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From Monasteries to Multinationals (and Back): A Historical Review of the Beer Economy

Eline Poelmans [1] and Johan Swinnen [2]

Abstract

This article reviews beer production, consumption and the industrial organization of breweries throughout history. Monasteries were the centers of the beer economy in the early Middle Ages. Innovation and increased demand later induced the growth of commercial breweries. Globalization and scientific discoveries transformed the beer industry and increased competition from the 16th through the 19th century. The 20th century was characterized by dramatic (domestic and international) consolidation, major shifts in consumption patterns, and the re-emergence of small breweries.

Keywords: economic history, history of beer, monasteries, innovation and taxation in brewing, modern brewing, consolidation and globalization

JEL classification: N30, N40, L23, L66

Introduction

> *'The church and the monasteries were … the birthplaces of brewing science'* (Jackson 1996: 1).

Traces of predecessors of our current beer were found several thousands of years ago in very distant places including North Africa, China and Europe. It is uncertain whether the technique to produce "beer" was discovered at one place and then spread among people and continents, or whether it was discovered at various places independently.[3] There are indications that "beer" was produced and consumed in China more than 7000 years ago (around 5000 BC) (Bai et al. 2011). Outside China, it is well known that by the beginning of the fifth millennium BC people in Mesopotamia, the fertile region between the Tigris and Euphrate rivers, and in Egypt were making beer.

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[3] Throughout history, different types of alcoholic beverages that were made from a whole range of products (fruits, sugar cane, honey, and cereals such as e.g. barley, wheat, oats, millets, rye and maize) have been labeled with the name 'beer'. Nelson (2005: 1-2) defines beer as: *'any sort of maltose-based alcoholic beverage, whether or not the ingredients include other products (fermented or not)'* and *'a fermented drink made essentially from malted cereal, water and yeast'*.

The earliest indications of beer production in Europe are from around 5000 years ago – 3000 BC (Patroons 1979 and Brewer and Teeter 2007). In many European regions which are now associated with wine, people did drink mostly (or only) beer for thousands of years. For example, in what is now France, Spain, Portugal and Northern Italy people drank beer, not wine, in the millennia before the Greek and Roman empires (Nelson 2003).[4] The widespread consumption of wine and viniculture did not arrive in large parts of Southern Europe until the Romans conquered these parts of Europe. Celtic people in (what is now) France, Spain, Belgium, Germany, and Britain were all avid beer drinkers (Nelson 2005).

The Greeks and the Romans drank wine, and only wine. They despised beer and its drinkers and referred to them as barbarians (Rabin and Forget 1998). With the Roman conquest of Europe, wine consumption – and later production – spread over the continent. (Poelmans and Swinnen 2011). Wine came to supplant beer as the upper-class beverage in most of these areas. The place where the old beer tradition remained most steadfast was what is North Central Europe, due to Germanic influence (Patroons 1979).

Also in more recent times international political and economic developments strongly affected beer consumption across the world. For example international conquests (e.g. the colonization of America and Australia), migration (e.g. of German settlers in the United States) and foreign investments by companies (e.g. recent investments by Western brewing companies in Russia, China and India) led to international transfers of technologies and knowledge of brewing as well as the spread of beer consumption globally (Poelmans and Swinnen 2011).

By the early 21st century, beer consumption is by far the most important alcoholic beverage in volume and value terms. On a global level, the volume of beer consumption is more than six times larger than wine consumption. By 2005, the total volume of beer was 153 billion liters while the volume of wine was 24 billion liters and that of other alcoholic drinks 18.5 billion liters. In value, the global consumption of beer has been double that of wine over the past 50 years, with beers accounting for about 130 billion US dollars by 2005 and wine for about 65 billion US dollars.

The past two decades have witnessed some dramatic changes in the global beer market (Colen and Swinnen 2011). The strongest growth in beer consumption is in middle and low income countries which experience growth, such as China, Russia, Poland and India. In contrast, in many traditional "beer-drinking nations", such as Belgium, the UK, Germany and the Czech Republic, there has been a reduction in beer

[4] There is evidence that the Greeks already exported wine to southern France, particularly via Massala (Marseille), starting from around 650 BC, and that there was some local production around Massala. However, even after that, for hundreds of years, in Southern Gaul (today's France) wine was a luxury item and only consumed by the upper class. According to Diodorus of Sicily, the price of wine was high: Gauls would exchange a slave for one jar of Italian wine (Nelson 2005: 49).

consumption per capita and beer lost importance in favour of other alcoholic drinks. The opposite is true in "wine-drinking (e.g. Spain and Italy) and "spirit-drinking" (e.g. China and Russia) countries, leading to a convergence of alcohol consumption patterns across countries.

During history, not just the geographic spread of beer production and consumption changed, but also the technologies used and the industrial organization of the beer industry. In this paper, we discuss some key elements of the historic evolution of beer production, consumption and technologies used and industrial organization of breweries.[5]

Monasteries as the Centers of the Beer Economy in the Early Middle Ages

With the spread of his Holy Roman Empire around 800 AD, Charlemagne built many monasteries across Europe, many of which became centres of brewing (Unger 2004). Initially, most of the monasteries were located in Southern Europe, where the climate permitted the monks to grow grapes and make wine for themselves and their guests. However, when later monasteries were established in Northern regions of Europe, where the cooler climate made it easier to grow barley instead of grapes, the monks started to brew beer instead of wine (Jackson 1996). Throughout the early Middle Ages *'monastic brewing'* spread to the British Isles, Germany, Scandinavia and the Low Countries (Unger 2004). Only in the twelfth and thirteenth centuries would brewing emerge as a commercial venture. Before that, the monastery was the only institution where beers were manufactured on anything like a commercial scale (Hornsey 2003).

Initially, beer brewed by the monks was used for their own consumption as well as to give to guests, pilgrims and the poor (Bickerdyke 1889).[6] Later, monks started to brew beer for other people as well, such as noblemen and to sell their brew in so-called 'monastery pubs'. There were also so-called *'church ales'* that were celebrations and feasts of the church where the peasants were allowed to drink beer for free, reducing the demand for commercial brewing (Rabin and Forget 1998).

Studies indicate that monks often drank large quantities of beer. Statistical sources even mention beer consumption of up to five liters a day for each monk in some monasteries. Several factors seem to have played a role (Rabin and Forget 1998). First, as the water in the Middle Ages was often polluted, beer was healthier than water. Second, apart from nutritional reasons, beer was often used in monasteries for spiritual and medicinal purposes. Third, an average meal in the monasteries of the early Middle Ages

[5] See various chapters in Swinnen (2010) for more details.

[6] According to the rule of Saint Benedict (480-547 A.D.), the founder of 'modern monasticism', the Benedictine monks not only had to live in their own community and be self-sufficient, but they also had to offer hospitality to travelers and people in need (Nelson 2005).

was rather frugal, and beer provided a welcome nutritious addition. Fourth, although beer contained alcohol, it was seen as a liquid like water, and was, as such, not forbidden during a fasting period. Beer was the '*ubiquitous social lubricant'* and this not only because it was an essential part of the – often dire – medieval diet, but also because during the Middle Ages *'every occasion that was even remotely 'social' called for a drink'* (Unger 2004: 3).

Innovation and Taxation in Brewing in the Middle Ages

An important innovation was the introduction of hops in brewing. There is evidence that already around 800 AD, German monasteries added extracts of the hops plant to preserve their beer longer. Moreover, the bitterness of the hops also balanced the rather sweet flavour of the malt, the other main ingredient of Germanic beer (Behre 1983 and 1999).

This innovation would ultimately transform the entire global beer economy. However, despite its benefits, the use of hops did not spread rapidly over the beer producing regions in Europe. In fact, it would last several centuries before its use would be widely accepted. The main reason for the slow diffusion of this innovation was its impact on the local tax base in many regions.

Before hops were used, breweries were subjected to a so-called *'Grutrecht'* or 'flavoring licence' in many regions. This Grutrecht was named after the 'grut', a combination of herbs that were used to flavour beer (or to 'disguise faults' in the brew) and to preserve the beer. Grut was an important factor in distinguishing between different beer brews (Doorman 1955). The 'Grutrecht' was determined by the local authorities and was used to tax breweries. It stated explicitly which particular flavouring additive could be added to the beer. All brewers were obliged to buy grut for their brews from the local rulers and brewing beer without grut was forbidden. To avoid tax evasion, the exact composition of grut was kept a secret (Mosher 2009).

While the addition of hops improved the taste and preservation of the beer and allowed for transportation over longer distances, hops threatened the Grutrecht. By using hops, brewers no longer needed grut (or less of it). Hence, the innovation of hops threatened local rulers' revenue from the Grutrecht tax on beer. Therefore, in many regions, including Britain and Holland, the use of hops was prohibited for a long time (Unger 2004). In fact, it took several centuries before the use of hops became commonplace in some European regions. Only after the Hundred Years' War between France and England (1337-1453), one was allowed to use hops in brewing English ales (Meussdoerffer 2009). Also in Holland, rulers did not allow the domestic brewers to use hops until the early fourteenth century (Hornsey 2003).

An interesting illustration of how the (compulsory) addition of grut to beer still has repercussions to the present day is from Belgium where breweries on opposite sides

of the Schelde river continue to use different brewing processes. Breweries located on the right bank of the Schelde were under German rule and allowed to use hops. Breweries that were located on the left bank of the Schelde river were subjected to French rule and obliged to use grut. They brew sour beers (because grut did not protect against acidification by bacteria). Some of these breweries still today produce more sour beer (Degrande 2010).

The Growth of Commercial Breweries and Decline of Monasteries in Early Modern Times

In the fourteenth century, the central position of the monasteries in the beer brewing industry changed dramatically. Commercial breweries emerged and grew in importance. These changes coincided with an overall growth of the brewing industry (Unger 2004).

Demand and supply factors played a role in this process (Rabin and Forget 1998 and Unger 2004). In the Early Middle Ages, many people only drank beer at religious festivities because it was free. Incomes were too low to sustain a large demand for beer. Demand for beer increased in the late fourteenth and fifteenth centuries with income growth, expansion of trade and towns, and increasing awareness of water pollution.

The growth of trade implied that more merchants were traveling between town markets and regional fairs. The increasing demand for lodging facilities, food and drink, led to the emergence of 'inns' and 'taverns' (Clark 1983). With it, the demand for beer in these places grew. Hanseatic cities that maintained a trade monopoly between the thirteenth and seventeenth centuries along the coast of Northern Europe became important centers of brewing (von Blanckenburg 2001). Cities known for commercial brewing included Bruges, Ghent, Leuven and Antwerp in Flanders; Haarlem and Gouda in Holland; Hamburg, Lübeck and Munich in Germany; and London in England (Unger 2004). As more beer was brewed and commercially traded, its quality as well as its distribution and export increased. Increasing competition between commercial breweries contributed to better beer.

Together with the emergence of commercial breweries, government regulations were introduced. Governments imposed a variety of taxes and rules that described how beer had to be produced, the duration of the brewing process, the required composition of beer, rules that fixed beer prices, etc. One of the most (in)famous brewing regulations was introduced in 1487 in Munich in Bavaria: the so-called *'Reinheitsgebot'* (or *'Purity Law'*), which survived for 500 years, and was only recently repealed. The

'Reinheitsgebot' stipulated that only barley, hops and pure water could be used to produce beer (Hackel-Stehr 1987).[7]

With the growth of commercial breweries, the role of monasteries as centers of brewing declined. This was heavily influenced by political considerations and actions. First, to compensate for the lost tax income from the 'Grutrecht', local rulers wanted to impose taxes on beer itself. However, beer brewing monasteries were linked to local parishes which did not have to pay taxes. As a result of this privileged position of the monasteries, local rulers favoured commercial breweries that had to pay taxes on beer (Meussdoerffer 2009).

During the Reformation in the early sixteenth century, the monasteries' breweries lost further market shares as the Catholic Church lost a lot of its power (Holt 2006). In the Northern European regions which turned to Protestantism, the Reformation eliminated Catholic monasteries and with it their beer production. Commercial breweries emerged to take their place (Wrightson 1981).

The final element causing the complete shift from monasteries to commercial breweries as centres of brewing came at the end of the eighteenth century. During the French Revolution in 1789, and French expansion under Napoleon, many remaining European monasteries – and with it their breweries – were destroyed (Patroons 1979). Hence, from the Napoleonic era onwards, the role of monasteries in brewing became very limited. Interestingly, the role of monasteries and abbeys in brewing has seen a remarkable revival in recent decades in some regions (see further).

Globalization and New Competition for Beer in the Early Modern Times

During Early Modern Times, the European superpowers of the time made voyages to the 'New World'. Convinced that water in newly discovered territories was polluted and carried diseases, the European discoverers took beer as a very important cargo on their ships (Mathias 1959 and Stubbs 2003). The Europeans also introduced beer brewing methods in the territories they conquered (Schmölders 1932). In some conquered regions, however, such as in the Southwestern region of North America, they found that native Americans were already brewing some form of 'beer', made from fermented maize (Rabin and Forget 1998). Another example could be found in Latin America, where the

[7] The purity laws had been issued by cities as part of urban legislation and they never attained more than local significance. In 1516 however, Wilhem IV, the duke of Bavaria extended this law to the whole state of Bavaria (Meussdoerffer 2009). However, in some rural regions of Bavaria that escaped state surveillance, beer was still brewed by adding 'Grut'. In this respect, the *Reinheitsgebot* was seen by some as an early protestant measure to break the dominance of the Grutrecht through which the often catholic local rulers earned a lot of money (Unger 2004). The Reinheitsgebot was ultimately extended to the whole of Germany, became federal German law in 1919 and was only repealed in 1988 (Van Tongeren 2011).

Aztecs – who lived in what is now Mexico – already produced some sort of beer made from the sprouted kernels of maize (Dickenson and Unwin 1992).

However, the globalization process also had very different effects on the European beer industry. Apart from finding new markets to sell their beer, the European beers faced stiff new competition from other, non-alcoholic, beverages coming from the new territories, such as tea, cocoa and coffee. Increased competition for beer in the seventeenth century also came from closer to home. As incomes in Europe increased, more people could afford wine, which had also become more available because of improved transport infrastructure. In addition, distilled alcoholic beverages such as gin, rum, vodka and whiskey were increasingly produced and traded (Aerts 1990 and Unger 1995).

Not surprisingly, such competition induced lobbying for protectionist measures. A well illustrated case is the introduction of high taxes in the UK on the import of French wine and alcoholic spirits in the early eighteenth century causing a dramatic decline in cheap wine consumption. The British masses collectively turned to beer as their most important and widely consumed alcoholic beverage, and hence, with a largely protected beer industry, the UK became a 'beer drinking nation' (Nye 2011).

Scientific Discoveries and the Development of Modern Brewing in the Eighteenth and Nineteenth Centuries

During the eighteenth and nineteenth centuries, several scientific discoveries had a dramatic impact on beer consumption and production.

First, the invention of '*carbonated water'* in 1767 led to the production of consumable 'soda water', and, almost a century later, in 1886, to the invention of a soda water that would become known as '*Coca-cola'*. In the following decades consumption of coca-cola and sodas grew very rapidly. In addition to the increasing competition from tea and coffee, from the end of the nineteenth century onwards, 'soda water', another non-alcoholic drink, became strong competition for beer.

Second, increasing knowledge about the function and composition of yeast made it possible to produce new types of beer and to better control the production process. An important innovation constituted the discovery of a new beer production process called *'lagering'* (Michel 1899).[8] By 1818, scientists had discovered that the beer fermentation process could be split up into a first phase, in which saccharine was transformed into alcohol and carbon dioxide, and a second phase, in which the beer 'ripened' and the

[8] Although a *'lager'* kind of beer was already brewed in Southern Germany in the late Middle Ages, the lager as we know it today is the pale and almost gold-coloured drink first brewed in the mid nineteenth century. This new beer is associated with the brewery of Pilsen (Plzen) in West Bohemia (now part of the Czech Republic) from which the name '*Pils beer'* derives.

remaining impurities were removed. This knowledge led to experiments to produce new beers by manipulating the yeast's environment (Sedlmayr 1934). To control the activity and suspension of the yeast, slow acting yeast and storage at a low temperature over a period of several weeks were used (Meussdoerffer 2009). In this way, the German 'lager' – which literally means 'storage' – beer was produced. The 'lager' beer was clearer and brighter than the then existing beers. Lager beer is produced through a '*bottom-fermentation process'*, in which the (slow-fermenting) yeast sinks to the bottom of the brewing vessel. The yeast is then removed through filtering, producing a clear beer. Before this method was invented, the yeast rose to the top of the fermenting brew, i.e. the top fermentation process (Hornsey 2003).

Around the same time that the lager brewing process was developed, the exact composition of yeast was discovered. Although for several centuries, yeast had already been used to produce beer, it was only in the nineteenth century that yeast was identified as the actual cause of fermentation (Barnett 2000). Whilst doing research into the causes of 'diseases' associated with wine in the 1860s, Louis Pasteur developed the so-called *'Pasteurization'* method, in which he found that wine could be preserved much longer if he heated the wine to a specific temperature and cooled it immediately to destroy pathogens in the wine.[9] Later on, he conducted similar research with regard to beer in his 'Etudes sur la bière' (1876).[10] Around the same time, in the Carlsberg laboratories in Copenhagen, the Danish scientist Emil Christian Hansen succeeded in isolating the strain of yeast that produced the German lager beer. This discovery allowed other breweries to produce lager beer which had become very popular (Hornsey 2003).

Two other technological innovations in the late eighteenth and nineteenth centuries were important for the growth of lager beer and the beer industry, i.e. the improvement of the steam engine [11] and the invention of refrigeration. The first made it possible to use more complicated, steam-operated machinery during the brewing process and it reduced transportation costs. The invention of the refrigerator in 1876 made it possible to brew lager beer – which required cooling – all year round and not just during the winter months, when natural ice was available to cool the beer (Meussdoerffer 2009).

Other important innovations affected storage of beer (Hornsey 2003). Using glass bottles was important for the transportation of the beer, as it enabled beer to be preserved much better than cask beer, especially on long journeys. In the seventeenth century, glass

[9] Pasteur, L. (1866) *Etudes sur le vin, ses maladies, causes qui les provoquent, procédés nouveaux pour le conserver et le vieillir*. Paris: Imprimerie Impériale V. Masson.
[10] Pasteur, L. (1876) *Etudes sur la bière, ses maladies, causes qui les provoquent, procédés pour la rendre inaltérable avec une théorie nouvelle de la fermentation*. Paris: Gauthier-Villars.
[11] In 1769, James Watts (1736-1819) considerably improved and reduced the operating costs of the 'steam engine' that had been invented by Newcomen in 1712.

beer bottles were hand blown and therefore expensive.[12] After the invention of the 'chilled iron mould' in the 1860s, glass bottles could be produced relatively cheaply in mass quantities, as of the 1890s (Teich 1998). Equally important was the invention of new methods to close beer bottles. Glass beer bottles were initially closed with a cork held in place with wire (Meussdoerffer 2009). Later on, beer bottles were closed with a 'screw stopper', invented by Henry Barrett in 1872. Another 20 years later, in 1892, William Painter patented the 'crown cork', which enabled automatic bottling machines to be developed. In the first half of the twentieth century, metal beer cans were invented and introduced (Stack 2003).

As a result, since the 1880s a dramatic transformation of the beer industry occurred. With the success of the new top fermentation process and enhanced understanding and control of the brewing process, the brewery industries in continental Europe embarked on the road to industrialization (Teich 1990). The mechanization and use of steam engines and the introduction of refrigeration made control of the environment in breweries possible. These developments came at the same time as elaborate research on yeast which made it possible to produce a consistent and reliable pilsner beer of high quality throughout the entire year and at lower costs. With an improved product which brewers could distribute along cheaper and faster transportation networks, the beer production and consumption grew and spread throughout the entire world (Unger 2004). In addition, throughout beer history, one of the main goals of brewers had always been to achieve consistency in their brew. Lack of technology and knowledge had made this very difficult for centuries. However, with increasing knowledge of how the actual brewing process took place and thanks to the introduction of beer bottles, beer cans and crown corks, it became increasingly possible to control the 'stability' of beer once it had been bottled (Gourvish 1998).

Growth and Decline in the Nineteenth to the Twenty-First Centuries

INSERT TABLE 1 AND FIGURE 1

The nineteenth century was characterized by strong and continuous growth in beer production (see Table 1 and Figure 1). Beer production and consumption increased particularly sharply in the last quarter of the nineteenth century and up to the eve of the First World War (WWI), a period characterized by a strong decline in global grain prices

[12] In some regions there was some kind of 'excise duty' on glass. For instance, in England and Wales there was such an excise duty from 1745 to 1845. This stalled the further development of the glass bottle technology in those regions for many years.

(Swinnen 2009). By the early twentieth century, the beer markets of Germany, the UK and the USA were the largest in the world and of similar size: between 5 to 7 billion liters each.

The evolution in the twentieth century is characterized by both growth and decline. In most countries, beer production declined dramatically in the 1915-1950 period. In Europe, production fell by around 70 % during WWI. The brewing industry suffered greatly, particularly in the occupied parts of Europe (e.g. Belgium and France). The mobilization caused many workers in the brewing industry to be scattered, which led to a shortage of employees in the breweries. Moreover, metal materials (such as copper), vehicles and draught animals were claimed by the occupying forces. As a consequence, a lot of breweries had to close down their businesses (Patroons 1979). Also in Germany, the beer industry suffered, as other industries (especially war industries) had priority in the allocation of resources. Moreover, grains were scarce and expensive with food and feed shortages throughout Europe.

After the war, the scarcity of raw materials persisted for several years. Breweries that wanted to start up again or increase production, had to manage with what they could find. For several years after the war, all kinds of grains, peas, beets and beans were used to produce beer. Yet, beer production recovered strongly in some European countries after the war. For example, in France, beer production increased four-fold between 1918 and the late 1930s. Recovery was less in Germany and the UK.

Production declined again dramatically in the 1940s. During the Second World War (WWII), food was rationed and raw materials for the European breweries were scarce and expensive. As during shortages before, breweries tried to cope by using a variety of substitutes for the normal brewing ingredients (Patroons 1979).

The impact of the world wars was smaller in the USA. During WWI, there was a 10 % decrease in American beer production. Grain rationing, which was imposed by the American government because of 'war-time emergencies', induced the American brewers to brew beer of a lower alcohol content (i.e. only 2.75 percent) (Stack 2003).

A much more radical decline in beer production was caused by government regulation. The 'temperance movement' succeeded in securing a nationwide prohibition of alcohol in the USA from 1919 to 1933. During this period, the sale, manufacture and transportation of alcohol of more than 0.5 percent were banned (Hartung 1932). As a result, the USA had no legal beer production for fourteen years. There was some illegal beer production in this period, but only minimal. Total beer output collapsed. Many American breweries were closed down. Some sold their plants and equipment as soon as possible, at substantial losses. Others, who expected the prohibition to be temporary, tried to use their equipment to produce related products; such as beer containing less than 0.5 percent alcohol (Stack 2003). In 1933, the prohibition was repealed. The manufacture and sale of certain kinds of alcoholic beverages, including beer, was allowed again. The

impact on the US brewing industry was severe. According to official figures, there were 1345 active breweries in the USA in 1915. By 1934, 50 % had closed (Table 2).

INSERT TABLE 2

Some authors (e.g. Rabin and Forget 1998) claim that also the great depression (reducing demand) and the dust bowl [13] (increasing grain prices) reduced production in the 1930s. However, within a few years after the repeal of prohibition, beer production increased to the level of the pre-prohibition years. The dust bowl seems to have affected the nature of the brewing process more than the amount of beer produced. As during WWI, US breweries reacted to increased grain prices by switching ingredients. Instead of barley, cheaper grains such as corn and rice were used. These adjustments to using cheaper substitute grains had important lasting effects. The beer produced was lighter than beer from barley and, after several years, including WWII, this changed US consumer preferences to lighter beer (see further). To this day Budweiser and Bud Light are brewed primarily with rice.

Strong growth was temporarily interrupted by WWII, but resumed soon afterwards. The 1950-1980 period was characterized by strong growth in beer production and consumption, both in Europe and in the USA. Technological innovations lowered real prices and increasing incomes increased demand, causing growth in beer consumption.

The 1980s were the start of a major structural change in beer consumption in Europe and the US. Colen and Swinnen (2011) show that there is a non-linear relationship between income and beer consumption. Beyond a certain level of income, per capita beer consumption falls instead of rises. In addition, alternative alcoholic drinks, in particular wine, became more available in traditional beer drinking countries. Since 1980, per capita consumption declined in all major beer producing countries, with consumers switching to other beverages because of increased choice and higher incomes. Total production continued to increase in some countries. It increased in the USA because of population growth as a result of migration, leading to an increase in total demand. In some European countries, such as Belgium, production grew because increasing exports more than offset declining local demand (Persyn et al. 2011).

Growth in global beer markets has shifted elsewhere. Beer consumption in emerging countries has grown rapidly over the past 20 years. The strongest growth in beer consumption is in Russia (Deconinck and Swinnen 2011), while also Brazil, India and China have shown strong growth in beer consumption. While per capita consumption

[13] An enormous drought during the 1930s transformed many grain fields into a massive ‘dust bowl’. As a result, grain became very expensive and many breweries started to look for alternatives.

in India is still very low, China is, since 2003, the largest beer market in the world (Arora et al. 2011, Bai et al. 2011).

Consolidation and the Growth of Multinationals in the Twentieth Century

The twentieth century was characterized by a strong consolidation in the brewery industry (Table 2). For example, the number of breweries in the UK decreased from 6447 in 1900 to 2914 in 1920. In the next thirty years, the number of UK breweries decreased further to 567 in 1950. The average size of the UK breweries grew from 0.9 million liters in 1900 to 2.0 million liters in 1920, and to 7.4 million liters in 1950. In Belgium, the number of breweries decreased from 3223 in 1900 to 2013 in 1920, to 663 in 1950. In the same period, the average Belgian brewery size increased from 0.45 million liters in 1900, to 0.51 million liters in 1920 and 1.5 million liters in 1950 (Persyn et al. 2011).

The World Wars played an important role in this consolidation process, in particular in continental Europe. Many breweries that had to start again from scratch after WWI decided to mechanize their brewery or merge with larger breweries. Similarly, many European breweries in the occupied countries suffered damages during WWII. These breweries needed to invest substantially in new brewing equipment. As a result, in the immediate post-war period, many breweries merged or concentrated because of the investments that were necessary for re-equipment and modernization of the breweries. Other breweries expanded their activities by producing mineral water and several types of lemonade. The production of these types of non-alcoholic drinks did not pose high technical demands and there were substantial cost savings through scale economies in the distribution of the drinks, which could happen through the same channels (Patroons 1979).[14]

In the USA, the number of breweries decreased from 1816 breweries in 1900 to 1345 in 1915. The average size of the American breweries grew from 2.6 million liters in 1900 to 5.2 million liters in 1915 (Table 2). Prohibition disrupted this process.[15] After the end of prohibition, 756 breweries started brewing again. By 1940, 684 breweries were still active on the American market, and their average size increased enormously after prohibition: from 5.9 million liters in 1934 to 9.4 million liters in 1940 to 25.6 million liters in 1950 reflecting a huge increase in the USA's total beer production: from 4.4 billion liters in 1934 to 10.4 billion liters in 1950 (Table1 and Stack 2003).

[14] In the US, in the same period, all large mergers were vertical, as the horizontal types of mergers were forbidden by the country's antitrust laws (Adams 2011).

[15] Some American breweries – e.g. Anheuser-Busch – were granted special licences by the American government to produce beer for medical purposes. This made it possible for those breweries to keep their staff active and still use their equipment and plants to make beer, which gave them a competitive advantage over the breweries that were not granted such a government license (Stack 2003).

The consolidation process continued after WWII. Between 1950 and 1980, the number of UK breweries decreased from 567 breweries in 1950 to 142 in 1980. The average size increased accordingly, from 7.4 million liters in 1950 to 48.1 million liters in 1980. Similarly, in Belgium, the number of breweries decreased from 663 in 1950 to 123 in 1980. As in the UK, the average Belgian brewery size increased strongly, from 1.5 million liters in 1950, to 11.6 million liters in 1980.

As in Europe, consolidation in the US beer industry continued in the second half of the twentieth century. The number of US breweries decreased sharply, from 407 in 1950 to only 101 in 1980. The average size of US breweries grew from 25.6 million liters in 1950 to 219.2 million liters in 1980 (Table 2). Large, national breweries, such as Anheuser-Busch and Pabst, grew in importance, to the detriment of small, local breweries. An important cause was scale economies in advertising, in particular with the arrival of TV (George 2011). The five largest American breweries' share in total USA beer production rose from 19 percent in 1947 to 75 percent in 1981 (Stack 2003).

This growing consolidation was reinforced by globalization of the breweries. During the 1980s and 1990s, an increasing number of breweries started looking abroad for additional sales. European and American breweries started to export more beer overseas, establish new firms abroad, and engage in 'licensing deals' in some countries where the already existing breweries started brewing their products. For example, in 1995 Anheuser-Busch entered into licensing accords to brew Budweiser in two breweries outside of the US, i.e. one brewery in the UK to serve the European market and one in China to serve the East Asian market (Stack 2003).

Companies such as Heineken (Holland), SABMiller (South Africa) and Interbrew (Belgium) made acquisitions across the globe. In the 1990s and the early twenty-first century they bought a whole series of breweries in Eastern Europe (Swinnen and Van Herck 2011) and extended their operations in North and South America (e.g. Canada, Mexico, Brazil and the US) and China. For example, in 2002, *SABMiller plc* – with headoffice in London, UK – was created through the merger between South African Breweries (SAB) (the dominant brewery of South Africa, with many operations in Europe), and the second largest US brewery, Miller (Stack 2003). Another example is *Anheuser-Busch Inbev NV* – with headquarters in Leuven, Belgium – that resulted from the 2004 merger between the Belgian Interbrew and the Brazilian AmBev and the 2008 merger with Anheuser-Busch (<http://www.ab-inbev.com>). The holdings that resulted from these brewing companies now dominate the global beer market.

From Ales to Lager to Light to Specialty Beers: The Return of the Monasteries

As already explained, the introduction of the lagering technology revolutionized brewing and dramatically changed the global beer markets in the nineteenth and twentieth centuries. All over the world, traditional ales produced with top fermentation lost market share to lager beer brewed with bottom fermentation. Lager came to dominate the beer market globally. However, some breweries continued to produce other types of beer, particularly in some European regions, such as Belgium, Ireland, England and Bavaria.

During the first half of the twentieth century, several grain shortages caused a further shift in beer brewing and ultimately in consumer preferences in the USA. Firstly, during WWI, grain rationing was imposed by the US government, which caused the US brewers to brew beer of a lower alcohol content (i.e. only 2.75 percent) (Stack 2003). Second, the 'dust bowl' drought during the 1930s made grain very expensive. In reaction, breweries looked for alternatives. Instead of barley, other and cheaper grains such as corn and rice were used. With these substitutes, the resulting lager beers were lighter in colour. They were called '*light lager'* or '*American lager'* beer. A few years later, during WWII, grain was again in short supply and, as a result, American brewers kept producing 'light lager'. Consequently, by the end of the war, the 'light lager' had gained a major share of the North American beer market and US consumers had become used to drinking 'light lager' (Rabin and Forget 1998).

Later, new types of beer were developed in response to a growing demand for low calorie foods and drinks (Tremblay and Tremblay 2005). Many beer producers discontinued the production of dark beer and started producing 'diet' or 'light' beers. These beers, brewed with more water relative to hops and grains and with an enzyme called amylogucosidase – added during fermentation – contained less alcohol, less calories and less carbohydrates than the 'regular' beers (Robertson 1984). In 1975, Miller introduced *Miller Lite*, successfully marketed as *'America's fine light beer'*. The new drink became an enormous success and similar brews were introduced in the following years. Light beer has been a great success ever since and, in 2005, it was the most popular beer category in the United States (Tremblay and Tremblay 2005).

However, the growing domination of increasingly standardized lager and light beers produced by increasingly fewer brewing companies led to a counter movement in the past 25 years. This reaction against consolidation and lack of variety started in the US. During the 1980s, people started to show a renewed interest in 'older' beer styles, such as porter, pale ales and brown cask ales, stout and bitters. At the beginning of the 1990s, this trend of (re-)appreciating and brewing 'special beers' and 'older' style beer was labeled the *'microbrewery movement'* because of the small scale of the new breweries which

started to brew different types of beer (Tremblay and Tremblay 2011).[16] The size of these new breweries was much smaller than that of the existing breweries. However, because of their success, some of these microbreweries have since outgrown the 'micro' term, but were still labeled 'microbreweries' because of the style of beer they are producing. Some are now referred to as 'regional specialty brewers' (Tremblay and Tremblay 2005). At the beginning of the twenty-first century, the microbreweries accounted for approximately 5 to 7 percent of the total US beer market (Stack 2003 and Duffy 2010).

Although this process started first in the US, similar developments can now be observed in many traditional beer consuming countries. While the share of the 'microbreweries' in the total global beer production is still relatively small, these breweries have influenced the beer markets significantly and in various ways. In countries like Belgium, beer brewing in (collaboration with) monasteries and abbeys has known a remarkable revival. Abbey beers are the fastest growing segment of the Belgian beer market (Persyn et al. 2011), but only a few of these abbey beers – mainly the very popular 'Trappist' beers – are nowadays still produced in monasteries. The other abbey beers are either based on old recipes from monasteries or they represent an attempt to brew 'abbey-style' beers in commercial breweries. The latter reflects an important strategy of the larger brewing companies. In recent years, many large beer brewers have tried to 'copy' the taste of the 'microbrews' or have bought (shares in) microbreweries or abbey-type beers (Stack 2003).

Finally, we would like to end this historical review with a reference. It is interesting to refer to Tremblay and Tremblay's (2011) observation that today the largest US owned brewery is the Boston Brewing Company, which started only a few years ago as a 'microbrewery'. This is a consequence of the simultaneous process of consolidation and global mergers and acquisitions of traditional (lager and light beer) brewers - which has caused all the large US breweries to be acquired or be majority owned by foreign brewing companies - and the growth of microbreweries. This is a powerful illustration of the dramatic changes that have taken place in the global beer markets during the twentieth century and which are ongoing in the twenty-first century.

[16] The term 'microbrewery' can have different meanings. Originally, the term – that already existed in the UK in the late 1970s – was used to describe the *size* of the breweries producing these older types of beer, i.e. breweries with a beer production of between 5,000 to 100,000 barrels a year. Very quickly, however, the term was used to denote a new and 'fresh' approach to brewing, in that instead of competing on the basis of low prices and advertising, the 'microbreweries' tried to compete on the basis of the inherent *product characteristics* that led to a greater quality and diversity of the 'end beer product', i.e. the taste, the added flavours, the freshness of the used ingredients, etc. When this kind of 'microbrewing' became more popular in the USA as well, the term was used for American breweries that adopted the above described 'brewing philosophy' and that produced fewer than 15,000 barrels of beer a year (Stack 2003).

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Table 1

The Largest Beer Producers by Continent (1820-2000), in billion liters

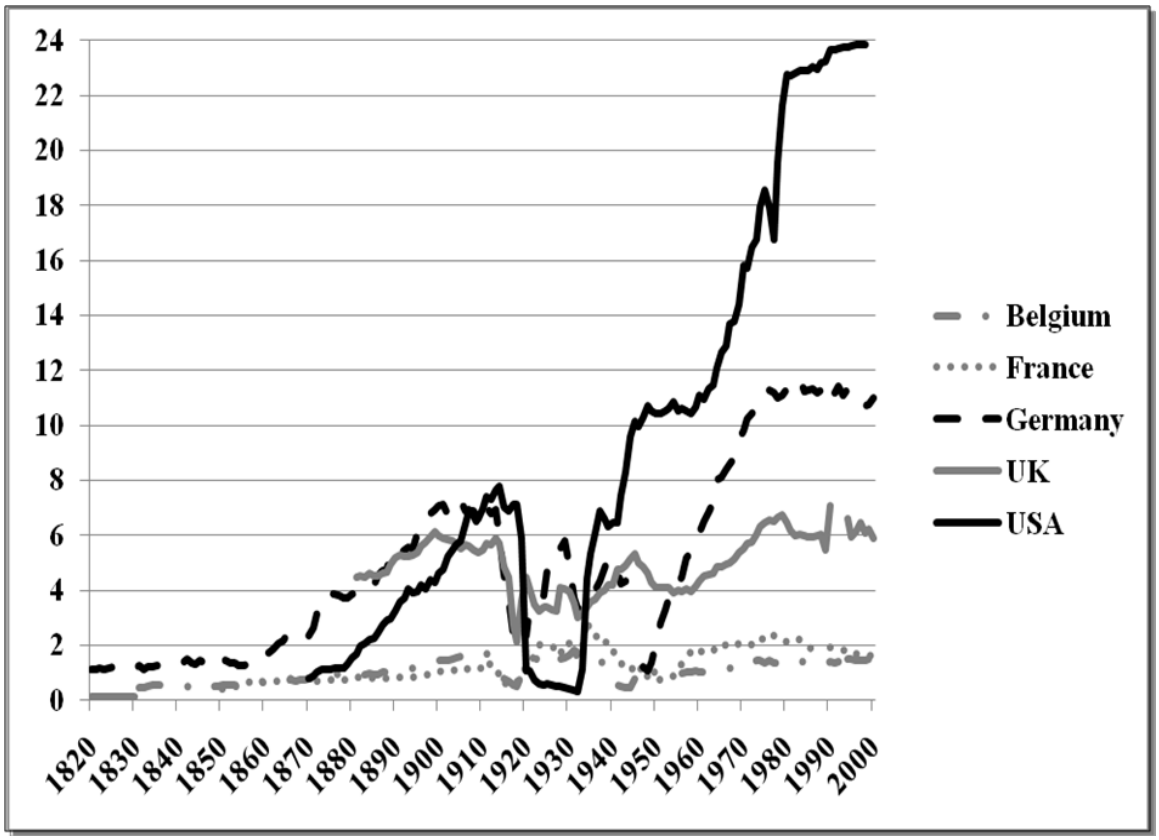
	1820	1840	1860	1880	1900	1920	1940	1960	1980	2000
Europe										
Belgium		0.531	0.656	0.924	1.462	1.041	1.023	1.011	1.429	1.551
France		0.424	0.657	0.823	1.071	1.155	1.815	1.726	2.129	1.599
Germany	1.110	1.310	1.700	3.850	7.086	2.344	4.872	6.075	11.320	10.988
UK	0.116			4.496	6.001	4.485	4.173	4.337	6.483	5.891
Czecho-Slovakia						0.589	0.599	1.409	2.339	1.780
Netherlands							0.176	0.355	1.568	2.496
Poland							0.150	0.673	1.116	2.523
Russia					0.587		1.213	2.498	6.133	5.156
America										
USA				1.561	4.635	1.080	6.441	11.094	22.777	
Canada					0.124	0.161	0.359	1.149	2.266	2.452
Mexico							0.179	0.853	2.688	5.985
Argentina							0.148	0.243	0.228	1.269
Brazil						0.082	0.206		2.782	6.695
Colombia							0.078	0.643	1.287	
Africa										
South Africa						0.032	0.066	0.097	1.144	
Nigeria								0.022	0.399	
Asia										
China									0.688	
Japan					0.015	0.122	0.311	0.929	4.559	5.464
South Korea								0.018	0.579	1.654
Thailand								0.008	0.124	1.165
Oceania										
Australia					0.200	0.325	0.427	1.053	2.023	1.768
New Zealand					0.031	0.071	0.083	0.245	0.378	0.298

For the period until 1830, the data for the UK refers to Great Britain only. From 1880 onwards, the data refers to the United Kingdom of Great Britain and Northern Ireland (UK). Alsace-Lorraine is included in Germany rather than France from 1871 to 1917, though it is not included in the French statistics until 1922. For the period 1945-1989, the figures of West Germany and East Germany were added together. With regard to Russia, figures until 1913 apply to the Russian Empire. For the period 1913-1939, they apply to the USSR territory of 1923. In 1940, they include territories incorporated in 1939-40. After 1990, they apply to the present territory of Russia. For Czecho-slovakia (which came into existence from 1918), the figures for the period 1938-44 are for the Czech lands only. From 1993 onwards, they refer to the Czech Republic.

Source: Mitchell, B.R. (2007a), table D23, 506-12; Mitchell, B.R. (2007b), table D26, 602-610 and Mitchell, B.R. (2007c), table D21, 415-421.

Figure 1

Beer Production in the Nineteenth & Twentieth Centuries in Europe (Belgium, France, Germany and the United Kingdom) and the USA (1820-2000), in billion liters



For the period until 1830, the data for the UK refers to Great Britain only. From 1880 onwards, the data refers to the United Kingdom of Great Britain and Northern Ireland (UK). For the period 1945-1989, the figures of West Germany and East Germany were added together.

Source: Mitchell, B.R. (2007b), table D26, 602-10 and Mitchell, B.R. (2007c), table D21, 415-21.

Table 2

The Number of Breweries and the Average Brewery Size in Belgium, in the UK and in the USA (1900-1980)

	Belgium		UK		USA	
	Number of Breweries	Average brewery size (x million liters)	Number of Breweries	Average brewery size (x million liters)	Number of Breweries	Average brewery size (x million liters)
1900	3223	0.454	6447	0.901	1816	2.556
1910	3349	0.478	4398	1.310	1568	4.466
1914	\	\	3746	1.540	\	\
1915	\	\	\	\	1345	5.224
1920	2013	0.517	2914	1.966	Prohibition	Prohibition
1930	1546	1.078	1418	2.850	Prohibition	Prohibition
1934	1362	1.081	\	\	756	5.859
1940	1120	0.914	840	4.898	684	9.430
1946	755	1.431	\	\	468	21.741
1950	663	1.529	567	7.437	407	25.634
1960	414	2.442	358	11.613	229	48.488
1965	305	3.637	\	\	197	64.408
1968	256	4.646	220	22.424	\	\
1970	232	5.610	\	\	154	102.769
1973	190	7.732	162	35.119	\	\
1975	174	7.929	\	\	117	158.565
1977	159	8.691	144	44.488	\	\
1980	123	11.619	142	48.108	101	219.154

The average brewery size was measured in million liters for Belgium, in UK barrels for the UK and in USA barrels for the USA. We calculated all figures into million liters taking 1 UK barrel = 36 imperial gallons (43 US gallons) and 1 US barrel = 31 US gallons (26 imperial gallons). 1 UK gallon = 4,55 liters and 1 US gallon = 3,79 liters. (The Finnish Foundation for Alcohol Studies 1977: 33).

\ = no data available

Source: Calculated from: Hornsey (2003), 618; Patroons (1979), 18; "History of Beer", The Belgian tourist office: Wallonia and Brussels; Union of Belgian Brewers; Stack (2000), 449 and Stack (2003).