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Abstract

For millennia alcoholic drinks have played an important role in food security and health (both positive and negative), but consumption patterns of beer, wine and spirits have altered substantially over the past two centuries. So too have their production technologies and industrial organization. Globalization and economic growth have contributed to considerable convergence in national alcohol consumption patterns. The industrial revolution contributed to excess consumption by stimulating demand and lowering the cost of alcohol. It also led to concentration in some alcohol industries, especially brewing. In recent years the emergence of craft producers has countered firm concentration and the homogenization of alcoholic beverages. Meanwhile, governments have intervened extensively in alcohol markets to reduce excessive consumption, raise taxes, protect domestic industries and/or ensure competition. These regulations have contributed to, and been affected by, evolving patterns of consumption and changing structures of alcohol industries.

Keywords: Globalization of preferences; Convergence of national beverage consumption mix; Alcohol and health; Restrictions on alcohol consumption and production; Beverage firm concentration

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INTRODUCTION

Throughout history, alcoholic drinks have played an important role in food security and health (both positive and negative), have been major sources of tax revenue for local and national governments, and in some countries have been a major export item and thus subject to changes in foreign and trade policies. Beverage consumption patterns have altered very substantially during the first and latest globalization waves though, as have production technologies and the industrial organization of beverage firms. Taxes and myriad other regulations have contributed to, and been affected by, those evolving patterns of consumption and production and firm concentration of alcohol industries. The present review surveys available evidence on and explanations for those developments and interactions.

This topic is of interest both as a set of industry cases studies of globalization and as a potential contribution to policy dialogues on the social and health consequences of alcohol consumption.

The paper begins with a brief history of beverage consumption prior to the 19th century globalization wave. It summarizes evidence on the evolving patterns of national alcohol consumption across the world since then, focusing on both aggregate volumes and their mix. Regulations affecting national alcoholic beverage consumption (and related production and international trade in beverages) are surveyed. Changes in the industrial organization of production for the three main alcohol groups (beer, wine, and spirits) are then reported. The final section summarizes what we know about the interactions between these markets and their regulation, and suggests where subsequent economic research should be focused to further improve our understanding of the contribution of these markets and associated policies and institutions to global welfare.

BRIEF HISTORY OF ALCOHOL

Evidence of beer and wine production several thousands of years ago have been found in distant places across the globe. Biomolecular archaeological evidence suggests wine was produced at least 8000 years ago in central Georgia (McGovern et al., 2017). There are indications that “beer” was produced and consumed more than 7000 years ago in China, North Africa and much of Europe—although the definition of “beer” included many types of brews (Nelson, 2005; McGovern, 2009).

The cultivation of *vinífera* vines and the making of grape wine gradually spread from the Caucasus region west to the Levant, Egypt and Greece by 2,500 BCE. The Etruscans began vine cultivation in central Italy using native varieties in the 8th century BCE, which is also when the Greek colonists began to take cuttings to southern Italy and Sicily. Viticulture was introduced to southern France by the Romans around 600 BCE, and was spread north in the 2nd and 1st centuries BCE. Initially these regions were mostly consumers of wine imported from Greece or Rome.¹ However, the settling armies soon started planting vineyards, and production spread in Southern Europe. It took only until the 4th century AD for winegrapes to be well established in all areas of Europe suited to its cultivation, and in North Africa (Nelson, 2005).

The Greeks and the Romans drank wine, and only wine. They despised beer, whose drinkers they considered barbarians (Rabin and Forget, 1998). Despite that, the cooler areas of northern Europe, under German rule, held out against the influence of wine (Poelmans and Swinnen, 2011).

¹ There is evidence that the Greeks exported wine to southern France, particularly via Massala (Marseille), from around 650 BCE, and that there was some local production around Massala at that time. However, for hundreds of years after that, wine was still a luxury item in Southern Gaul (today’s France) and only consumed by the upper classes. According to Diodorus of Sicily, the price of wine was high: Gauls would exchange a slave for one jar of Italian wine (Nelson, 2005, p. 49).

Distilled spirits are fermented liquids whose alcohol has been increased by distillation. The process involves heating the liquid to a temperature between 79°C (at which alcohol boils) and 99°C (after which water boils) and then cooling the vapour which will then contain less water. The Chinese have distilled a beverage from rice beer since at least 800 BCE. Other regions making early use of this method include the East Indies, where arrack was made from sugarcane and rice, and Arab countries, using wine. Britain made spirits before the Roman conquest, as did people in other parts of Western Europe, but production was limited until the 8th century when contact with Arabs increased. Initially spirits were used almost uniquely for medical purposes. Spirits based on starchy grains began to expand probably in the Middle Ages, and from the 15th and 16th centuries distillation was increasingly used to produce not only whiskey, gin, and vodka from grains or potatoes but also brandy from grapes and rum from sugar. Certainly by the 17th century the production of spirits was sufficiently widespread as to attract government regulators. That was when the Dutch industrialized and commercialized brandy production and used it to lubricate its ever-enlarging fleet. Spirits were considered ideal for long ocean voyages because their high alcohol content meant they took up little space, kept perfectly, and were saleable at the destination (Johnson, 1989, Ch. 17).

The inter-continental spread of beer, wine and spirits consumption accompanied European conquests across the world. Trade costs and spoilage were proportionately lowest for higher-alcohol spirits, so beer and wine consumption in the settler economies of the New World had to wait until local production was commercialized.

Meanwhile, the industrial revolution got under way, first in Britain from the late 1700s and then in neighboring European countries. That totally transformed the making of consistent-quality beer and spirits, reduced their real prices, and contributed to both widespread alcoholism and a dramatic consolidation of producers in the brewing and distilling

industries. It also led to the invention of new non-alcoholic drinks late in the 18th century, in particular carbonated drinks. By the 1830s there were 10 soft drink manufacturers in Britain, and more than 50 by the 1840s.² These factors had a major impact on subsequent developments in alcohol consumption and production, and on associated technologies and regulations, which we now consider in turn.

CONSUMPTION PATTERNS

Alcohol consumption patterns have changed substantially over the past two centuries, and are converging across countries with increasing globalization and associated interactions between cultures. At the same time, overall alcohol consumption has been affected by per capita income growth, the availability of alternatives, increased health concerns, and government regulations.

Several studies have analyzed these patterns, but most focus on a specific region or group of (high-income) countries and/or specific types of alcohol. For example, Smith and Solgaard (2000) explore alcohol consumption trends in European countries from 1960 to 2000. Bentzen, Eriksson and Smith (2001) study alcohol consumption convergence in a number of European countries. Aizenman and Brooks (2008) study convergence during 1963 to 2000 across a larger sample of OECD and middle-income countries, but only for beer and wine. Colen and Swinnen (2016) analyze mainly beer consumption across a large sample of high-income and developing countries.

The most comprehensive study is by Holmes and Anderson (2017a,b) which covers all countries of the world since 1961 and key high-income countries since 1888. They look at aggregate consumption per capita of each of the three key beverages globally and nationally,

² Schweppes was the first, founded in Geneva in 1783 and relocated to London in 1792. Coca-Cola and Pepsi-Cola were not born until 100 years later, in the hot humid US states of Georgia and North Carolina, respectively.

and differences between volume and expenditure (value). They also account for unrecorded alcohol consumption, and compare alcohol with soft drink spending.

Determinants of alcohol consumption: some conceptual issues

Several factors affect alcohol consumption patterns. Key determinants are trade costs, government taxes and regulations, consumer preferences, incomes, and the availability and cost of non-alcoholic beverages and other stimulants.

The costs of trading beverages across large distances were substantial in earlier times when transport infrastructure was less developed. This means countries in the past tended to concentrate their consumption on those alcoholic beverages that can be produced at lowest cost locally. Hence the dominance of spirits in cold countries, beer where malting barley can be easily grown, and wine in countries in the 30° to 50° latitude range near maritime weather influences. Trade costs have declined greatly over the past 50 years, contributing to the price reduction and increase in consumption of imported alcoholic beverages. Cultural exchanges with increased travel and information transmission through global marketing campaigns and social media have been additional forces. The latter especially affect young people so that shifts in alcohol consumption have important demographic features (Deconinck and Swinnen, 2015).

Excise and import taxes on beverages vary greatly across countries, and across beverage types too (Anderson 2010, 2014). In some cases those consumer tax differences are to protect local producers, thereby reinforcing climate-induced differences in the consumption mix. Generic value-added taxes as well as a variety of regulations that affect availability of alcoholic beverages also vary across countries (see next section).

As well, temperance movements and religious groups have had different effects on the social acceptability of alcohol consumption at different times in various places (see, for

example, Eddy, 1887; Wilson, 1940; Briggs, 1985; Pinney, 1989, 2005; and Phillips, 2014). So too have personal concerns about human health: as per capita incomes rise, people can afford to spend more on alcohol consumption, but they also choose to limit its volume for health reasons (in some cases, switching to soft drinks including bottled water); and some people are also substituting towards (especially still red) wine because of its perceived positive influence on health when drunk in moderation.

The degree of substitutability between alcoholic and soft drink consumption also may vary across countries because of differences in costs and availability of non-alcoholic drinks and other stimulants. For example, retail prices of soft drinks vary greatly between countries³ and so too does the availability of low-cost reticulated potable water. Also influential are the availability and prices of (legal or illegal) recreational drugs (Clements et al., 2010). These facts suggest further reasons to expect differences across countries in alcohol consumption.

Given all these possible influences on beverage consumption patterns, it would not be surprising if convergence in those patterns was not evident in the data, notwithstanding Stigler and Becker (1977).

Alcohol consumption and income

When total alcohol consumption per capita is plotted against real income per capita, for countries spanning the world from 1961 to 2014, the data suggest the volume of consumption first tends to rise with per capita incomes but then fall (Figure 1). The peak consumption occurs at a real per capita income (in 1990 International Geary-Khamis dollars) of \$16,900 in

³ Soft drink prices range from an average for 2013-15 of 70 US cents per litre in Africa and the Middle East to 260 cents in Australasia (Euromonitor International, 2016).

the case of all alcohol. That is just slightly above what the average per capita income of Western Europe was in 1990.⁴

[Insert Figure 1 here]

Data on alcohol consumption suggest it has nearly trebled globally over the past half century (Anderson, Nelgen and Pinilla, 2017, Table 151). However, those standard data refer only to what has been recorded by national governments, and so overstate the rise because not all alcohol consumption is recorded: the poorer a country, the larger tends to be the share of alcohol consumption that is unrecorded. WHO (2015) reports survey estimates of the volume of unrecorded alcohol consumption in 98 countries for 2000, 2005 and 2010. When these are added to recorded alcohol consumption, an inverted U-shaped curve still exists, although it is somewhat flatter than that for just recorded consumption (Figure 2).

[Insert Figure 2 here]

If consumers switch from quantity to quality of consumption as their incomes rise, the inverted U-shaped curve would be flatter for alcohol expenditure. Holmes and Anderson (2017b) indeed find that expenditures on alcohol rise with income at low income levels (as with volume), but do not decline with income growth at higher income levels (Figure 3).

[Insert Figure 3 here]

When alcohol expenditure data are disaggregated into the three key beverage types, they reveal that while both wine and beer expenditures rise with aggregate expenditure, spending on spirits peaks at an aggregate national expenditure level of \$27,800 per capita (in 2015 US dollars) and declines thereafter (Holmes and Anderson, 2017b).

Alcoholic versus non-alcoholic beverages

⁴ Longer time series data for 17 high-income countries back to 1888 adds support to the inverted-U finding from Figure 1 (see Holmes and Anderson, 2017a,b).

As of 2010-14, alcohol made up nearly two-thirds of the world's recorded expenditure on beverages, the rest being bottled water (8%), carbonated soft drinks (15%), and other soft drinks such as fruit juices (13%). Those beverage shares vary across regions though (Table 1).

[Insert Table 1 here]

Globally, during 2001 to 2015 the world's volume of alcohol consumption increased by one-quarter while that of non-alcoholic beverages rose by two-thirds. However, global retail expenditure (including taxes) on those two product groups rose by similar current US dollar amounts: 81% for alcoholic and 90% for non-alcoholic beverages (Euromonitor International 2016; Holmes and Anderson, 2017a). Assuming there is more scope to upgrade the quality of alcoholic beverages than there is for soft drinks, that difference between the volume and value increases for alcohol consumption is not inconsistent with the above finding that the volume of alcohol consumption traces a much more-pronounced inverted U-shape as total expenditure rises than does the value of alcohol consumption.

Trends in the mix of wine, beer and spirits consumption

The global mix of recorded alcohol consumption has changed dramatically over the past half century: wine's share of the volume of global alcohol consumption has fallen from 34% to 13% since the early 1960s, while beer's has risen from 28% to 36% and the spirits' share has gone from 38% to 51%. In litres of alcohol per capita, global consumption of wine has halved while that of beer and spirits has increased by 50% (Anderson, Nelgen and Pinilla, 2017).

Several studies find a convergence in the consumption mix of alcoholic beverages. Smith and Solgaard (2000) and Bentzen, Eriksson and Smith (2001) found that in Europe the market shares for traditional beverages declined. In the Nordic countries, for example, the traditional dominance of spirits diminished as beer and wine shares grew. Colen and Swinnen

(2016) also find that in many traditional beer- (wine-) drinking countries, the share of beer (wine) in total alcohol consumption is declining and that of wine (beer) is increasing.

To study convergence across all countries and all alcohols, Holmes and Anderson (2017) define a consumption intensity index for country i as its fraction of beer, wine, or spirits consumption in total national alcohol consumption volume or value divided by the fraction of that same beverage in world total alcohol consumption. The indices in Table 2 reveal that, as of 2010-14, there remain very wide differences across the regions of the world in their mix of alcoholic beverages consumed.

[Insert Table 2 here]

Nonetheless, there has been significant convergence, although convergence differs among regions and products. Figure 4 illustrates convergence for 3 different groups based on their traditional consumption patterns: according to which beverage had the highest volume share in 1961-64, Holmes and Anderson (2017b) classify 19 countries as wine-focused, 17 as beer-focused and 17 as spirits-focused. On average, there is (a) no convergence in wine-focused countries; (b) convergence in the beer-focused countries not in spirits but in terms of beer and wine consumption (the intensity indices converge from 2.0 (beer) and 0.35 (wine) in the 1960s to around 1.3 for both now); (c) convergence in the spirits-focused countries not in wine but in terms of spirits and beer (intensity indices converge from 2.2 (spirits) and 0.6 (beer) in the 1960s to between 1.3 and 0.9 now). These volume indexes suggest there are still major differences in consumption patterns despite the convergence that has occurred in some regions for some beverages.

[Insert Figure 4 here]

Holmes and Anderson (2017b) also analyze value-based indexes to account for the fact that tax-inclusive retail prices of alcoholic beverages vary enormously across regions (Table 2). For the period 2013-15, all three value intensity indexes are closer to unity than are

their volume indexes for three of the regions (Western Europe, Eastern Europe and North America); two of the three value indexes are closer to unity than are their volume indexes for two regions (Australasia and Africa/Middle East); and for the other two regions, one of the three value indexes is closer to unity than their volume indexes. This comparison suggests that part of the reason for the cross-country variation in volume intensity indexes has to do with the variation in national average retail beverage prices. That in turn is partly due to wide differences in consumer taxation of the various beverages (Anderson 2010, 2014).

ALCOHOL REGULATIONS

Alcoholic products have been subject to many government regulations, and for myriad reasons. Stated—and often conflicting—objectives include: to enhance government revenues through taxes, to protect consumer health, to lower health costs, to reduce violence from alcohol abuse, to raise producer product prices, to reduce the price of producers' inputs (grains), and to constrain market power of producers.

We consider four types of regulations in this review: health regulations, taxes and subsidies, quality and input regulations, and competition regulations.

Individual and social health regulations

“We are fighting Germany, Austria, and Drink, and as far as I can see, the greatest of these three deadly foes is Drink”

British prime minister, David Lloyd George, 1915⁵

In early history, wine and beer consumption were mostly positively perceived from health and food security perspectives. Both wine and beer were safe to drink in moderation, because

⁵ Quoted in Hornsey (2003, p. 581).

fermentation kills harmful bacteria. Where available at affordable prices, they were attractive substitutes for water in those settings in which people's access to potable water had deteriorated.⁶ Beer also was a source of calories. For both reasons beer was used to pay workers for their labor from Egyptian times to the middle ages. Wine too was part of some workers' remuneration, and was included in army rations of some countries right up to World War II. As well, spirits such as rum and brandy were a standard part of the diet for those in European navies from the 15th century.

Most cultures and religions in ancient civilizations had alcohol deities. Examples are Osiris (Egyptian god of beer and wine), Dionysus/Bacchus (Greek and then Roman god of wine) or Tezcatzoncatli (the Aztec god of *pulque*, alcoholic beverage made from the agave plant in Central America). For the Catholic Church wine embodied a very strong symbol (the blood of Jesus Christ in communion) and wine was also integral to Jesus's first miracle, in which he turned water into wine at the wedding at Cana (Dion, 1959; Johnson, 1989; Unwin, 1991; Kreglinger 2016). The Catholic Church often instigated winegrowing in New World countries, beginning in Latin America in the 16th century. At its beginning in the 1830s, even the Church of Jesus Christ of Latter-day Saints (Mormons) owned vineyards and used wine in their communion services, switching to water only in 1912 (Phillips, 2014, p. 213).

In many societies, alcohol consumption was seen also as an aid to medicine. Hippocrates, the ancient Greek father of medicine, claimed that wine was a cure for a number of diseases (Hassan, 1998; Hippocrates, 460–377 BCE; Phillips, 2014). It was prescribed as a medicine by doctors and in hospitals until the 19th century (when drug therapy was introduced).⁷ The welfare-enhancing use of wine was boosted after Pasteur's discoveries of

⁶ Potable water became available only from the 19th century, with the introduction of major public water projects and hydraulic engineering (Phillips, 2014).

⁷ Until the mid-19th century, only "natural remedies" such as plants, herbs, roots, and alcohol were used to relieve people's illnesses. This changed from 1869, when the first synthetic drug, chloral hydrate, was discovered (Jones, 2011).

yeast in the 1860s and the introduction of advanced refrigeration systems to control temperature during fermentation and prevent wine spoilage (Bohling, 2012; Meloni and Swinnen, 2014).

As for dealing with welfare-reducing aspects of excessive alcohol consumption, the first major call to ban alcoholic drink came from the Prophet Muhammad (c.570–632 CE), founder of Islam.⁸ This led to the first comprehensive prohibition policy that banned the production, distribution, and consumption of alcohol (Phillips, 2014, p. 59). It is also the longest lasting prohibition, as 1,500 years later it is still in place in many countries with a Muslim majority.

Other major regulations to reduce alcohol consumption came only several centuries later. The arrival of distilled spirits changed the general perception of alcohol and led to the introduction of a variety of regulations to limit the consumption of hard liquor in particular, and alcohol more generally. In many cases these regulations were a combination of taxes and restrictions on the sales of alcohol. From the mid-15th century onwards, the Russian tsars imposed a state monopoly on sales of vodka (Pokhlebkin, 1992). Around the same time, many German towns introduced regulations on where one could drink (citizens could not drink their brandy on the spot) and when (brandy sales were banned on feast days and during church services) (Forbes, 1956, p. 144; Unwin, 1991, p. 235). They also imposed taxes on spirits, and were soon followed by the Dutch, the English (1643) and the Scots (1644). In France too, brandy was portrayed as a “bad beverage” (in contrast to “healthy” wine). In 1677 brandy sellers were forced to close their shops after 4 pm (Phillips, 2014, p. 107).

⁸ Four verses in the Quran refer to wine but there is consensus that the fourth verse enforces the alcohol prohibition: “*Believers, wine and games of chance, idols and divining arrows, are abominations devised by Satan. Avoid them, so that you may prosper. Satan seeks to stir up enmity and hatred among you by means of wine and gambling, and to keep you from the remembrance of Allah and from your prayers. Will you not abstain from them?*” (Sura 5, verse 90 In: Unwin, 1991, p.150).

Two major developments reinforced restrictions and regulations on alcohol use. The first was the industrial revolution which (a) lowered the production cost and hence price of spirits, and (b) created a class of industrial workers who became large consumers of spirits. Alcoholic drinks became more-readily available, stronger and cheaper. Consumption therefore grew—as did problems of abuse, especially in the industrializing regions (Gately, 2008; Phillips, 2014).

Britain, the most industrialized country, was the first to introduce a comprehensive anti-alcohol policy during the mid-18th century. Following the “Gin Craze” period early that century, when the consumption of spirits increased massively, the British government implemented the so-called “Gin Acts” (in 1736 and 1751) to reduce spirits consumption by taxing retail sales and requiring sellers to be licensed (Nicholls, 2009).

The second development was the growing availability of non-alcoholic safe drinks. Imports of tea, coffee and cocoa were growing and, by the 1750s, were widely drunk in Western Europe and the United States (Grigg, 2002; Wickizer, 1951). Then scientific discoveries during the industrial revolution led to the invention of carbonated soft drinks.

The combination of these factors increased the demand by various groups for much wider restrictions on alcohol consumption, since alcoholic drinks were no longer needed for safe drinking and since the social and personal costs of excessive alcohol use had become much clearer. This translated into the ‘temperance movement’, which led to various restrictions on alcohol use.⁹ That included total prohibitions in some countries, for example Russia from 1914 to 1933, the United States from 1920 to 1933,¹⁰ and in various periods in Mexico, Canada, Finland, Norway and India.

⁹ In some cases restrictions prohibited certain types of alcoholic beverages (in 1916 Norway banned spirits and beer; in 1919 Finland banned all beverages with an alcohol level higher than 2%, and in 1918 Belgium banned distilled spirits) while in other cases individual purchases of alcohol were limited; or alcohol sales were controlled by state monopolies (Phillips, 2014).

¹⁰ For an analysis of the political and economic factors driving the introduction and the repeal of Prohibition in the USA, see Malone and Stack (2017), Poelmans *et al.* (2018) and Okrent (2010).

More recently, attempts have been made to estimate the social costs of excessive alcohol consumption, including as a risk factor for chronic disease and injury. Rehm *et al.* (2009), for example, quantify the burden of mortality and disease attributable to alcohol, both globally and for ten large countries. An estimated 3.8% of all global deaths and 4.6% of global disability-adjusted life-years are attributable to alcohol. These costs amount to more than 1% of gross national product in high- and middle-income countries, with the costs of social harm constituting a major proportion in addition to health costs.

Current alcohol regulations¹¹ include restrictions on drinking age, advertising, drink-driving, and pub/liquor store opening hours (see Table 3).¹² Most governments have restricted the density of outlets and opening hours of retailers selling alcohol. Canada, Finland, Norway and Sweden have alcohol state monopolies, while Germany, Italy, Spain and others have restrictions on places and hours of sale (Butler *et al.*, 2017; Karlsson and Österberg, 2007). Other countries regulate the hours during which alcohol can be sold.¹³ Most countries have a minimum age for alcohol purchase and consumption. In 115 countries, the age is 18 years (WHO, 2014).¹⁴

[Insert Table 3 here]

¹¹ Several studies have developed comparative scales against which to rank national policies (see, e.g., Karlsson and Österberg, 2007; Babor *et al.*, 2010, pp. 243–8; Giesbrecht *et al.*, 2013; Lehto, 1997; Nelson *et al.*, 2013; Naimi *et al.*, 2014). Other studies look at the relationship between restrictive policies and the level of consumption (Allamani *et al.*, 2014; Eisenbach-Stangl, 2011; Erickson *et al.*, 2014; Karlsson *et al.*, 2012).

¹² The World Health Organization (WHO) uses seven categories: (a) regulating the marketing of alcoholic beverages (in particular to younger people); (b) regulating and restricting availability of alcohol; (c) enacting appropriate drink-driving policies; (d) reducing demand through taxation and pricing mechanisms; (e) raising awareness of public health problems caused by harmful use of alcohol and ensuring support for effective alcohol policies; (f) providing accessible and affordable treatment for people with alcohol-use disorders; (g) and implementing in health services screening and brief interventions programs for hazardous and harmful drinking (WHO, 2014).

¹³ For instance, in Peru there is a local ban in Lima on the sale of alcohol during the week from Sundays to Wednesdays after midnight and from Thursdays to Sundays after 3 am (WHO, 2014, p. 71).

¹⁴ In the United States, the National Minimum Drinking Age Act of 1984 required states to raise their minimum drinking age to 21 years (Phillips, 2014, p. 305).

The increase in automobile ownership in the 20th century induced regulations to reduce the drink-driving problem. Most countries have blood-alcohol concentration limits between 0.05% and 0.08% (Figure 5); others such as Brazil, Norway, Russia and Sweden have a zero-tolerance regime (Burns, 2013; Room et al., 2005).

[Insert Figure 5 here]

Restrictions on alcohol advertising range from no restrictions to total bans, across all media types. Of the 158 WHO Member States that reported on this in 2012, almost 40% (66 countries) had implemented at least a partial ban on product placement of beer advertisements on television (WHO, 2014, pp. 77–78).

Taxes and subsidies

Alcoholic beverages have been a major source of government revenue through most of history. Unger (2001) documents how in the Middle Ages and Renaissance, many towns in Western Europe's main source of tax revenue was beer taxes, making up to 80% of their tax revenue.¹⁵ Nye (2007) argues that much of the British Royal Navy—and thus the growth of the British Empire—was financed by porter industry taxes, which were able to be sustained because of high tariffs on import-competing wine (see Ludington, 2013, 2018). Deconinck et al. (2016) show that during the 80-year war between Dutch cities and the Spanish Empire in the 16th and 17th centuries (which lead to the separation of the Netherlands) the military

¹⁵ Tax policy also restricted the use of hops, the most important innovation in brewing that would ultimately transform the entire global beer economy. Its use spread only slowly over the beer-producing regions in Europe for several centuries before its use was widely accepted. The main reason for the slow diffusion of this innovation was its impact on the local tax base. Before hops were used, breweries were subjected to a so-called 'Grutrecht' or 'flavoring license' in many regions. This Grutrecht was named after the 'grut', a combination of herbs that were used to flavor beer (or to 'disguise faults' in the brew) and to preserve the beer. The 'Grutrecht' was determined by the local authorities and was used to tax breweries. All brewers were obliged to buy grut from the local rulers. To avoid tax evasion, the exact composition of grut was kept a secret (Mosher, 2009). The innovation of hops threatened local rulers' revenue from the Grutrecht tax. Therefore, in many regions, including Britain and Holland, the use of hops was prohibited for a long time (Unger, 2004). It took several centuries and a reform of the tax system before the use of hops became commonplace in some European regions.

expenditures of the Dutch were largely financed by taxes on beer. Nor was it just the Protestants who used beer taxes to finance wars. Catholic Bavarian King Maximilian I used his monopoly on weissbier production and sales to finance the Catholic Counter-reformation and its army to support the attacks on Protestant forces (Swinnen and Briski, 2017).

The first revenue law introduced by the United States Congress was a liquor excise tax in order to finance the debt it had incurred during the American War of Independence in 1775–83 (Hu, 1950; National Research Council US Panel, 1981). Until Prohibition (in 1920), alcohol tax revenues represented up to 80% of all federal internal tax collections in the United States (National Research Council, 1981).

With the spread of spirits and growing alcohol abuse, taxation of alcohol served the dual purpose of raising government revenue and reducing consumption (see previous section). However, taxes have been used also to protect domestic industries from foreign competition. For example, in the late 19th and early 20th centuries, French import taxes protected domestic markets from imports of wine and raisins. That strongly affected not only trade in wine throughout the Mediterranean region (which at that point accounted for roughly 80% of global wine trade), by also whole economies of the exporting countries of Spain, Italy and Greece (Meloni and Swinnen, 2016a, 2017; Pinilla and Ayuda, 2002). Likewise, wine import tariffs were used as a form of protection for vigneron in New World countries such as Argentina, Australia, Chile and New Zealand (Anderson and Pinilla 2018, Chs. 11–13).

Given the wide range of objectives that government policies seek to achieve and the large number of interventions adopted, it is a hazardous exercise to estimate an optimal set of taxes on national alcohol consumption. Attempts have been made (e.g., Kenkel, 1996), but all such studies conclude that the optimal tax rates depend heavily on the other policy

interventions by the government and on behavioural responses of consumers to those and alternative interventions.

Quality and input regulations

Quality concerns and asymmetric information on alcohol have existed as long as products have been produced and traded. The addition of water in wine, the use of cheap starches to produce beer, and home production of cheap spirits have been documented throughout history and across the globe. Authorities and producer organizations have tried to limit these problems through regulations (Swinnen, 2016, 2017).¹⁶ Regulations that refer to “quality” often relate to certain inputs that can(not) be used.

Over time, regulations have increased both geographically and in addressing new concerns. A crucial aspect of such regulations is that they may enhance aggregate welfare, e.g. by protecting consumers from inferior (or unhealthy) products; but they can also be used to protect vested interests of producer groups at the expense of consumers. Alcohol regulations have done both.

In the case of beer standards, the German *Reinheitsgebot* is arguably the oldest still-active food law in the world. It demonstrates how beer standards, protection and international integration interact. The *Reinheitsgebot*, or “Purity Law”, decreed that all beer be made from three ingredients: barley, water and hops (yeast was added later when it was discovered). It was signed into law by Duke Wilhelm IV for Munich in 1487 and for all of Bavaria in 1516. It is generally argued that the *Reinheitsgebot* served first as a consumer protection policy—to ensure quality and safety of beer (as brewers experimented with various additives)—and to protect consumers from rising bread prices if wheat was used for

¹⁶ The oldest written (literally, in stone) set of regulations come from Babylon, 2000 BCE, and the Code of Hammurabi, King of Babylon, states that “*If a wine-seller make the measure for drink smaller than the measure for corn, they shall ... drawn her in the water*” (Lyon, 1904; Vincent, 1904).

beer production. Later, however, brewers became the strongest lobby for it. Changes in the political constellations of Bavaria and Germany over the next five centuries were intertwined with discussions on the Reinheitsgebot because of the protection it provided to Bavarian and German brewers. After five centuries, the European Court of Justice (ECJ) ruled in 1987 that the Reinheitsgebot was a non-tariff barrier and ordered it to be removed – at least for foreign beers.¹⁷ The Reinheitsgebot transitioned to a private quality label as German breweries began advertising their adherence to the Reinheitsgebot on bottles.

Other input regulations in beer were introduced when grain was scarce. This was the case in the period 1915 to 1950, due to a combination of wars and economic declines. In both Europe and the US, food and feed shortages meant grains were expensive. The US government imposed grain rationing because of ‘war-time emergencies’, which induced the American brewers to brew beer with a lower alcohol content of 2.75% (Stack, 2003). Government regulations on inputs of brewing continued during the Great Depression and the Dust Bowl, effectively changing the American consumers’ tastes and preferences for lighter beer.

The case of wine standards is different in that several standards were introduced to protect producer interests from the beginning—although consumer benefits were often used to justify them. Most were introduced first in France, as a protectionist reaction to international trade; then with international integration they expanded to much of Europe. By the mid-19th century, France was the world’s leading producer and exporter of wine. However, a dramatic invasion of the vine disease *Phylloxera* destroyed many vineyards. French wine production fell by 70% between 1875 and 1889, and France became a net wine

¹⁷ After the 1987 ECJ ruling, imports of foreign beer increased from 1% of German beer consumption to around 3% a decade later and around 8% three decades later. These numbers confirm the protectionist nature of the Reinheitsgebot but also suggest that other forces are at work. Van Tongeren (2011) argues that taste and consumer perception probably also played a big role in the slow change.

importer. Imports came initially mostly from Spain and Italy (Pinilla and Ayuda, 2002), but later also from Algeria and Tunisia, France's North African colonies (Meloni and Swinnen, 2013, 2014, 2018).

When French vineyards recovered thanks to the use of resistant grape rootstocks from the US, wine prices fell as expanding French production competed with imports. Under pressure from French producers, the government introduced several regulations. In addition to import tariffs they included the following:

- Regulations explicitly linking the “quality” of the wine, its production location (the *terroir*) and the “traditional way” of producing wine: between 1905 and 1912, regulations formally established the boundaries of Bordeaux, Cognac, Armagnac and Champagne, called *Appellations* (Simpson, 2011).
- “Wine” could no longer be produced from imported grapes, effectively destroying the raisin exports from Greece to France and today defining “wine” in the EU (Meloni and Swinnen, 2017).
- Restrictions on grape varieties and production methods included the prohibition of hybrid vines. The official argument was safety, since hybrid-based wines were argued to be harmful for human consumption. Later, these standards were integrated in the *Appellations d'Origine Contrôlées* (AOC), which restricted production to specific regions and grape varieties, and imposed maximum vineyards yields, etc.
- Later regulations introduced minimum prices for wine producers, and planting rights were regulated (Deconinck and Swinnen, 2015; Gaeta and Corsinovi, 2014; Meloni and Swinnen, 2016b).

Many French wine regulations were integrated into the official EU wine policy. These regulations thus expanded to a vast wine-producing region. As was initially the case

in France, EU “wine” cannot be produced from imported grapes, hybrid vines are outlawed for “quality wines”, and vineyard planting is highly regulated.

EU winegrowers have been effectively subsidized through these regulations plus other support measures. It is difficult to estimate the extent of such assistance, but one recent attempt suggests in aggregate that they may have raised gross producer returns by as much as 20% (Anderson and Jensen, 2016).

Regulations to protect the quality of spirits also abound, again with a mix of producer and consumer interests being served (Blue 2004). The large number of distilled beverages and the wide range of regulations in many countries make it impossible to provide a summary of them here.

Competition regulations

Competition issues have been especially important in the brewery sector because of its growing concentration after WWII. Regulations have addressed both horizontal and vertical competition concerns.

In horizontal terms, the main issue is the increasingly dominant power of a few brewers with increasing consolidation of breweries in the 20th century, a process reinforced by global mergers and acquisitions in the 21st century (see next section). Both in the US and in the EU, competition authorities have intervened several times to control anti-competitive behavior of large-scale breweries and have forced divestitures with M&As (Elzinga and Swisher, 2011; Slade, 1998, 2011; Tremblay and Tremblay, 2005). Most recently, the take-over of SAB Miller by AB Inbev, the world’s two largest brewing multinationals, is inducing competition authorities worldwide to look into the competition implications for their local markets.

Vertical competition has often focused on vertical relationships, in particular “tied houses”.¹⁸ They have been an important feature of pubs in many countries.¹⁹ In the UK, two-thirds of pubs are tied to regional breweries and so-called “pub companies” or “pubcos” (real estate companies specializing in pubs, for which they also act as exclusive beer distributors, see Gottfried and Muir, 2011). It is estimated that around 60% of pubs in the Netherlands and Belgium have some form of contract (Pleijster et al., 2011; Van Passel and Wauters, 2009). As well, about 30% of Belgian pubs early this century had some form of exclusivity contract with one brewer, AB InBev (European Commission, 2002).

The tied house system has received much criticism as an institution of market power. In the United States, tied houses have been illegal since 1933. After the repeal of Prohibition, a “three-tier” system was introduced with a strict separation between production, distribution and retailing of alcohol (Adams, 2006).²⁰ In the U.K. in the 1980s, complaints led the Thatcher government to force a divestiture of tied houses by breweries, in the hope of improving the situation of formerly tied publicans. In retrospect, however, it has become clear that the divestiture was a failure. It has merely caused a shift from pub ties with breweries to ties with real estate companies (Slade, 1998, 2011).

Deconinck and Swinnen (2016) explain why tied houses are common and why they are charged high prices for their beer supplies. They do so with a model of rational agents who decide to join in a contractual arrangement, taking into account important transaction costs, credit market imperfections, moral hazard, and differences in risk aversion. The

¹⁸ Pubs with exclusivity contracts with breweries or drinks distributors are known as “tied houses”. Often, the building in which the pub is located is the property of the brewery or is being rented by the brewery from a third party on behalf of the publican. In other cases, the brewery has made financial or material investments in the pub, for example by giving loans or providing furniture. In return, publicans agree to exclusively buy products from that brewery.

¹⁹ See, for example, studies by Pleijster et al. (2011) on the Dutch market and a few studies on the UK market such as Gottfried and Muir (2011), by Slade (1998, 2011) on competition policy and the divestiture of brewer-owned pubs, and by Preece (2008) and his colleagues (Preece *et al.*, 1999) on public house retailing in the UK.

²⁰ Interestingly, the prohibition of links between brewers and pubs in the US created problems for craft brewers in recent years as brewpubs were not allowed (Malone and Lusk, 2016).

widespread prevalence of tied houses (and the growth of “pub companies” with the forced divestiture of pubs in the U.K.) is driven by credit constraints on the part of publicans.

INDUSTRIAL ORGANIZATION

The industrial organizations of the beer, wine and spirits industries differ substantially.²¹ The beer industry is the most consolidated, the wine industry least so: the top 5 brewing companies have a global market share of more than 50%, while this is only 8% in the wine industry. The spirits industry is in between with 22% (Table 4). We discuss each in turn.

[Insert Table 4]

Consolidation and a craft revolution in the brewing industry

There have been major changes in the industrial organization of the brewing industry, equal to some of the most radical structural transformations of any industry (Elzinga et al., 2018).

Throughout most of history, beer brewing was a household activity, often performed by women. Later, in the early middle ages, monasteries became the centres of brewing in Europe. This lasted until the discovery of hops, as a way to preserve beer, allowed commercial brewing and the emergence of beer trade. Scale economies were fairly small and so were breweries until the scientific and industrial revolution transformed the brewing industry by yielding insights in the process of brewing and in creating scale economies.

The period of consolidation and homogenization in the beer industry started around 1900 in most countries. Breweries merged, were acquired, or went bankrupt. In the US the number of breweries fell from 421 in 1947 to less than 50 by 1980, with just a small number

²¹ We focus on horizontal IO issues and ignore vertical relationships. Vertical IO issues relate to the downstream relations with wholesalers, retailers and bars (as discussed in the previous section) and to the upstream relationships with suppliers of raw materials. The latter was particularly important in Eastern Europe in the 1990s when breweries were restructured, with significant FDI and upgrading of the entire vertical supply chain (see Swinnen and Van Herck, 2011)—an issue that is highly relevant in today’s brewery investments in Africa.

of beer styles dominating an increasingly homogenized market. In other traditional beer markets the number of breweries fell by more than 90% over the same period (Table 5).

[Insert Table 5 here]

The reasons for this consolidation are well known (Swinnen, 2011; Tremblay and Tremblay, 2005). Technological progress—such as automation of beer production and packaging, lower distribution costs, and improved road networks—led to greater economies of scale (Adams, 2006; Gourvish, 1994). The introduction of bottom-fermented beers (lagers) led to higher fixed costs as cooling is needed during fermentation and maturation. Large-scale advertising led to an escalation of sunk advertising costs, especially on commercial television (George, 2009).

From the 1990s onwards, consolidation went international. Cross-border mergers and acquisitions led to a few multinationals dominating the global market, notably AB Inbev (21%), SABMiller (10%) and Heineken (9%). As of late 2017, AB Inbev was taking over SABMiller, already the world's two largest alcohol beverage companies, making it the third-biggest corporate takeover in history.

The consolidation, and even more the homogenization, of beers triggered the rise of craft brewing.²² With the take-off of craft beer, the number of breweries increased again (Figure 6), and their share of the total beer market grew rapidly (Figure 7).

[Insert Figures 6 and 7 here]

In countries where post-World War II consolidation was stronger and where craft brewers emerged earlier, the turnaround in the number of breweries occurred earlier.²³ For

²² Regulations have also affected the growth of craft brewing, either by restricting their growth (e.g. in Japan; and early on in the USA through the prohibition of home-brewing) or by stimulating it through tax advantages. Legalization of home-brewing represented a key factor to facilitate entry of craft brewers.

²³ In some countries, it is relatively easy to identify the start of the craft revolution. Elzinga et al. (2018) point in the USA to when Fritz Maytag bought the Anchor Brewing Company of San Francisco in 1965. Similarly, van Dijk et al. (2018) identify the start in the Netherlands to when the first new brewery since World War II was launched in 1981. The first brewpub in Italy started in 1988 (Garavaglia, 2018); in Australia craft brewing started around 1980 (Sammartino, 2018). In the UK, the origin of the craft beer movement is typically associated

example, in the US and the UK, the total number of breweries was at its lowest point around 1980. In the US the total number of breweries has since grown from less than 50 to more than 3,500, the vast majority of which are craft-type breweries. The growth of craft breweries started later and is less rapid in countries such as Belgium and Germany where more breweries survived the 20th century consolidation. They had (by far) the highest number of breweries per capita in the 1980s, respectively 17.4 (Germany) and 14.5 (Belgium) per million people compared to less than 1 in the UK and the US (Table 6). A third pattern is from countries with historically fewer breweries per capita because they consumed mostly other alcohol, such as wine in the case of Italy. In these countries, the recent growth of craft has increased the number of breweries. As a result, the number of breweries per million people is converging across these different beer markets: in 2015 it was between 10 and 25 in all these countries. The emergence and growth of the craft breweries are thus strongly linked to the consolidation in the traditional brewing industry.

[Insert Table 6 here]

While the success of craft beer initially took the macro-brewers by surprise, they soon responded by a mixed strategy of (a) own production of craft-style beer; (b) take-overs of successful craft breweries; and (c) using their control over bars and retailers to reduce access by craft beers (Garavaglia and Swinnen, 2017, 2018). As a result, a sizable share of the “craft beer” market is supplied now by multinational macro-breweries.

Firm concentration in the wine industry

with the emergence of the CAMRA association during the 1970s. In a way, Belgium has to some extent always been a “craft beer nation” (Swinnen and Briski, 2017). In Germany, it is even more difficult to classify the beginning of craft beer given the continual historical presence of small and local producers (Deppenbusch *et al.*, 2018). However, also in these countries there is a clear time period when new, mostly smaller, breweries started producing new specialty beers.

The wine market is much more fragmented than that of beer, spirits or soft drinks, with no single company holding a substantial share of the global market. The extent of concentration is far greater in the so-called New World than in Western Europe though: the top four firms have domestic sales of less than 20% in total in most Western European countries (and less than 10% in Austria, Germany and Portugal), whereas the top four firms have domestic sales of more than 40% of the total in Argentina, Australia, Chile, New Zealand and the United States (Table 7). Nor is that difference between the Old and New World just recent: Australian firms began to consolidate when exports took off in the first globalization wave (Anderson, 2015, pp. 21–23).

[Insert Table 7 here]

Constellation Brands, the world's largest wine company, represents less than 3% of the global wine market, despite its acquisitions of recent times.²⁴ The consolidations that have occurred have provided the opportunity to reap large economies of scale not only in winemaking but also in distribution and brand promotion, including through establishing their own sales offices abroad rather than relying on distributors. The large volumes of grapes grown and purchased by these firms from numerous regions in the Southern Hemisphere has enabled them to produce large volumes of consistent, popular wines for specific markets abroad. In particular, the production of large volumes of low-end premium wines that used grapes from several regions, so as to ensure little variation from year to year, suited perfectly the customers of large supermarkets in the UK. By the mid-1980s those supermarkets, dominated by Sainsbury's, Marks and Spencer, Waitrose and Tesco, accounted for more than half of all retail wine sales in the United Kingdom (Unwin, 1991, p. 341).

²⁴ Among Constellation's acquisitions are BRL Hardy (Australia) and Nobile (New Zealand) in 2003, Robert Mondavi (US) in 2004, Vincor International (Canada) in 2006 and Beam Wine Estates in 2008. Similar to the beer and spirits industries, Constellation Brands also own spirits and wine through the acquisitions of Spirits Marque One (owners of the SVEDKA vodka brand) in 2007, and of Corona and Modelo beer brands (Institute of Alcohol Studies, 2016; Constellation Brands, 2016). Constellation divested itself of its Australian wine assets in 2011 to a private equity firm, Accolade, which continues to operate on a similar scale.

Firm concentration in the distilled spirits industry

The global spirits market is in between the wine and beer industrial concentration. More than 70% of the market is still characterized by small local producers but, in recent decades, the spirits industry has experienced significant consolidation due to international mergers and acquisitions (M&As). Two leading producers—British Diageo (owner of Johnnie Walker, the world's top selling whiskey, and Smirnoff, the world's top selling vodka) and French Pernod Ricard (owner of Absolut, the number two vodka, and Chivas Regal, the number two whiskey)—together have 14% of the market (see Tables 4 and 8).

[Insert Table 8 here]

Diageo was formed in 1997 from the merger of Guinness and Grand Metropolitan. Between 2011 and 2012, Diageo acquired local spirits industries such as Mey Icki in Turkey, Ypioca in Brazil, and shares of China's Sichuan Shuijingfang and of India's United Spirits (the largest Indian spirits company). Pernod Ricard bought Allied Domecq in 2005 and the Swedish monopoly V&S Group in 2008 (Institute of Alcohol Studies, 2016; Jones, 2012).²⁵

The M&As were associated with a global shift in sales. From 2000 to 2015, Diageo's traditional markets in Europe and North America dropped from 83% to 42% of all sales; whereas its sales in fast-growing economies such as Brazil, China, India and Turkey increased from 10% to 40% in the same period (Institute of Alcohol Studies, 2016).

Along these consolidation trends, the spirits industry is recently also experiencing a “craft” revolution.²⁶ In less than two decades, the number of distilleries increased from 50 to

²⁵ Note that the larger spirits companies also own beer and wine (see Table 8). For instance, Diageo also owns famous beer brands (as Guinness) and Cognac and Champagne brands (34% of Moët Hennessy). Similarly, in 2010, Pernod Ricard, launched its wine company Pernod Ricard Winemakers, which owns among others Jacob's Creek, the Australian wine brand.

²⁶ In the last decade in Norway, the production of artisan Akvavit or aquavit, a spirit that has been produced in Scandinavia since the 15th century in various flavors, has grown again (Lascelles, 2017).

1,589 in the US. The market share of US craft spirits increased from 1.2% to 3.8% in value between 2011 and 2015 (Figure 8), confirming very rapid growth (American Craft Spirits Association, 2017).

[Insert Figure 8]

CONCLUSIONS

The past decade has witnessed a rapidly growing literature on economic aspects of alcoholic beverage production, consumption, trade and regulation. This article is the first broad review of how alcohol markets have evolved in terms of consumption and industrial organization, and how these have interacted with a variety of regulations. It is clear that throughout history, alcoholic drinks have played an important role in food security and health (both positive and negative). Consumption patterns have altered substantially over the past two centuries, as have production technologies and the industrial organization of beverage firms. Governments have intervened in many ways in alcohol markets: they have imposed taxes to raise revenue and to protect domestic industries, they have introduced regulations to protect individuals' and social health, they have determined which ingredients can be used in alcohol production, and they have tried to prevent excessive concentration in vertical and horizontal organizations of the alcohol industry.

While much has been learned through recent research, there is room for more economic research to further improve our understanding of the contribution of these markets and associated policies and institutions to global welfare. The availability of more data (see also Anderson and Pinilla 2017) allows an update of global demand elasticity estimates to be made, along the lines of Selvanathan and Selvanathan (2007) and Srivastava *et al.* (2014), and more precise convergence estimates. It should also allow us to better disentangle the forces that cause differences in consumer demand across countries and generations, such as

differences in quality, taxes, availability of alternatives, etc. This paper has pointed to the different relationship of volume versus value with income growth. As with tobacco consumption, the volume of alcohol consumption declines with health concerns rising as income rises; but the value of alcohol consumption does not seem to decline, probably because of a shift to higher-quality products. If so, this shift may benefit consumer health and industry profits simultaneously. These relationships are likely to be affected in the future by the emergence of new products that may influence alcohol consumption, such as the legalization of marijuana, or the new attempt by multinational firms to promote alcohol-free beer and low-alcohol wine.

There is also much to learn from further analysis of the changes in alcohol industry structures, and in particular the quasi-simultaneous process of consolidation and growth of niche products – changes that have already occurred in a dramatic way in the brewing industry over recent decades and that may be developing in other alcohol markets as well.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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Table 1: Shares of beverage household expenditure by beverage type, seven regions spanning the world, 2010-14 (%)

	Budget shares of alcohol expenditure (%)			Beverage shares of all expenditure (%)				Alcohol as % of all beverage expenditure
	Beer	Wine	Spirits	All alcohol	Bottled water	Carbon-ates	Other soft drinks	
Western Europe	40	34	26	3.88	0.54	0.73	0.53	68
Eastern Europe	46	20	34	5.87	0.53	0.76	0.72	74
Australasia	53	28	19	3.49	0.17	0.77	0.51	71
North America	48	21	30	1.94	0.34	0.66	0.58	55
Latin America	64	10	26	4.22	0.61	2.01	0.76	56
Africa & M East	60	15	25	2.49	0.57	1.14	0.58	52
Asia	35	15	50	4.29	0.32	0.49	1.07	70
WORLD	44	21	35	3.46	0.43	0.79	0.72	64

Source: Holmes and Anderson (2017b).

Table 2: Wine, beer and spirits consumption volume and value intensity indexes, by region, 2013-15

	Wine		Beer		Spirits	
	Volume	Value	Volume	Value	Volume	Value
Western Europe	2.51	1.62	0.85	0.90	0.53	0.75
Eastern Europe	0.90	0.93	1.01	1.01	1.03	1.02
Australasia	2.31	1.36	1.09	1.19	0.34	0.54
North America	1.07	1.01	1.16	1.08	0.79	0.89
Latin America	0.58	0.46	1.36	1.44	1.16	1.16
Africa & M. East	0.82	0.72	1.51	1.34	0.51	0.73
Asia	0.53	0.69	0.85	0.82	1.36	1.41
WORLD	1.00	1.00	1.00	1.00	1.00	1.00

Source: Holmes and Anderson (2017b).

Table 3. Health regulations on alcohol (beer/wine/spirits) in China, France and the United States, 2012

	<i>China</i>	<i>France</i>	<i>United States</i>
<i>Advertising restrictions</i>			
On national TV	partial restriction time/place/content	ban	voluntary/self-restricted
On national radio	partial restriction time/place/content	partial restriction time/place	voluntary/self-restricted
<i>Age limits</i>			
Alcohol service/sales	no	18 / 18 / 18	21 / 21 / 21
<i>Drinking Driving</i>			
Legal limit for blood alcohol (general / young / professional), in %	0.02 / 0.02 / 0.02	0.05 / 0.05 / 0.05 (0.02 public transport)	0.08 / Subnational / 0.04
<i>Legally binding regulations on alcohol sponsorship / sales promotion</i>	No / No	Yes / Yes	No / No
<i>Legally required health warning labels on alcohol advertisements / containers</i>	No / No	Yes / Yes	Yes / Yes
<i>Licensing requirements</i>			
Production	Yes	No	Yes
Retail sales	Yes	Yes	No
<i>Restrictions for on-/off-premise sales</i>			
Hours, days / places, density	No, No / No, No	No, No / Yes, Yes	Subnational
Specific events / intoxicated persons / petrol stations	No / Yes / No	Yes / Yes / Yes	Subnational

Source: WHO (2014); Federal Office of Public Health (2017).

Table 4. Leading producer shares of global beer, wine and spirits production, 2014 (percent)

	<i>Leading producers</i>	<i>Top five producers</i>
<i>Beer</i>		
AB InBev	21	52
SABMiller	10	
Heineken	9	
Carlsberg	6	
CR Snow Breweries	6	
<i>Wine</i>		
Constellation Brands	3	8
E & J Gallo	2	
The Wine Group	2	
Treasury Wine Estates	1	
<i>Spirits</i>		
Diageo	9	22
Pernod Ricard	5	
Hite Jinro	3	
Thai Beverage	3	
Beam Suntory	2	

Source: Institute of Alcohol Studies (2016).

Table 5. Number of breweries and average brewery size, Belgium, UK and US, 1900 to 1980 (Index 1900 =100)

	<i>Number of Breweries (1900=100)</i>		
	<i>USA</i>	<i>UK</i>	<i>Belgium</i>
1900	100	100	100
1920	Prohibition	45	62
1940	38	13	35
1960	13	6	13
1980	6	2	4
	<i>Average Brewery Size (1900=100)</i>		
	<i>USA</i>	<i>UK</i>	<i>Belgium</i>
1900	100	100	100
1920	Prohibition	211	125
1940	376	544	225
1960	1936	1289	600
1980	8764	5344	2900

Source: Swinnen (2011).

Table 6. Number of breweries per million inhabitants, key high-income countries, 1980 to 2015

	1980	1990	2000	2010	2015
Belgium	14.5	12.6	11.0	11.3	17.6
Germany	17.4	15.5	15.7	16.4	17.0
Italy	0.5	0.3	1.3	5.5	11.2
Netherlands	0.9	1.6	3.8	7.3	23.0
UK	2.5	4.9	8.5	13.1	23.0
USA	0.2	1.1	5.3	5.7	10.9

Source: Garavaglia and Swinnen (2017).

Table 7: Share of national wine sales volume by four largest firms, 2014 (percent)

	largest	2nd largest	3rd largest	4th largest	Residual
Italy	8.1	7.8	1.2	1.1	81.8
Portugal	3.1	2.4	2.1	2.1	90.3
Spain	11.0	3.7	3.6	1.8	79.9
Austria	6.3	2.1	0.6	0.6	90.4
Germany	1.2	1.1	1.1	1.0	95.6
Greece	7.9	6.9	3.4	2.8	79.0
Switzerland	12.9	7.7	4.0	0.8	74.6
Bulgaria	12.2	11.1	9.5	6.9	60.3
Hungary	8.6	4.4	3.1	2.8	81.1
Romania	11.3	10.8	9.5	6.1	62.3
Russia	4.1	3.8	3.4	2.8	85.9
Ukraine	8.6	8.6	8.3	7.6	66.9
Australia	15.9	9.3	9.2	7.0	58.6
New Zealand	23.4	11.4	9.5	8.7	47.0
Canada	11.9	10.6	7.2	4.1	66.2
United States	22.9	14.5	12.9	5.6	44.1
Argentina	27.0	14.1	12.0	6.6	40.3
Chile	30.5	29.6	29.1	1.4	9.4
South Africa	30.5	2.5	1.6	1.4	64.0
China	3.2	2.8	1.0	0.9	92.1

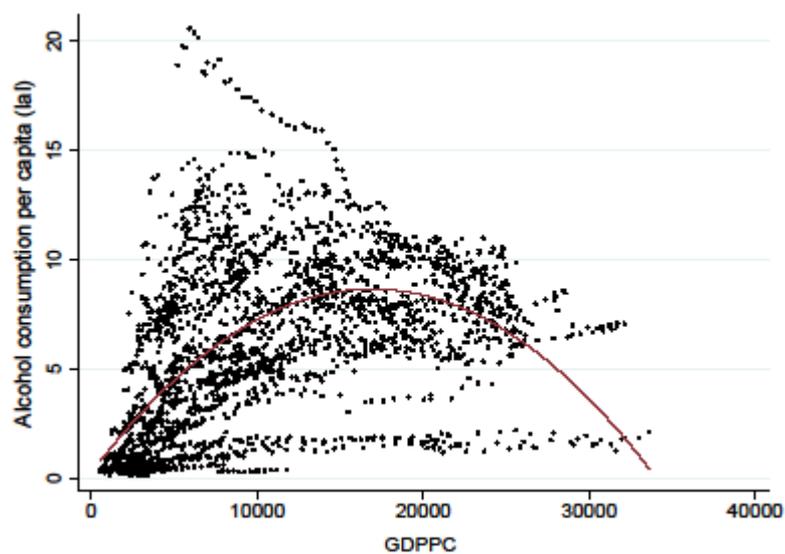
Source: Anderson, Nelgen and Pinilla (2017, Table 44).

Table 8. Leading global alcohol producers, 2014

Company	Category	Headquarters	2014 Global Revenue	Major Brands
AB InBev	Beer	Leuven, Belgium	£31 bn	Budweiser, Stella Artois, Corona, Skol, Brahma
SABMiller	Beer, Cider	London, UK	£15bn	Miller, Peroni, Pilsner Urquell, Grolsch, Aguila, Strongbow, Carling, Castie
Heineken	Beer, Cider	Amsterdam, Netherlands	£14bn	Heinken, Amstel, Desperados, Sol, Strongbow
Carlsberg	Beer, Cider	Copenhagen, Denmark	£6bn	Carlsberg, Tuborg, Kronenbourg, Battika, Somersby
Diageo	Spirits, Beer, Wine	London, UK	£10bn	Johnnie Walker, Smirnoff, Captain Morgan, Baileys, Guinness, Tanqueray
Pernod Ricard	Spirits, Wine	Paris, France	£6bn	Jameson, Absolut, Malibu, Jacobs Creek, Chivas Regal
Constellation	Wine, Beer, Spirits	Victor, NY, USA	£4bn	Robert Mondavi, Clos du Bois, Blackstone, Modelo, Simi, Ruffino
E & J Gallo	Wine	Modesto, CA, USA	£3bn	Andre, Carlo Rossi, Boone's Farm, Barefoot Wine

Source: Institute of Alcohol Studies (2016).

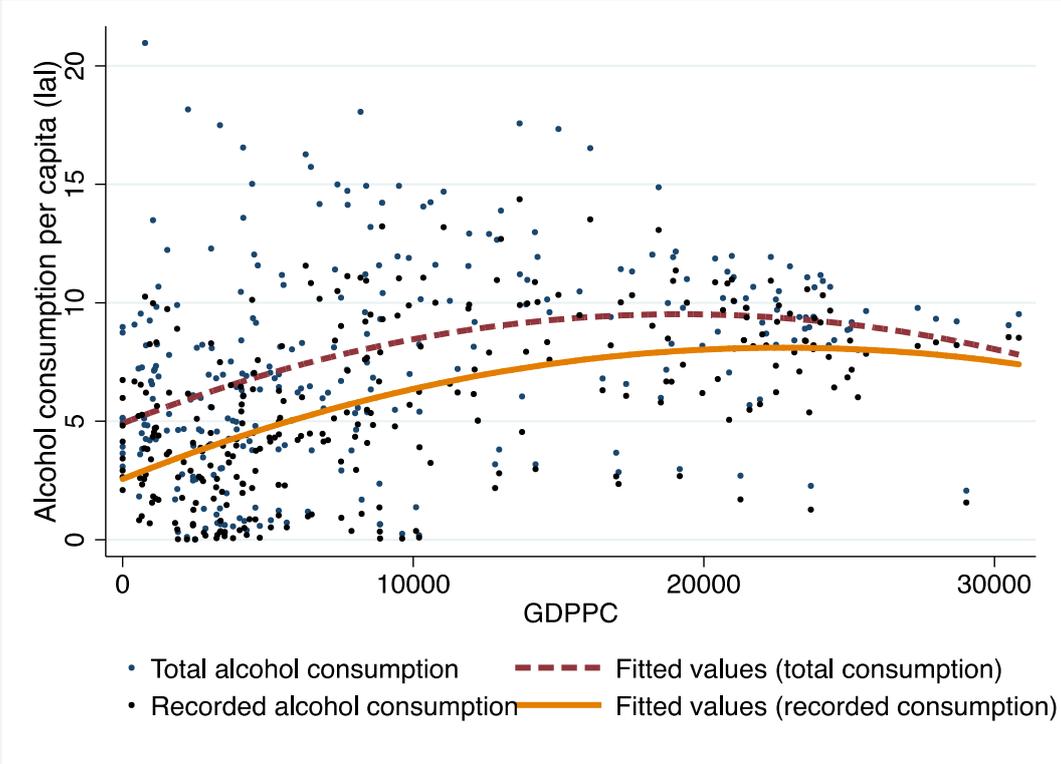
Figure 1: Relationship between recorded alcohol consumption volume and real GDP per capita,^a 53 countries/regions, 1961 to 2014 (one dot per country-year)



^a Real GDP per capita are in 1990 International Geary-Khamis dollars from www.ggd.net/maddison/maddison-project/data.htm. The curved line is a fitted quadratic regression line.

Source: Holmes and Anderson (2017b).

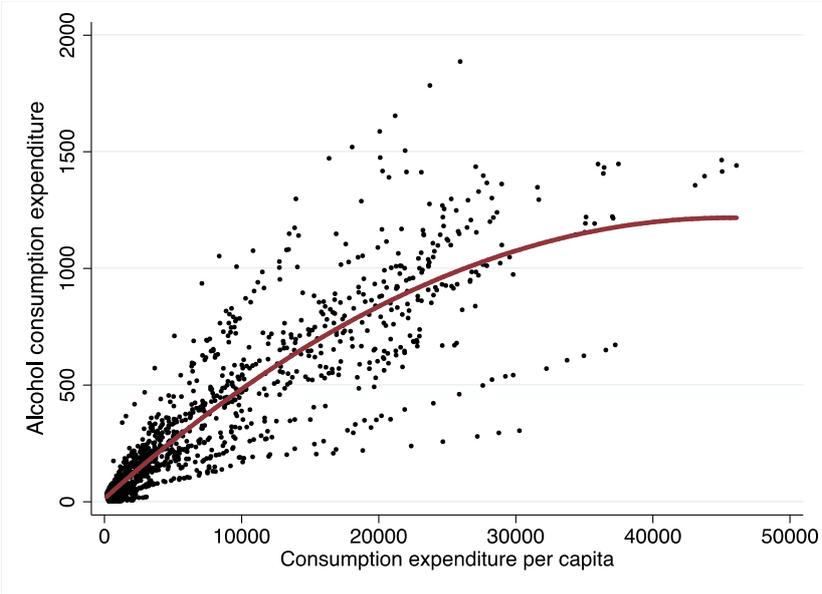
Figure 2: Relationships between alcohol consumption volume and real GDP per capita,^a recorded and total (recorded plus unrecorded), 98 countries, 2000, 2005 and 2010 (one dot per country-year)



^a Real GDP per capita are in 1990 International Geary-Khamis dollars from www.ggdcc.net/maddison/maddison-project/data.htm

Source: Holmes and Anderson (2017b).

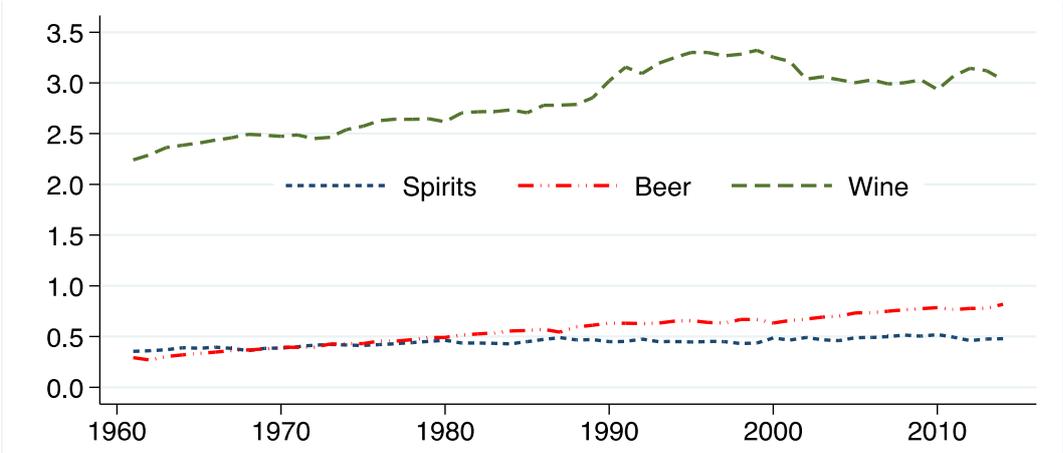
Figure 3: Relationship between per capita aggregate expenditure and recorded alcohol expenditure, 80 countries,^a 2001 to 2015 (US\$/year in 2015 dollars, one dot per country-year)



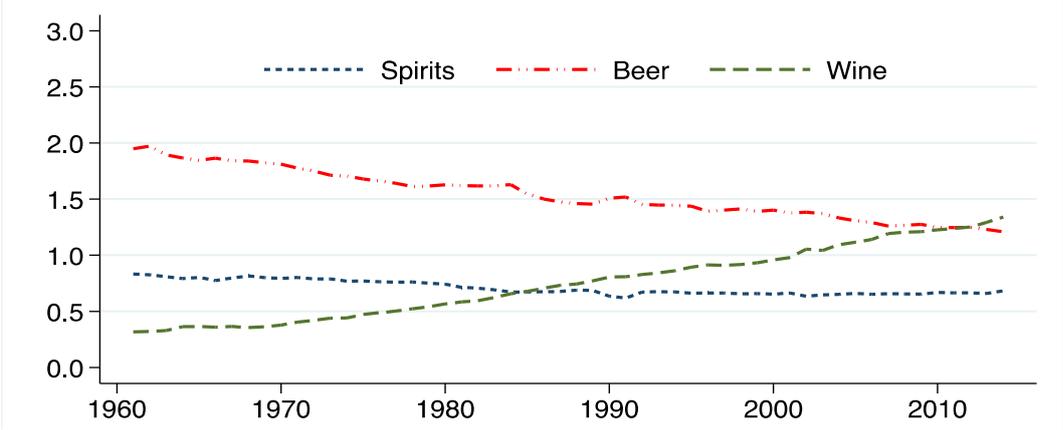
Source: Holmes and Anderson (2017b).

Figure 4: Wine, beer and spirits consumption volume intensity indexes^a for sub-sets of 53 countries/regions, by main focus in 1961-64, 1961 to 2014

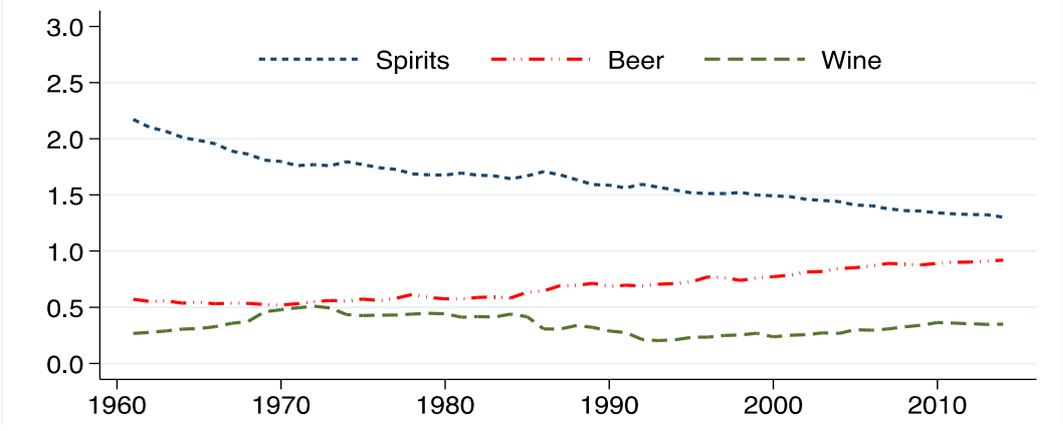
(a) Wine-focused countries



(b) Beer-focused countries

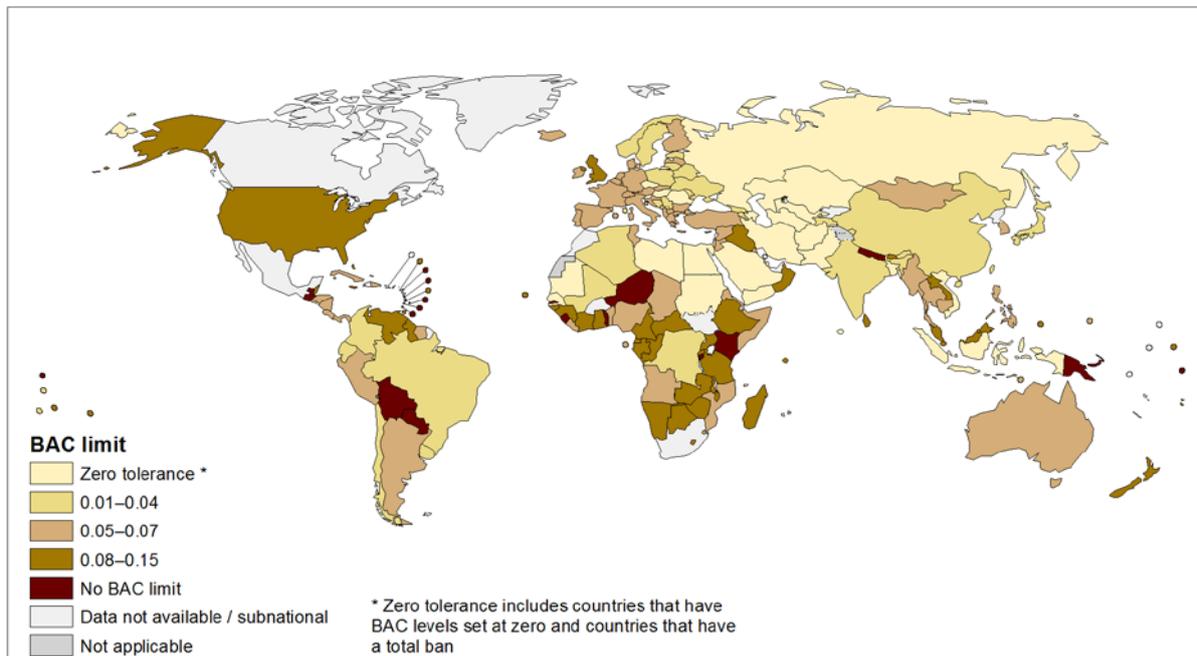


(c) Spirits-focused countries



Source: Holmes and Anderson (2017b).

Figure 5. Blood alcohol concentration (BAC) limits for drivers in the general population, 2012



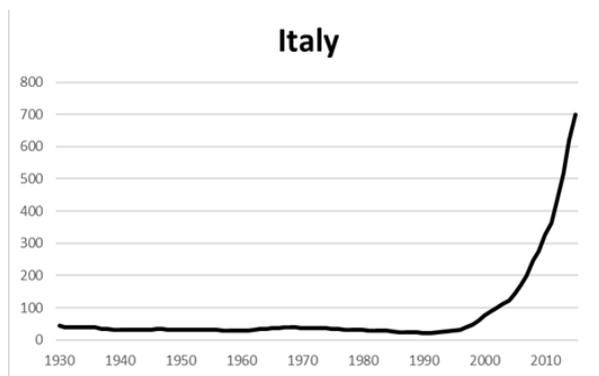
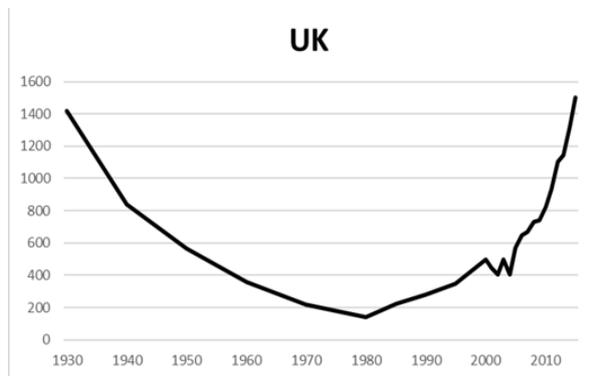
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Data Source: World Health Organization
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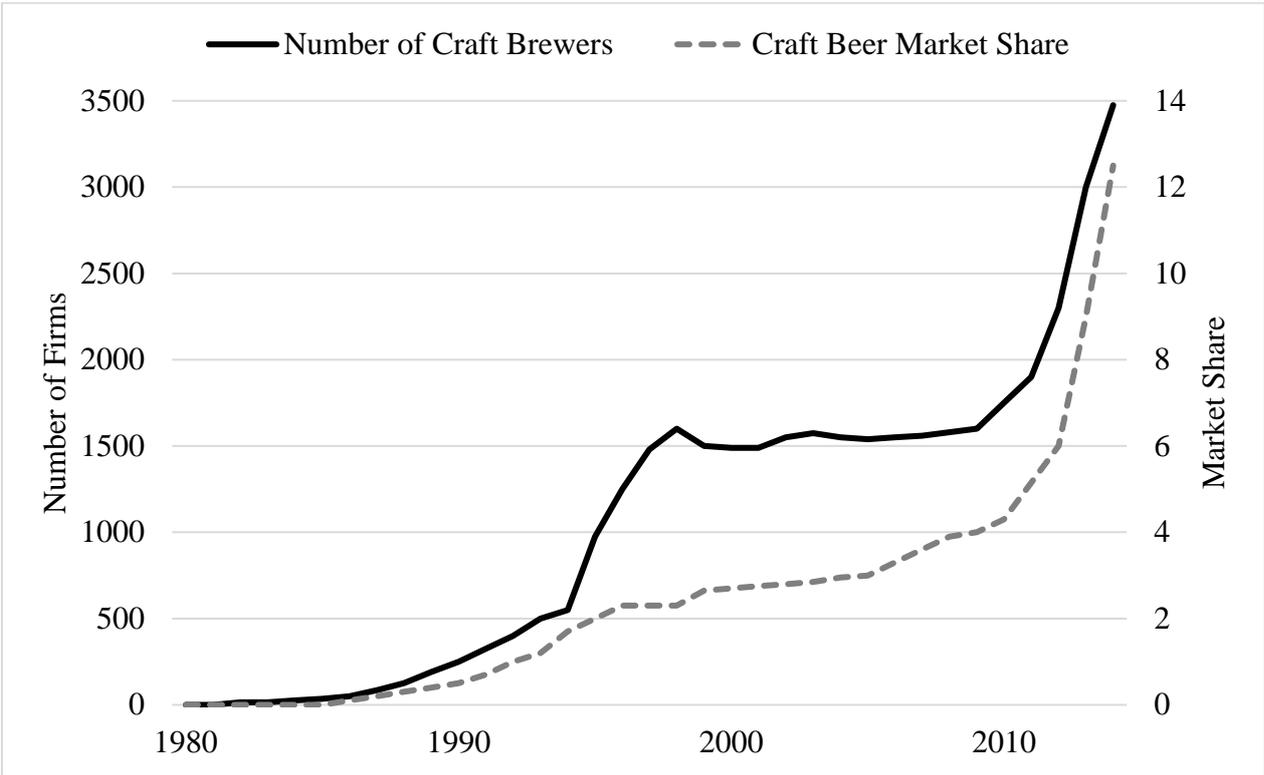
Source: WHO (2014, p. 68).

Figure 6. Number of breweries, Germany, Italy and UK, 1930 to 2015



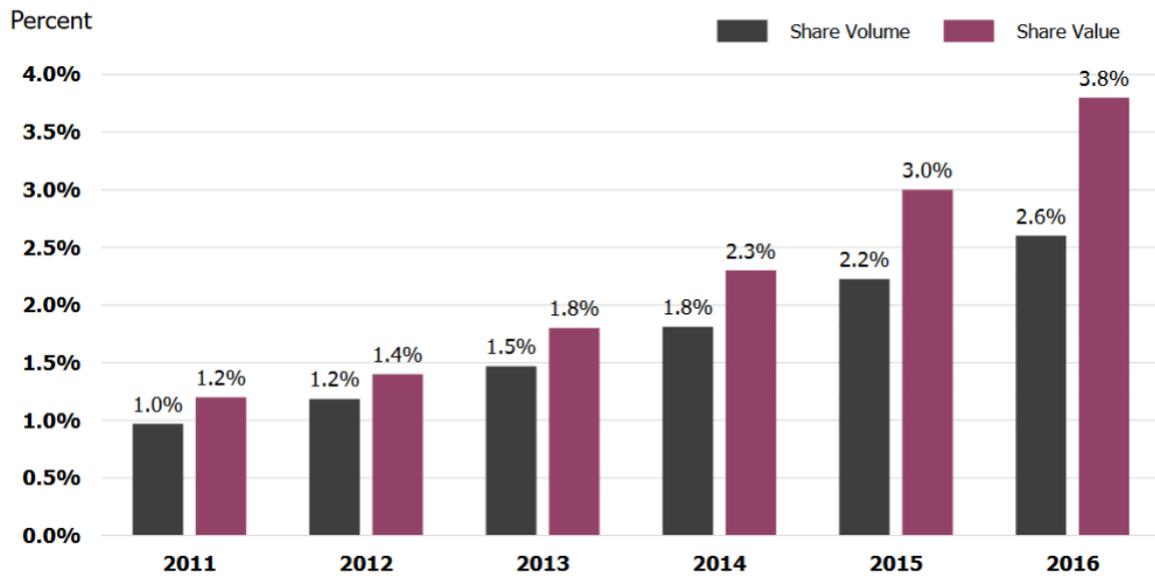
Source: Garavaglia and Swinnen (2017, 2018).

Figure 7: Number of craft brewers and craft market share in the USA (%), 1980 to 2014



Source: Elzinga et al. (2018).

Figure 8. Craft spirits sales as a share of total US spirits volume and value, 2011 to 2016



Source: American Craft Spirits Association (2017).