that it is aimed at aiming at buyers with the highest costs. It is supposed that the premium beer sector will register the CAGR by 6.4% in the period from 2015 to 2020 in comparison with the super-premium and usual beer sector. Apart from this, super-premium beer is seen as an eyewitness to the rapid growth of business and will grow three-fold. Now grocery stores make up an important share of alcohol sales in value terms. This highlights the tremendous ability to lift super-premium beer by channeling. More so, conventional beer occupied the largest market share within 43% of the cooperative beer industry in 2014 (Figure 4).

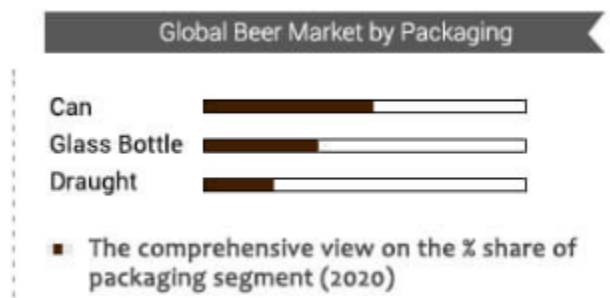
**Figure 4: Top Impacting Factors**



Source: Data from ([Allied Market Research](#), 2018)

Packaging plays a vital role when it comes to the impact on the model of purchases of customers. Available in bottles, cans or draught these drinks are delivered with caution and interest. In agreement with the growing sales of beer, these are like ales, fresh and flavored drinks in bottles are making waves. What is not the least, with this acceleration, canned brews give active competition to their bottles and components of their peers. The demand for canned beverages is increasing, which can be simply taken care of and transported. Apart from this, in fact, that the canned first choice is prepared, it is a precedent that it defends contents from outside heat. In the same row with this moment, the range of installed draft beer continues to expand in a competitive business environment (Figure 5).

**Figure 5: Global Beer Market by Packaging**



Source: Data from ([Allied Market Research](#), 2018)

For 300 years of ale's existence in North America, the demand of buyers every day sent the sector forward to a steady rise in profits. After that, the influence of buyers on the creation of beer made great opportunities for beer producers for beer, and the larger public responded to it with subsequent help. In Europe, weakened brewing mandates have

stabilized the amount of consumption that has declined over the last 2 years. Developing states still buy a weighty sense for large international brands of beer, because the sales in some mature areas are still lagging behind. The rise in sales in Latin America and Asia allowed manufacturers to save an absolute rise in sales. It is supposed, actually, that by 2020 the beer market in the Asia-Pacific area will be bought within 202.4 billion. Doll. USA. Apart from this, it is expected that in the market of 2015 the CAGR will be recorded at the level of 7.3% (Figure 6).

**Figure 6: Global Beer Market by Geography**



Source: Data from ([Allied Market Research](#), 2018)

In order to buy a large piece of the market, beer manufacturers are now expanding their own channels implemented in emerging markets. Mergers and announcements of acquisition over many years hovered over the brewing sector, with almost all domestic and international brewers assessing the probability of unleashing at some time. Similarly, multinational manufacturers continue to create large investments to expand their own market conditions and establish cooperation with local operators in order to allow buyers to explore regional and international types of beer.

### **3.3.2 Key Challenges Facing New Breweries**

For anyone who wants to start a brewery in the US, the biggest challenge, most likely, will be a shortage of capital. Without the purchase of soft investments or other solid external assistance, the amount of seed money will become tightly restricted for most fresh breweries. This limitation will make a number of all possible tasks that need to be addressed. With the application of the least means, it will be necessary to find and

assemble important equipment. Fresh equipment built on purpose for a brewery will require a very large investment for a brewery's budget, in fact, which will lead to the need for "Frankenbrewery", similar to those you can find in the varieties of the nanobreweries and microbreweries, such as Throwback. These tanks, welded together, can be found from various places; from other district breweries, which outgrew the equipment into dairy farms, wanting to get some feedback from used barrels. But they have all the chances to look not as excellent as fresh equipment, this equipment does not make serious problems for a fresh brewery (Egelston, 2012). With this, because the fresh brewery continues to grow, there will be a need for constant reinvestment in breweries to ensure the subsequent improvement of the quality and manufacturing.

While the quality of brewing has the ability not to be severely affected with the least equipment, the number that can be brewed for a batch will undoubtedly become. With a smaller production and volumes, new small breweries will not own the same financial superiority that can be used by larger breweries. This means, in fact, that they are faced with higher costs for components than their "competitors", including when the values in the branch continue to grow. More low production capacity will be exacerbated by the inability of small breweries to give a huge wage, once again a deficit of limited cash (Throwback Brewery, 2017). Having only a few people working on dozens of jobs, it is rather difficult to manufacture more than a few lots a week, for example, as other jobs, such as cleaning and dispensing, take for example a large amount of time. As you can see from the possibility of Throwback just to cook 2 or 3 parties a week on a small three-point system, this limited creation has a strong effect on the number of customers who have the opportunity to achieve a new brewery (Throwback Brewery, 2017). With the lowest consumption of beer in these breweries, less beer is sold, which actually leads to the lowest profits and benefits than what exactly is necessary for proper reinvestment and expansion.

Limited creation still limits the ability of a fresh brewery to expire and embrace their unification. These more small breweries are obliged to settle more reasonably, what prerequisites to donate and who to give their beer to. Including small breweries, as a rule, receive weekly orders for sponsorship of various groups and events (Throwback Brewery, 2017). If fresh breweries with limited production probabilities start participating in an increasing number of beer months or sponsoring a very large number of district

organizations, they will promptly find out their own beer, in fact, that they no longer have a product for sale.

This inability to participate in as many events as they would like, makes these fresh breweries lose out of their own best chances the conclusion of another serious difficulty: the inaccessibility of brand recognition. With the lack of employees and money to carry out important marketing, in order to spread the text about a fresh brewery, it becomes quite difficult for them to give out their name and advertise about the opening. They do not have the luxury to allow themselves time and money for the employee, in order to benefit from all possible means of global information and marketing probabilities. That's why all sorts of sponsorships and actions that they receive, for example, are relevant for their early success. Beer weeks and other festivals provide an effective method to meet with beer buyers, make a real association and allow these customers to taste their own beer, in fact, what subsequently makes demand and sales. If the breweries are not careful, they will quickly find out that the lack of money, workforce and workmanship is able to promptly lead to a model that does not permit quick reinforcement of reinvestment for lifting.

In order to expire from this cycle and begin to grow, these breweries are required to find an effective method to distinguish themselves from other breweries in the region and the market. Because the market is becoming crowded, as it was more than 10 years ago, it is possible to wait for a decrease in the number of breweries. However, between the data and at the moment there are 2 main differences:

- As the economic market has become tougher, and the brewery market, extracted from past failures, will become much less beaten than before. With a limited number of cash, floating around and with more skilled brewers, key mistakes made earlier will not be made so often (Throwback Brewery, 2017). When the decrease happened earlier, it was a key way because of the huge number of funds provided to start-ups, who either knew a lot about commercials, but also a few about brewing or vice versa. Now fresh breweries have to be made more cooked for the purpose of a success before they start, reducing the number of breweries that are locked very early.
- The beer market turned out of its own niche reputation and begins to enter the leading market, bringing with it a great potential for recovery (Egelston, 2012). As



industry continues to grow, there will also be a shelf space on which breweries have every chance to store a personal product.

These configurations from the previous hacking have all the chances to mean, in fact, that the breweries will be the least located to immediate closure, but this still makes a huge difference for successful differentiation from other breweries. Because the market already has breweries with successful business models, entrepreneurial brewers must invent new methods to resist the breweries that have already formed in their own areas. Once again, the nuance, due to which it is difficult to stand out, is that the quality of beer continues to grow, because most of the breweries came up with the best manufacturing methods (Egelston, 2012). This meant that, insofar as quality and processes progressed, there is not, for example, a large number of methods to depart from the classical methods and still possess the highest quality of beer, which in fact makes its uniqueness difficult.

Another one important problem for fresh brewers outside of limited resources and problems in differentiation is the new ability of the brewery to distribute its beer. As it was mentioned earlier in this report, there is still a number of archaic laws in New Hampshire that restrict the rights to breweries and microbreweries in contracts with distributors. The laws do this so that small breweries subscribe to the contract, and after they grow up, they have to protect the same negative circumstances or go out of business just to get a fresh position (Throwback Brewery, 2017). Not only deals that are inclined in distributors, but also distributors are often present in partnership with one of the largest state breweries. This means that in fact this often contradicts the interests of distributors in the market of craft beer. The shift to the worst side of the story is that the microbrewers themselves do not have the right to talk about how beer is processed on the basis of distributors, it is autonomous from such, whether it is maintained at the right temperature or is painstakingly processed, in fact that has the ability to influence the quality of beer, when it reaches customers (Throwback Brewery, 2017). For small breweries, their single option, if they are rather small, is self-allocation, which costs a lot of time and money, which actually makes it difficult to reconnoiter a profitable success. Including in the case if a new microbrewery wants to get an agreement with a distributor, it is often quite difficult to get a fresh product into someone's portfolio. In stores in New Hampshire, there is only so much space on the shelves, in fact, as distributors who prefer beer, which, they understand, will be bought by retailers, and not a new brew in town.

## 4 Practical part

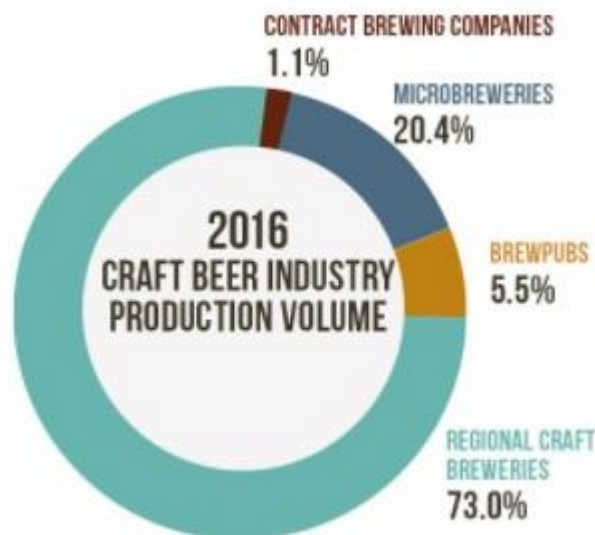
### 4.1 Analysis of US brewing industry

Craft beer is becoming increasingly popular as a result of the adoption of the brewing act in 2011 in the US with the introduction of a lower excise rate for medium and small breweries and complete exemption from beer excise for restaurant-type producers without the right to wholesale products in the United States there is a real so-called "Craft Revolution", which has a significant impact on the development of related industries in the agrarian and engineering sectors of the economy.

At the end of 2016 the number of breweries in the United States has reached 5301 in total, which is 16.2 percent more than in the previous year in 2015. According to "Brewers Association" in 2016, total quantity of breweries in United States is 5301 ([brewers association](#), 2017):

- Craft breweries:
  - o Regional Craft Breweries – 186
  - o Microbreweries – 3132
  - o Brewpubs – 1916
- Large non-craft – 51
- Other non-craft - 16

**Figure 7: US beer production volume 2016**



Source: Data from ([brewers association](#), 2017)

Over the past 5 years, the number of breweries has increased by more than 50 percent.

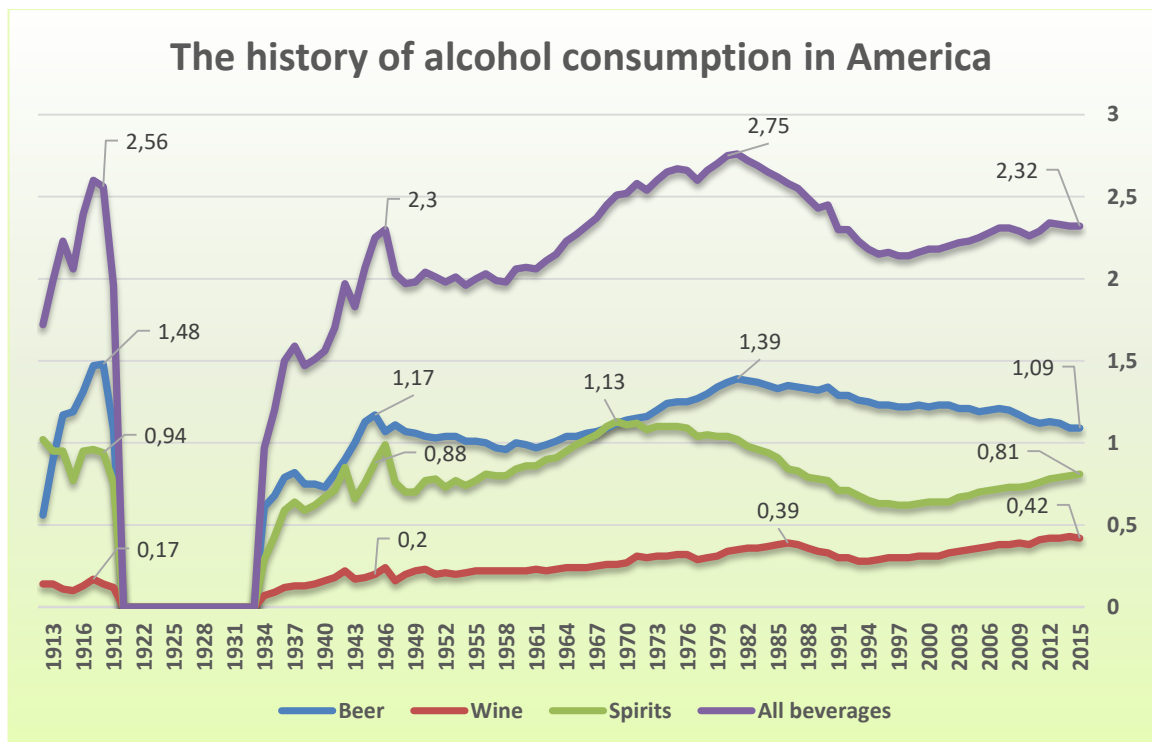
According to the Figure 7, the highest share of craft production volume taken by regional craft breweries with 73 percent. The second one is microbreweries with share of 20.4 percent, brewpubs share of 5.5 percent and other 1.1 percent. Total annual production for the 2017 was 185 million barrels. Furthermore, annual beer production in United States is decreasing according to Table 1.

The export of beer from the United States for 2016 was 614.4 million dollars, 4.6% share of world exports. Canada is the leading by imported beer from United States. According for 2016, there was 54.8 percent of total exports. The second leading were the United Kingdom, with 10.1 percent of exports (brewers association, 2017).

#### 4.1.1 Regional consumption of beer

In 1980, according to Figure 8 the amount of alcohol consumption reached the highest index 2.75 gallons per capita.

**Figure 8: Alcohol consumption USA in gallons per capita 1913-2015**



Source: Data from \*([Pubs.niaaa.nih.gov](http://Pubs.niaaa.nih.gov), 2018), own figure data processing

Meanwhile, the share of beer was 51 percent or 1.39 gallons per capita. It's not a surprise due to the prohibition, there was a sharp drop in alcohol consumption from 1920

to 1930 years. In the average United States drank around one gallon of beer per resident for the last 5 years, which is highest indicator compared with wine or spirits. The figure shows that American residents have always favored beer, but the share of beer has been decreased since early 1990s.

In Figure 8, apparent per capita gallons of ethanol consumption is based on population age 14 and older.

#### 4.2 Time series forecast of beer production using Gretl

Autoregressive integrated moving average (ARIMA) is a method of time series forecasting, which help to understand the data, prognose future indicators in observed series.

Observes data based on 14-time period from 2004 to 2017. Frequency of time series is annually. The data is collected from The Alcohol and Tobacco Tax and Trade Bureau web site. Observation of  $y_i$  considers value of the total annual beer production in million barrels.

**Table 1: Data set of beer production in US 2004-2017**

<i>Years</i>	$t_i$ (Time)	$y_i$ (Beer*)
2004	1	198,04
2005	2	196,83
2006	3	197,66
2007	4	198,95
2008	5	199,47
2009	6	196,25
2010	7	194,60
2011	8	192,53
2012	9	195,74
2013	10	191,60
2014	11	191,98
2015	12	191,15
2016	13	189,84
2017	14	185,35

Source: Data from [\\*Ttb.gov, 2017](http://*Ttb.gov, 2017) , own table processing

The first step of the model is to determine value “d”. Based on ADF Unit Root Test it can be figured out value "d".

The ADF Unit Root hypotheses:

- Null hypothesis: Unit Root
- Alternative hypothesis: No Unit Root

The graph below has been generated by the following data in the table 1 (Table 1).

**Figure 9: Graph of beer production in US 2004-2017**



Source: Own figure used Gretl

Null hypothesis rejects If the data is around a stationary constant, and alternative hypothesis will be accepted. An vice versa.

As shown in the graph, in this case the null hypothesis will be **“accepted”**

→ there is a Unit Root.

**Figure 10: Augmented Dickey Fuller Test**

```

Augmented Dickey-Fuller test for y
testing down from 2 lags, criterion AIC
sample size 13
unit-root null hypothesis: a = 1

test with constant
including 0 lags of (1-L)y
model: (1-L)y = b0 + (a-1)*y(-1) + e
estimated value of (a - 1): 0.0462198
test statistic: tau_c(1) = 0.223848
p-value 0.9626
1st-order autocorrelation coeff. for e: -0.354

```

Source: Own figure used Gretl

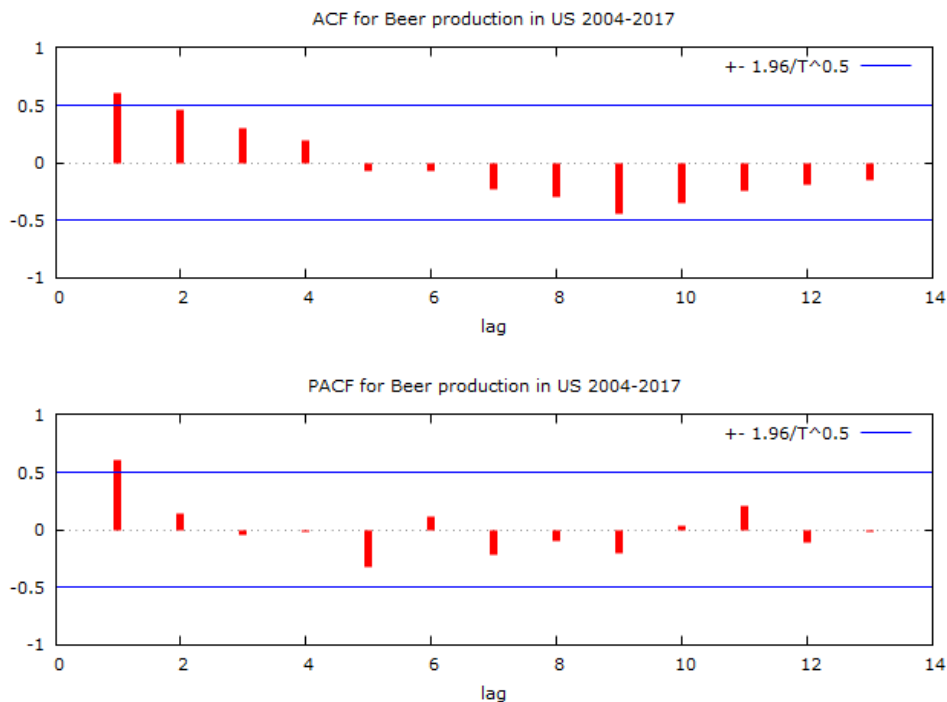
- Augmented Dickey Fuller test.

This test is used to check the null hypothesis if its present in the model.

In the result, the test has been showed p-value as 0.9626. To compare this with significance level,  $0.9626 > 0.05$  where p-value is greater -> Null hypothesis **“Accepted”** at 5% level of significance.

It means the data should be made differenced, “d” value is equal to “1”.

**Figure 11: Correlogram for Beer production 2004-2017**



Source: Own figure used Gretl

The next steps need to determine “p” and “q” values. To determine these values should be used a correlogram. If there appears to be no correlation, for instance no determinable patterns in the correlograms then values to be used equal to 0. If there appears determinable pattern, then values are equal to 1.

In Figure 11, the auto correlation function(ACF) there is appearing to be decreasing, which mean “p” is equal to 1. However, in the partial autocorrelation function(PACF) there is no determinable pattern appeared, which mean “q” is equal to "0".

The model is completed as a “1-1-0”.

**Figure 12: Time series ARIMA**

```

Function evaluations: 12
Evaluations of gradient: 6

Model 4: ARIMA, using observations 2005-2017 (T = 13)
Estimated using Kalman filter (exact ML)
Dependent variable: (1-L) y
Standard errors based on Outer Products matrix

```

	coefficient	std. error	z	p-value
const	-0.908229	0.448231	-2.026	0.0427 **
phi_1	-0.294409	0.302351	-0.9737	0.3302

Mean dependent var	-0.976320	S.D. dependent var	2.220819
Mean of innovations	-0.006929	S.D. of innovations	2.046336
Log-likelihood	-27.80020	Akaike criterion	61.60039
Schwarz criterion	63.29524	Hannan-Quinn	61.25203

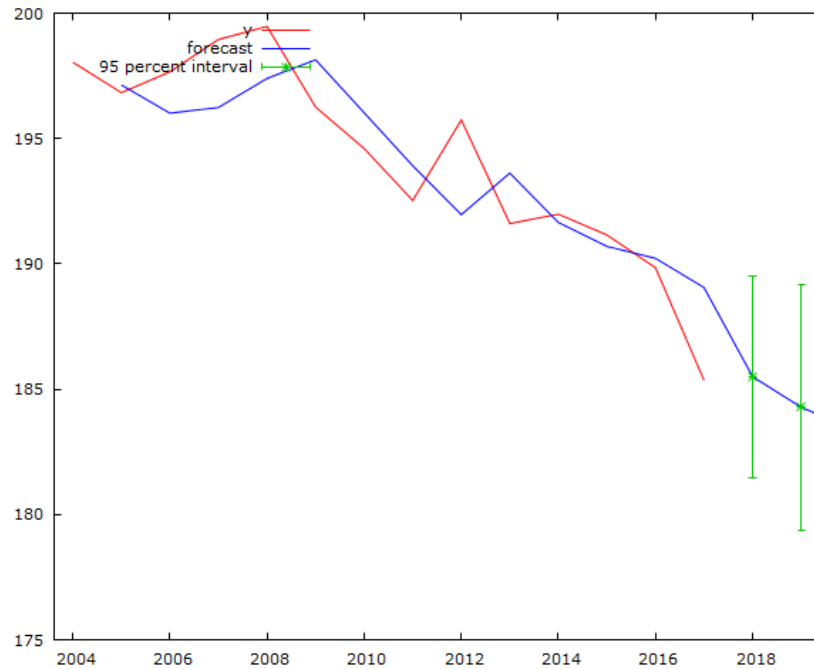
	Real	Imaginary	Modulus	Frequency
AR				
Root 1	-3.3966	0.0000	3.3966	0.5000

Source: Own figure used Gretl

According to the above figure p-value for const is equal to 0.0427 which is less < 0.05 than significance level at 5%, parameter **is statistically significant**.

Phi\_1 p-value is equal to 0.3302 which is more > 0.05 than significance level at 5%, parameter **is not statistically significant**.

**Figure 13: Forecast for 2018-2019**



Source: Own figure used Gretl

In the graph above, the trend has been pointing to be decreased over the next 2 years based on 95 % interval. In conclusion we can mention that based on provided data beer production numbers in next 2 years will be in this range which marked as green (Figure 13).

The below figure shown comparison between real and predicted values of beer production for 2004 to 2017. In addition, predicted values for the future years also included.

**Figure 14: Predicted versus real values**

	y	prediction
2004	198.040680	
2005	196.826478	197.132451
2006	197.656836	196.008331
2007	198.947456	196.236751
2008	199.466287	197.391866
2009	196.254418	198.137919
2010	194.597129	196.024403
2011	192.528401	193.909431
2012	195.739089	191.961834
2013	191.604938	193.618213
2014	191.980362	191.646451
2015	191.148441	190.694214
2016	189.842638	190.217747
2017	185.348514	189.051459
2018		185.496007
2019		184.276964
2020		183.460241

Source: Own figure used Gretl

### 4.3 Econometric Model: Impact of various variables on beer consumption

The time series observes data based on 15-time period from 2001 to 2015. Since data on beer consumption is currently available only until 2015. The method are analyze variables output and dynamic relationship between three variables. It is to find out relationship between beer consumption, annual average income and real beer price. Where beer consumption is endogenous or dependent variable, annual income and beer price are exogenous or independent variables. Goals of the model are:

- write a general economic model;
- write econometric regression model for the stated issue and declare its variables;
- compute and interpret summary statistics;



- estimate the regression model and parameters;
- interpret results.

Assumptions:

1. Relating to the fact that over the past fifteen years, beer consumption in the USA is decreasing, production of beer expects to be decreased for the next year.
2. People consume more beer if their annual income increases.
3. There is relationship between own price of beer and beer consumption.

**4.3.1 Data**

Data for beer consumption has been taken from National Institute on Alcohol Abuse and Alcoholism. Apparent per capita gallons of beer consumption in United States, based on population age 14 and older. Gallons has been converted to liters, 1 gallon equal to 3.78541178 liters. Annual average income based on United States census bureau. Average real beer price (adjusted for inflation) based on article about "A Historical Look at the Price of Beer" written by Paul DeMerritt.

**Table 2: Data set using observations 2001-2015**

<i>Years</i>	<b>Beer consumption*</b>	<b>Unit Vector</b>	<b>Income**</b>	<b>Beer price***</b>
<i>time series</i>	$y_t$	$x_{1t}$	$x_{2t}$	$x_{3t}$
2001	4,66	1	57,246	4,06
2002	4,65	1	56,599	4,04
2003	4,58	1	56,528	4,05
2004	4,58	1	56,332	4,08
2005	4,50	1	56,935	4,05
2006	4,54	1	57,379	4,01
2007	4,58	1	58,149	4,00
2008	4,54	1	56,076	4,03
2009	4,42	1	55,683	4,00
2010	4,31	1	54,245	4,06
2011	4,23	1	53,401	4,05
2012	4,27	1	53,331	4,00
2013	4,23	1	55,214	3,99
2014	4,12	1	54,398	3,97
2015	4,12	1	57,230	3,95

Source: Data from \*([Pubs.niaaa.nih.gov](http://pubs.niaaa.nih.gov), 2018), \*\*([AMADEO](http://amaдео), 2018) \*\*\*([DeMerritt](http://DeMerritt), 2017) own table processing

### 4.3.2 Declaration of the model

#### General economic model:

Beer consumption =  $f$  (Income; Beer price;)

#### Econometric model:

$$\beta y_{1t} = \beta_{11}x_{1t} + \beta_{12}x_{2t} + \beta_{13}x_{3t} + \mu_{1t}$$

where:

$\mu_{1t}$  – is the random (error) component;

#### Endogenous or Dependent variable:

- $y_{1t}$  – Beer consumption in liters per capita;

#### Exogenous or Independent variables:

- $x_{1t}$  – Unit vector
- $x_{2t}$  – Annual average Income in thousand dollars per capita;
- $x_{3t}$  – Average real price of beer in dollars per 0.5 liters;

#### Generation graphs of variables

**Figure 15: Generated graphs of variables 2001-2015**



Source: Own figure used Gretl

The graph of beer consumption shows the average consumption in liters per capita in time-period from 2001 to 2015 years. In period 2001 there was peak 4,66 liters per capita. For the last 15 years beer consumption in United States is decreasing. The second graph shows annual average income in dollars per capita in United States for the same time-period from 2001 to 2015 years. As of 2007 to 2012 the graph shows a strong fall of income, which related with Financial crisis of 2007 to 2008. The third graph shows average real price of beer (adjusted for inflation) in dollars per 0,5 liters in time from 2001 to 2015 years. In 2004, price of beer reached the highest index 4,08 dollars for the mug of beer. For the last 5 more years beer price is decreasing.

#### 4.3.3 Parameters' estimation using Ordinary Least Squares method in SW Gretl

Summary statistics of observed data shown below as mean, median, standard deviation.

**Table 3: Summary Statistics, using the observations 2001 - 2015**

Variable	Mean	Median	Minimum	Maximum
yt	4.4217	4.5000	4.1200	4.6561
x2t	55.916	56.332	53.331	58.149
x3t	4.0227	4.0300	3.9500	4.0800
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
yt	0.19037	0.043054	-0.35891	-1.3680
x2t	1.4965	0.026762	-0.46712	-0.93874
x3t	0.037315	0.0092761	-0.34470	-0.86871
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.
yt	undefined	undefined	0.35000	0
x2t	undefined	undefined	2.8320	0
x3t	undefined	undefined	0.050000	0

Source: Own table processing used Gretl

The mean value of beer consumption in time period 2001-2015 is 4.42 liter per capita. Annual income for the same period is 55.916 thousand dollars and beer price at the level of 4.02 dollar per 0,5 liters. The highest variability is in the case of annual income. The lowest variability in case of beer price. The median variables in all cases are a little bit higher than mean value.

**Table 4: OLS, using observations 2001-2015**

Model 2: OLS, using observations 2001-2015 (T = 15)  
Dependent variable: yt

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	-12.8440	2.90002	-4.429	0.0008	***
x2t	0.0799458	0.0169985	4.703	0.0005	***
x3t	3.18085	0.681703	4.666	0.0005	***
Mean dependent var	4.421737	S.D. dependent var		0.190371	
Sum squared resid	0.108706	S.E. of regression		0.095178	
R-squared	0.785749	Adjusted R-squared		0.750040	
F(2, 12)	22.00449	P-value(F)		0.000097	
Log-likelihood	15.66959	Akaike criterion		-25.33918	
Schwarz criterion	-23.21503	Hannan-Quinn		-25.36181	
rho	0.067983	Durbin-Watson		1.618120	

Source: Own table processing used Gretl

Where:

- const is intercept of endogenous variable (beer consumption) when all exogenous variables equal to zero.
- x2t and x3t are parameters of relationship with endogenous variable. These parameters show on how much endogenous variable will change if exogenous variable increases by 1 unit.

○ **Statistical verification by Goodness of Fit:**

R-squared 0.785749. R-squared is coefficient of determination provides a measure how close the data are to the fitted regression model.

Interpretation:

- Goodness of fit is **very good**, 78% of variability of the endogenous variable was explained by estimated model.

○ **Statistical significance according to p-values:**

Hypotheses of the P-value:

- Null hypothesis: parameter is not statistically significant
- Alternative hypothesis: parameter statistically significant

Decision rule:

**If  $p\text{-value} \leq \alpha$  then, reject  $H_0$**

Evaluation for significant levels:  $\alpha = 0.01$ ;  $\alpha = 0.05$ ;  $\alpha = 0.1$ ;

- const = 0.0008;

0.0008 less than all 0.01, 0.05 and 0,1

Intercept is **statistically significant** at all 1%, 5% and at 10% level of significance.

- $x_{2t} = 0.0005$ ;

0.0005 less than all 0.01, 0.05 and 0,1

Null hypothesis "*Rejected*" is **statistically significant** at 1%, 5% and at 10% level of significance. With 99% probability, the  $x_{2t}$  exogenous variable has an effect on  $y_t$  endogenous variable, but with a level of significance (1% of wrong rejection of null hypothesis).

- $x_{3t} = 0.0005$ ;

0.0005 less than all 0.01, 0.05 and 0,1

Null hypothesis "*Rejected*" is **statistically significant** at 1%, 5% and at 10% level of significance. With 99% probability, the  $x_{3t}$  exogenous variable has an effect on  $y_t$  endogenous variable, but with a level of significance (1% of wrong rejection of null hypothesis).

- o **Statistical significance according to t-values:**

Hypotheses of the P-value:

- Null hypothesis: parameter is not statistically significant
- Alternative hypothesis: parameter statistically significant

Decision rule:

**$|t| \geq t_{\alpha/2} [n-p] \rightarrow$  reject  $H_0$**

Evaluation for significant levels:  $\alpha = 0.01$ ;  $\alpha = 0.05$ ;

t-critical for 5% =  $t_{\alpha/2}[n-p] = t_{0.025}[12] = 2.179$

t-critical for 1% =  $t_{\alpha/2}[n-p] = t_{0.005}[12] = 3.055$

- Const = -4.429 (in absolute value 4.429)

Comparison:  $4.429 > 2.179 \rightarrow$  **reject  $H_0$**   $\rightarrow$  intercept is **statistically significant** at a 5% level of significance.

$4.429 > 3.055 \rightarrow$  **reject  $H_0$**   $\rightarrow$  intercept is **statistically significant** at a 1% level of significance

- Parameter  $x_{2t} = 4.703$

Comparison:  $4.703 > 2.179$  -> **reject  $H_0$**  -> intercept is **statistically significant** at a 5% level of significance.

$4.703 > 3.055$  -> **reject  $H_0$**  -> intercept is **statistically significant** at a 1% level of significance

- Parameter  $x_{3t} = 4.666$

Comparison:  $4.666 > 2.179$  -> **reject  $H_0$**  -> intercept is **statistically significant** at a 5% level of significance.

$4.666 > 3.055$  -> **reject  $H_0$**  -> intercept is **statistically significant** at a 1% level of significance

Conclusion: There is a statistically significant relationship between const,  $x_{2t}$  and  $x_{3t}$ .

○ **Correlation matrix.**

If all correlation coefficients are less than  $[0,8]$ , -> then there is no multicollinearity problem in the model.

Correlation coefficients, using the observations 2001 - 2015  
5% critical value (two-tailed) = 0.5140 for  $n = 15$

**Table 5: Correlation coefficients, using the observations 2001 - 2015**

<b>yt</b>	<b>x<sub>2t</sub></b>	<b>x<sub>3t</sub></b>	
1.0000	0.6301	0.6252	<b>yt</b>
	1.0000	0.0027	<b>x<sub>2t</sub></b>
		1.0000	<b>x<sub>3t</sub></b>

Source: Own table processing used Gretl

➔ There is no multicollinearity has been detected between exogenous variables.

**4.3.4 Interpretation**

*Final estimation model*

$$y_{1t} = -12.8440 + 0.0799458x_{i2} + 3.18085x_{i3} + \mu_{1t}$$

$$y_{1t} = -12.8440 + 0.0799458x_{i2} + 3.18085x_{i3}$$

Estimated parameters of the model show how changes of the variable value can change the beer consumption.

The literal interpretation of the intercept is:

*If all variables are equal to zero, beer consumption is –12.8440 liters per capita.*

In this case, the literal interpretation has a negative intercept which suggest that needs some level of income and beer price to be able to start consuming a beer.

Relationship between *income* and *beer consumption* explained by following function:

$$y_{1t} = 0.0799458x_{t2}$$

*If the income increases by 1 liter per capita, the beer consumption will increase by 0.0799458 liters per capita.*

*If the income decreases by 1 liter per capita, the beer consumption will decrease by 0.0799458 liters per capita.*

Estimated parameter  $y_{1t}$  is beer consumption endogenous or depending variable,  $x_{2t}$  is annual average income exogenous or independent variable. Relation above has positive influence 0.0799458. It can be said that relationship stands logically to the function. Annual income for the people plays a significant role of their needs and desires. Increases of earnings lead to possibility to buy more products or use more services, this applies to the beer consumption too.

Relationship between *beer price* and *beer consumption* explained by following function:

$$y_{1t} = 3.18085x_{t3}$$

*If the beer price increases by 1 dollar per 0,5 liters, the beer consumption will increase by 3.18085 liters per capita.*

*If the beer price decreases by 1 dollar per 0,5 liters, the beer consumption will decrease by 3.18085 liters per capita.*

In this relation, is taken to consideration average beer price as independent variable and beer consumption depending variable. Relation of this function show positive number as 3.18085. Price of beer has strong relationship or correlation with consumption of beer. Raising the price of a product or service can lead to the risk that the customer or consumer will consider choosing another product or service that is called interchangeable or substitute. In this case, it's for instance wine.

### 4.3.5 Autocorrelation problem

*Autocorrelation test for the model*, regression model with variables as beer consumption, income and real beer price.

- Null hypothesis: not autocorrelation in the model
  - Alternative hypothesis: autocorrelation in the model
- Breusch-Godfrey test for first-order autocorrelation

**Table 6: Breusch-Godfrey test for first-order autocorrelation**

OLS, using observations 2001-2015 (T = 15)				
Dependent variable: uhat				
	coefficient	std. error	t-ratio	p-value
const	0.0668676	3.04283	0.02198	0.9829
x2t	-0.000496009	0.0179028	-0.02771	0.9784
x3t	-0.00993643	0.712575	-0.01394	0.9891
uhat_1	0.0716056	0.364982	0.1962	0.8480

Source: Own table processing used Gretl

Unadjusted R-squared = 0.003487

Test statistic: LMF = 0.038490,

with p-value =  $P(F(1,11) > 0.0384904) = 0.848$

Alternative statistic:  $TR^2 = 0.052304$ ,

with p-value =  $P(\text{Chi-square}(1) > 0.0523039) = 0.819$

$R^2$  shows 0.003487, and followed p-value 0.848 greater than significance level 0.05

→ Null hypothesis “Accepted” there is **No Autocorrelation** in the model

In alternative, critical value for Chi-square(1) is consider as;

$TR^2 = 0.052304$ , p-value 0.819 > 0.05 → Null hypothesis “Accepted” there is **No**

**Autocorrelation** in the model

Chi-square(1) right-tail probability = 0.05 complementary probability = 0.95

Critical value = **3.841**

Critical value = 3.841 >  $TR^2 = 0.052304$  → Null hypothesis “Accepted” there is

**No Autocorrelation** in the model

It means there is no autocorrelations in the model.

- Durbin Watson Test

5% critical values for Durbin-Watson statistic, n = 15, k = 3



The test estimated in program Gretl = 1.618120

$dL = 0.82 < 1.618120 < dU = 1.75$

→ there is **No Autocorrelation** in the model

#### 4.3.6 Test for heteroskedasticity

- Breusch-Pagan test for heteroskedasticity, regression model with variables as beer consumption, income and real beer price.
  - Null hypothesis: heteroskedasticity not present
  - Alternative hypothesis: heteroskedasticity present

**Table 7: Breusch-Pagan test for heteroskedasticity**

OLS, using observations 2001-2015 (T = 15)  
Dependent variable: scaled uhat^2

	coefficient	std. error	t-ratio	p-value
const	50.0303	34.2736	1.460	0.1700
x2t	-0.0237636	0.200895	-0.1183	0.9078
x3t	-11.8582	8.05665	-1.472	0.1668

Source: Own table processing used Gretl

Explained sum of squares = 2.75997

Test statistic: LM = 1.379984,

with p-value =  $P(\text{Chi-square}(2) > 1.379984) = 0.501580$

Chi-square(2) right-tail probability = 0.05 complementary probability = 0.95

Critical value = **5.911**

P value  $0.501580 > 0.05$

→ Null hypothesis “Accepted” *Heteroskedasticity NOT present in the model*

Critical value =  $5.911 > LM = 1.379984$

→ Null hypothesis “Accepted” *Heteroskedasticity NOT present in the model*

- White's test for heteroskedasticity, regression model with variables as beer consumption, income and real beer price.
  - Null hypothesis: heteroskedasticity not present
  - Alternative hypothesis: heteroskedasticity present

**Table 8: White's test for heteroskedasticity**

OLS, using observations 2001-2015 (T = 15)  
Dependent variable: uhat^2

	coefficient	std. error	t-ratio	p-value
const	14.9777	31.5651	0.4745	0.6464
x2t	0.254365	0.259279	0.9810	0.3522
x3t	-10.9148	13.8044	-0.7907	0.4495
sq_x2t	-2.43592e-05	0.00114879	-0.02120	0.9835
X2_X3	-0.0627138	0.0458612	-1.367	0.2047
sq_x3t	1.78553	1.61122	1.108	0.2965

Source: Own table processing used Gretl

Unadjusted R-squared = 0.422089

Test statistic:  $TR^2 = 6.331328$ ,

with p-value =  $P(\text{Chi-square}(5) > 6.331328) = 0.275301$

Chi-square(5) right-tail probability = 0.05 complementary probability = 0.95

Critical value = **11.07**

P value  $0.275301 > 0.05$

➔ Null hypothesis “Accepted” *Heteroskedasticity NOT present in the model*

Critical value =  $11.07 > TR^2 = 6.331328$

➔ Null hypothesis “Accepted” *Heteroskedasticity NOT present in the model*

#### 4.3.7 Normality. Testing of parameter stability & collinearity problem

○ Using *Jarpure-Bera-Test* for normality.

- Null hypothesis: normal distribution of random variable
- Alternative hypothesis: not normal distribution of random variable

**Table 9: Jarpure-Bera-Test for normality**

Frequency distribution for uhat2, obs 1-15  
number of bins = 5, mean =  $-2.60532e-015$ , sd =  $0.095178$

interval	midpt	frequency	rel.	cum.	
< -0.13778	-0.17561	1	6.67%	6.67%	**
-0.13778 -	-0.062112	3	20.00%	26.67%	*****
-0.062112 -	0.013554	4	26.67%	53.33%	*****
0.013554 -	0.089221	5	33.33%	86.67%	*****
>= 0.089221	0.12705	2	13.33%	100.00%	****

Source: Own table processing used Gretl

Test for null hypothesis of normal distribution:

Chi-square(2) = 0.352 with p-value 0.83857

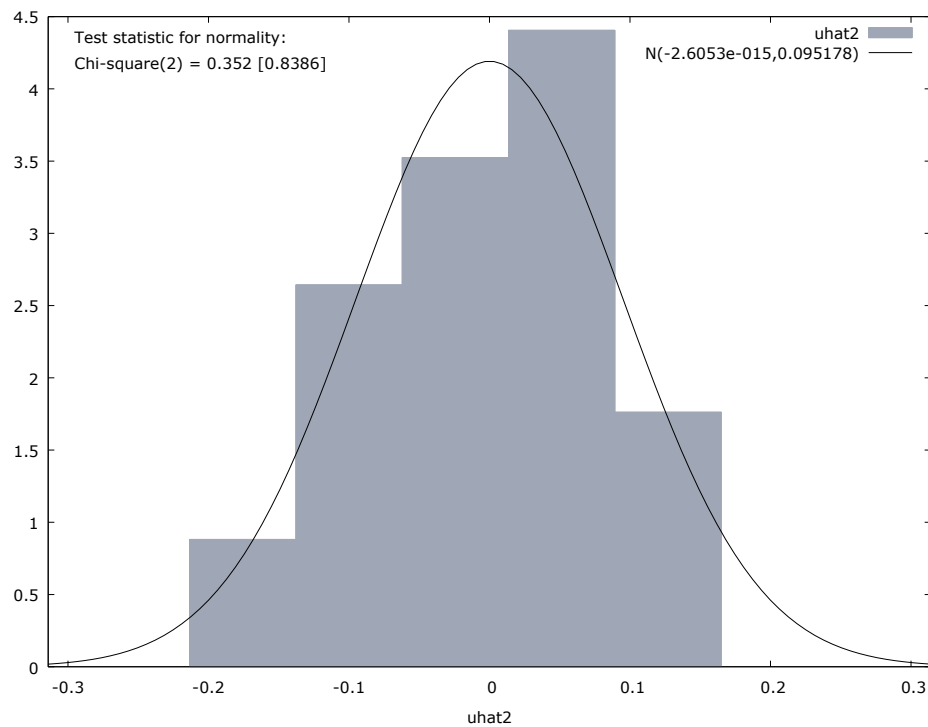
$p > \alpha$

Critical value = **5.911**

→ Null hypothesis “Accepted” **error is normally** distributed.

The figure below demonstrate how normal residuals in the model are distributed.

**Figure 16: Normal distribution**



Source: Own figure used Gretl

- Chow test is used for testing of parameter stability. Hypotheses of Chow's test:
  - Null hypothesis: stability of parameters
  - Alternative hypothesis: not stability of parameters

**Table 10: Chow test for parameter stability**

Augmented regression for Chow test  
 OLS, using observations 2001-2015 (T = 15)  
 Dependent variable:  $y_t$

	coefficient	std. error	t-ratio	p-value
const	0.722732	15.4544	0.04677	0.9637
x2t	0.0171861	0.109846	0.1565	0.8791
x3t	0.712859	2.46225	0.2895	0.7787
splitdum	-11.8831	16.4796	-0.7211	0.4892
sd_x2t	0.0407414	0.114498	0.3558	0.7302
sd_x3t	2.34672	2.71729	0.8636	0.4102

Mean dependent var	4.421737	S.D. dependent var	0.190371
Sum squared resid	0.089250	S.E. of regression	0.099582
R-squared	0.824096	Adjusted R-squared	0.726371
F(5, 9)	8.432829	P-value(F)	0.003292
Log-likelihood	17.14866	Akaike criterion	-22.29732
Schwarz criterion	-18.04902	Hannan-Quinn	-22.34257
rho	0.159830	Durbin-Watson	1.536088

Source: Own table processing used Gretl

Chow test for structural break at observation 2008

$$F(3, 9) = 0.653996 \text{ with p-value } 0.6003$$

Critical value = **3,86**

$\alpha = 0.05$  (5% significant level)

$P > \alpha$

→ Null hypothesis “Accepted”. There **is stability of parameters**.

- Collinearity test for the regression model with variables as beer consumption, income and real beer price.

Variance Inflation Factors

Minimum possible value = 1.0

Values > 10.0 may indicate a collinearity problem

x2t	<b>1.000</b>
x3t	<b>1.000</b>

→ There **is no collinearity** has been detected in the model as both exogenous variables are less than **10.0**

**Table 11: Belsley-Kuh-Welsch collinearity test**

	--- variance proportions ---			
lambda	cond	const	x2t	x3t
3.000	1.000	0.000	0.000	0.000
0.000	80.784	0.021	0.966	0.035
0.000	277.644	0.979	0.034	0.965

Source: Own table processing used Gretl

lambda = eigenvalues of  $X'X$ , largest to smallest

cond = condition index

note: variance proportions columns **sum to 1.0**

## 5 Results & Discussion

### 5.1 Results

The brewing industry in the US attracts a lot of investor attention and is already popular at the moment. Over the past 5 years, the number of breweries has increased by more than 50 percent. According to the latest available data for 2016 in the states there are about 5301 breweries in general, where 5234 breweries produce craft beer. Export beer for 2016 amounted to 614.4 million dollars, with a share of 4.6 percent of world exports. The leaders in the import of American beer are Canada and the United Kingdom. In the average, Americans drank around one gallon of beer per person for the last 5 years, which is highest indicator compared with wine or spirits.

To assess the total production of beer in the states, the data had been considered for the last 14 years from 2004 to 2017. The time series for this period shows that annual beer production is falling rapidly. According to the data annual production in 2008 was 199 in million barrels, then for the last available data in 2017 its 185 million barrels. The production of beer fell by 7% or by 14 million barrels over the past 10 years. The model for time series forecast ARIMA has been completed as a "1-1-0". The intercept p-value is statistically significant at 5 percent level. In the Figure 13, the estimate forecast for 2018-2019 years has been pointing to be decreased, based on 95 percent interval. The predicted values for 2018 are equal to 185 million and 184 million barrels for 2019 accordingly.

In the regression model, have been estimated impact of annual income and the real price on the beer consumption in the United States. Based on 15-time period from 2001 to 2015, where beer consumption is dependent variable or exogenous. The regression based on ordinary least square method. Coefficient of determination or R-squared of the model is equal to 0.785749, which is very good. It means that 78 percent of the endogenous or independent variable was explained by estimation model. All parameters include intercept are statistically significant for relationship between variables at 1%, 5% and 10% levels, according to p-values and t-ratio too. Meanwhile, all p-values are not higher than 0.0008. It means that with 99% probability exogenous or independent variables have effect on endogenous or dependent variable, but with a level of significance (1 percent for error). Correlation matrix has been showed that the is no multicollinearity in the model between independent variables.

In case of relationship between annual income and beer consumption per capita of the country has been found positive impact, which econometric model explains endogenous or dependent variable only by 0.0799456. It means that if income increases by 1 unit, then beer consumption will increase by 0.0799456 liters per capita or vice versa. It was expected to have positive dependency between these variables. Increasing of earnings for residents is stimulating to buy more products or use more services, this applies to consume more beer too.

Relationship between beer price and beer consumption has positive effect as well. The econometric model has been found that if the beer price increases by 1 unit, then people will consume more beer by 3.18085 liters per capita. Beer price has strong correlation with beer consumption. Raising the price of beer can lead to the risk that the customer or consumer will consider choosing another product.

Results testing for autocorrelation through Breusch-Godfrey test shows that there is no autocorrelation in model. Estimated Durbin Watson test in Gretl equal to 1.618120. It shows that 5% critical values with time lag 15 years and with 3 variables Durbin Watson test situated between  $dL = 0.82 < 1.618120 < dU = 1.75$ , it means there is no autocorrelation in the model.

Residuals are normally distributed in the model, it has been tested for Normality using Jargue Bera test. Normality equal to 0.352 with p-value 0.83857. Null hypothesis accepted, according to p-value. As estimated p-value is higher than significance level at 5 percent.

Test for heteroskedasticity using Breusch-Pagan and White's test. According to the results, the variance of the error is constant throughout the model. The difference does not vary from observation to observation. We can accept the null hypothesis and our model as a whole. No collinearity has been detected in the model using Belsley-Kuh-Welsch test, as both exogenous variables are less than 10.0.

## **5.2 Discussion**

In this section, the work of the author will be compared with several similar scientific publications.

The National Institute of Alcoholism and Alcohol Abuse has done research based on data from the past 20 years. Prices for alcohol can be manipulated through an excise tax policy. Given these data, rising prices for alcoholic beverages is an effective policy of

reducing alcohol consumption (Pubs.niaaa.nih.gov, 2002). In another scientific publication, the authors wanted to know what relationship there is between the price change and the demand for beer for regular consumers. They found that based on a 10 percent increase in prices, the average elasticity of demand for demand (% change in the amount required /% of price change) is negative -1.14 for ordinary drinkers (Thomas French and BrownTaylor, 2006). The rise in the price of beer is attracted to the consideration of the choice of either another product or to all refuse consumption. The price and consumption of the product are closely related to each other. In the case of beer and an increase in the price for it can increase consumption for another product, for example wine.

Consumption of beer is gradually falling, as already noted in the results of the author's work. There are suggestions that this is due to the popularity of wine in the United States. Wine is rapidly gaining momentum and is becoming more popular, according to statistics of wine consumption is more stable than that of beer in recent decades. A simple reason for Americans to drink wine can be just healthy benefit. Many doctors for many years recommended drinking a moderate amount of wine, especially red wine. To reduce blood pressure, reduce the risk of heart disease and simple stories about live longer.

Meanwhile, the segment of the American beer market has changed significantly. The popularity of craft beer or it is called also a craft revolution. The number of craft breweries has doubled for the last 5 years. That entails a decrease in consumption in general, because craft beer is much more expensive than supermarket lager beer. In this case, quantity of annual earning plays a role, neither each person with a middle income can pamper itself often with craft beer.



## **6 Conclusion & Recommendation**

The objectives of this work were to analyze the beer figures in the United States in recent years. Segments of the market were shown both world and local. Analysis have been done to compare beer consumption with other beverages such as wine and spirits, which are indicated on figures and tables in this work. The number of craft breweries and their volumes.

The first model used to analyze the annual production of beer in the United States and received a forecast for future production using the ARIMA method. In this model, the time series ranged from 2004 to 2017. The model is developed using by Excel program. The result showed a decrease in beer consumption in the next 2 years.

The second econometric model analyzed the influence of the annual income per capita and the average beer own price on the annual beer consumption in the United States. Dependent variable was chosen as the beer consumption while the average own beer price and annual income were independent variables. Regression model is developed using hand calculation and the Excel program. The model assumptions were accepted. Outcome of the regression model showed a good results and direct relationships between observed variables.

Recommendation for further research will take to consideration consumption of wine as a substitute goods to beer, the impact and interaction of prices for these products with data set for the last 12 or 14 years.

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## 8 Appendix

### Appendix 1: Chi-Squared Distribution: Critical Values

<i>Degrees of freedom</i>	<i>Significance level</i>		
	5%	1%	0.1%
<b>1</b>	3.841	6.635	10.828
<b>2</b>	5.991	9.210	13.816
<b>3</b>	7.815	11.345	16.266
<b>4</b>	9.488	13.277	18.467
<b>5</b>	11.070	15.086	20.515
<b>6</b>	12.592	16.812	22.458
<b>7</b>	14.067	18.475	24.322
<b>8</b>	15.507	20.090	26.124
<b>9</b>	16.919	21.666	27.877
<b>10</b>	18.307	23.209	29.588

Source: (Home.ubalt.edu, 2018)

### Appendix 2: Critical Values for the Durbin-Watson Statistic (d)

Level of Significance $\alpha = .05$										
<i>n</i>	<i>k = 1</i>		<i>k = 2</i>		<i>k = 3</i>		<i>k = 4</i>		<i>k = 5</i>	
	$d_L$	$d_U$	$d_L$	$d_U$	$d_L$	$d_U$	$d_L$	$d_U$	$d_L$	$d_U$
<b>6</b>	0.61	1.40								
<b>7</b>	0.70	1.36	0.47	1.90						
<b>8</b>	0.76	1.33	0.56	1.78	0.37	2.29				
<b>9</b>	0.82	1.32	0.63	1.70	0.46	2.13	0.30	2.59		
<b>10</b>	0.88	1.32	0.70	1.64	0.53	2.02	0.38	2.41	0.24	2.82
<b>11</b>	0.93	1.32	0.66	1.60	0.60	1.93	0.44	2.28	0.32	2.65
<b>12</b>	0.97	1.33	0.81	1.58	0.66	1.86	0.51	2.18	0.38	2.51
<b>13</b>	1.01	1.34	0.86	1.56	0.72	1.82	0.57	2.09	0.45	2.39
<b>14</b>	1.05	1.35	0.91	1.55	0.77	1.78	0.63	2.03	0.51	2.30
<b>15</b>	1.08	1.36	0.95	1.54	0.82	1.75	0.69	1.97	0.56	2.21

Source: (Statistics, 2018)

**Appendix 3: Critical values for t-test**

Degrees of freedom	Significance level					
	20% (0.20)	10% (0.10)	5% (0.05)	2% (0.02)	1% (0.01)	0.1% (0.001)
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.405
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073

Source: (Grange, 2018)