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Liesbeth Colen and Johan Swinnen

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Liesbeth Colen and Johan Swinnen

LICOS Centre for Institutions and Economic Performance
& Department of Economics
University of Leuven (KUL)

Abstract

In this paper we analyze the evolution of beer consumption between countries and over time. Historically, there have been major changes in beer consumption in the world. In recent times, per capita consumption has decreased in traditional "beer drinking nations" while it increased strongly in emerging economies. Recently, China has overtaken the US as the largest beer economy. A quantitative empirical analysis shows that the relationship between income and beer consumption has an inverse U-shape. Beer consumption initially increases with rising incomes, but at higher levels of income beer consumption falls. Increased openness to trade and globalization has contributed to a convergence in alcohol consumption patterns across countries. In countries that were originally "beer drinking nations", the share of beer in total alcohol consumption reduced while this is not the case in countries which traditionally drank mostly wine or spirits. Climatic conditions, religion, and relative prices also influence beer consumption.

JEL Classification: N30, D12, Q11
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When one thinks of the favorite alcoholic drinks of people in Italy, Spain and France, one thinks of wine; when one thinks of Russia one thinks of vodka; when one thinks of countries like Belgium, Germany, Czech Republic or Britain, one thinks of beer. The question then arises: what makes a country a "beer (or wine) drinking nation"?

The first answer that may come to mind is "the climate". Viticulture – the production of grapes for wine – requires certain ecological conditions typically found in warmer (but not too warm) climates, so it seems logical that people living around the Mediterranean and in California drink wine, and people living in Northern Europe and around the Great Lakes in the US – deprived of the opportunity of growing quality grapes because of the cold – have to resort to beer, based on barley which can be grown in harsher conditions.

This explanation is based on production arguments – and the implicit assumption that trade in beer or wine cannot make up for different production conditions. This is – as we will document – a good assumption for most of history. Trade in beer or wine is expensive since it involves mostly transport of water, which made it costly except for the more expensive wines. That said, trade in beverages has always existed and has grown more important in recent years.

Another explanation that seems intuitive is religion. Islam, Mormon and Hindu religions forbid alcohol use. In contrast, wine is used in Catholic religious services, and monasteries were centers of brewing for many centuries. Not surprisingly wine and beer have been actively used and produced in Catholic regions.

Government regulations obviously affect consumption as well. Governments have actively intervened in alcohol markets throughout history (Meloni and Swinnen 2010). Regulations have

been motivated by religious purposes and by those favoring the prohibition of alcohol for health and social reasons (Okrent 2010). Governments have universally imposed various taxes on beer, wine and spirits as a source of revenue or to protect certain interests. For example, heavy import tariffs on French wines induced a massive shift from wine to beer consumption in 18th century Britain (Nye 2011).

In this paper we study beer consumption across countries and over time. We analyze empirically which factors have affected beer consumption. Before addressing the question "what makes a country a beer drinking nation?" more rigorously, it is obviously important to first analyze whether the images of countries in people's minds are actually true, i.e. whether our associations of a certain alcoholic drink with countries is consistent with their actual consumption habits. We will therefore first document beer consumption across countries and time. We will do this in two steps. We start by briefly discussing beer and wine consumption in history. Afterwards we will turn to more recent times and look at comparative data. In the second part of the paper we then formally analyze the determinants of beer consumption across times and nations.

A Brief Historical Review[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.

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

[1] See Poelmans and Swinnen (2011) for a more elaborate discussion and for more references to the literature on the history of beer, including Nelson (2005) and Unger (2004).

fourth millennium BC people in Mesopotamia, the fertile region between the Tigris and Euphrate rivers, and in Egypt were making beer. The earliest indications of beer production in Europe are from around 5000 years ago – 3000 BC.

Interestingly, it appears that many regions which we now typically no longer associate with beer were initially "beer drinking nations". At the height of the Egyptian empire, beer was the drink of choice for all in Egypt. It was only later that the elite in Egypt shifted to preferring wine. However even then beer remained the drink for the masses. In more recent times beer consumption declined in North Africa with the spread of Islam.

Also in Europe in many 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[2]. The widespread consumption of wine and viniculture did not arrive in large parts of Southern Europe until the Romans conquered these parts of Europe. Both the Greeks and the Romans drank wine, and only wine, no beer. Moreover, they despised beer and its drinkers. They referred to them as barbarians, uncivilized etc. With the Roman conquest of Europe, wine consumption – and later production – spread over the continent. Northern Italy (above the Po-river), then Southern Gaul (France), the Iberian peninsula (Spain and Portugal), and later Northern Gaul (Northern France and Belgium) were conquered one by one by the Romans, and with it came a dramatic geographic spread of wine consumption and production.

Celtic people in (what is now) France, Spain, Belgium, Germany, and Britain were all avid beer drinkers, probably from very early times and for the most part even after the Roman conquests

[2] 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).

(Nelson 2005). However, due to Greek and especially Roman influence, wine came to supplant beer (or honey beer or mead) as the upper-class beverage in most of these areas. The place where the old beer tradition remained most steadfast was what is now Germany, perhaps due to Germanic influence on Celts. This is reflected in Caesar's comment about the resistance to wine by the Suevi and the Nervi, two German tribes:

> "*[the Germanic tribe Suevi] on no account permit wine to be imported to them, because they consider that men degenerate in their powers of enduring fatigue, and are rendered effeminate by that commodity*". (De Bello Gallico: Book 4, Chapter 2)
> "*That there was no access for merchants to them [the Nervii]; that they suffered no wine and other things tending to luxury to be imported; because, they thought that by their use the mind is enervated and the courage impaired*". (De Bello Gallico: Book 2, Chapter 15)[3]

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) lead to international transfers of technologies and knowledge of brewing and wine production. Together with local traditions, climatic conditions, government regulations, economic development and religious constraints these factors have a major impact on whether countries became "beer drinking nations", or not.

This brief historical introduction shows that local traditions, climatic conditions, trade, technology diffusion with economic integration (through military means and conquests, or through migration and foreign investments), government regulations, economic development and religious constraints have a major impact on whether countries became "beer drinking nations", or not. Also

[3] De Bello Gallico, Book 2, Chap. 15. In: McDevitte and Bohn (1869). Special thanks go to Giulia Melon for coming up with these nice quotes. See Meloni and Swinnen (2010) for more details.

in more recent times each of these factors appears to have been important in explaining (changes in) beer consumption.

Recent History and Current Situation

On a global level, beer consumption is much more important than wine or other alcoholic beverages in volume terms. Moreover, the gap has grown strongly over the past 50 years (Figure 1). While in the 1960s the global volume of beer was approximately double that of wine, beer consumption was more than six times larger than wine consumption by 2005. The gap with other alcoholic drinks increased substantially as well. 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 drinks18.5 billion liters.

Since wine and other alcohol are typically more expensive than beer, the differences in value terms are smaller (Figure 1). Between 1960 and 1990 the global value of beer and "other alcoholic beverages" was roughly equal and approximately double the value of wine. However over the past twenty years, the value of beer has continued to increase while that of "other alcoholic beverages" has stagnated. The global value 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.

Figure 2 illustrates the evolution of beer consumption for a series of countries over the past 50 years. For most of that period the US was the largest beer market, consuming around 25 billion liters per year for the past 30 years. In the 1960-1980 period the other large markets were in Western Europe: Germany, the UK and France. However, consumption of beer has declined significantly in the past 25 years in some of the traditional European beer drinking countries such as Germany, the UK and Belgium.

Growth in demand is concentrated in the emerging countries. In particular the rise of consumption in China is spectacular. Since 2003 China has overtaken the US as the largest beer market and China now consumes 20 percent of all beer in the world. The dramatic growth of China[4] in the global beer economy is well illustrated in Figure 2. From close to zero beer consumption as recently as 1980, the Chinese beer market grew to 40 billion liters by 2007. Growth was strong in other emerging markets as well. Also in Russia and Brazil beer consumption has increased strongly over the past two decades and today these countries are larger beer markets than Germany. In all these countries the combination of income growth and economic liberalization has induced a dramatic growth of production and consumption. Also in India, there has been substantive growth in beer consumption in recent years albeit India is far behind China. In fact total Indian beer consumption is only slightly higher than that of Belgium (Arora et al. 2011). Table 1 summarizes the changes in the structure of the global beer market.

Clearly the total consumption volumes are affected by the number of people living in the country. Therefore another interesting indicator is beer consumption per capita. Figure 3 (and Tables A1 in Appendix) provide details on per capita beer consumption in various countries. Per capita beer consumption is still the highest in Western and Central Europe. The "world champions beer drinking" are the Irish and the Czech with more than 160 liter per capita – much more than any other country. Austrians, Germans, Belgians and British consumers also drink 100 liters per capita or more. The highest consumption in non-European countries is in Australia (89 l/cap) and the US (86 l/cap). Per capita consumption in other major beer markets is considerably less: 63 l/cap in Russia, 40 l/cap in Brazil, and 24 l/cap in China. Per capita consumption was less than 1 liter in India in 2005.

Figure 4 shows the evolution of per capita consumption over the past 50 years. There are several interesting patterns. First, among the recently growing beer markets, growth in per capita

[4] See Bai et al. (2011) for the fascinating story of what happened in the Chinese beer market.

consumption has been strongest in Russia[5], almost quadrupling between 1995 and 2005, much stronger even than in China. In Brazil, growth was strongest in the 1975-1995 period and has slowed since.

Second, Figure 4 also suggests that there is huge potential for further growth in beer consumption in the world's largest countries. In India, despite a large population that does not consume beer, there appears much room for growth. Also in China, while average consumption has grown continuously since 1980, it is still far below that of the US or Western and Central Europe.

Third, a remarkable observation is that in all West European countries and in the US per capita consumption has been declining for decades. The decline is substantial. The maximum consumption per capita was reached in 1974 in Belgium, in 1976 in France, in 1980 in the UK, in 1981 in the US and in 1983 in Germany. Per capita consumption has declined significantly since then: in Germany and Belgium beer consumption declined from close to 150 l/cap to around 100 l/cap, a decline of around 30 percent.

To conclude whether a country is a "beer drinking nation" or not, one should not only consider total and per capita consumption but also compare beer consumption with consumption of other drinks such as wine and spirits. Table 2 presents the share of beer, wine and spirits in total alcohol consumption for several countries for 1961 and 2005 (see Appendix for the full list of countries). One can classify countries in "beer-drinking", "wine-drinking" and "spirit-drinking nations" based on which beverage has the highest share in total alcohol consumption. With the largest part of alcohol intake coming from beer, the US, Germany, the Czech Republic and Belgium have always been "beer-drinking nations" over the past 50 years. France and Greece are "wine-drinking nations" and Russia and China "spirit-drinking nations".

[5] Russia is a very interesting case since beer consumption increased dramatically over the past 15 years, with consumers shifting "from vodka to Baltika" (i.e. the most popular beer in Russia) (Deconinck and Swinnen 2011).

There are major changes in the shares for some of the countries between 1961 and 2005. For example, Spain and Poland have become beer drinking nations in recent years, while before they were wine (Spain) and spirit (Poland) drinkers. Interestingly, in many "beer-drinking nations" the relative share of beer is declining and that of wine increasing. For example, in Belgium, the UK, Germany and the Czech Republic the consumption of beer is reducing, while wine consumption increased over the past decades in most of these countries. In Belgium the share of beer in total alcohol consumption has decreased from 71 percent in 1965 to 57 percent in 2005, with the share of wine consumption increasing from 15 to 37 percent over the same period. In the UK the shift was even larger: beer fell from 81 percent to 45 percent, while the share of wine in total alcohol consumption went from 4 to 32 percent. Inversely, in "wine-drinking nations" such as France, Spain and Greece, the share of wine is declining and that of beer increasing – and substantially so. For example in Spain, beer consumption increased from 11 percent in 1961 to 48 percent in 2005, effectively overtaking wine consumption, which was at 38 percent in 2005 (compared to 65 % in 1961). Also for "spirit-drinking nations" a relative increase in beer consumption is found. In 1965 the Russians, Polish and Chinese consumed most of their alcohol in the form of spirits, while the share of beer was respectively 15, 28 and 2 percent. By 2005, the share of beer had increased strongly: to respectively 33, 56 and 36 percent of total alcohol consumption. These observations are consistent with arguments of Aizenman and Brooks (2008), Bentzen and Smith (2009) and Leifman (2001) that economic integration and globalization has led to a "convergence" of alcohol consumption patterns.

In summary, the indicators we reviewed in this section point to several interesting developments in the global beer market. In middle and low income countries which experience growth, such as China, Russia, Poland and India, beer consumption grows. In rich countries,

however, further growth has led to a reduction in beer consumption per capita. These observations suggest a non-linear relationship between income and beer consumption. At the same time it seems that in many "beer-drinking nations" beer seems to loose importance in favour of other alcohol drinks, while the opposite is true in "wine-drinking" and "spirit-drinking" countries. In the regression model which we use later in the paper we will test whether such a non-linear, inverse-U function, relationship does indeed exist and whether there is international convergence in alcohol consumption patterns.

The Role of Trade

Before formally analyzing the determinants of beer consumption it is useful to consider the role of trade in beer markets. Convergence of alcohol consumption may occur through various mechanisms. One of them is trade.

Because beer is a voluminous product, made up mostly of water, trade is costly. That is why trade in beer has traditionally been limited and restricted to neighbouring regions. Expansion of brewing companies happens mostly through mergers and acquisitions and brewing licenses for in-country production of foreign beers rather than actual trade of beer.

In recent years, trade has grown substantially in volumes and value. Trade growth was particularly strong in the past two decades, as Figure 6 illustrates. In the US imports increased from around 0.5 billion liter in 1980 to 3.5 billion liter in 2007 (Tremblay and Tremblay 2011). Belgian exports of beer increased from less than 250 million liter in 1980 to more than 1 billion in 2007 (Persyn et al. 2011).

However, if one looks at trade as a share of total production one does not find such a spectacular growth. In fact, over the past 50 years trade in beer has always been a small fraction of

production. Around 5 percent of global beer production is traded and this share has been quite constant over this entire period (see Figure 5). Still, as we will show further, increased trade openness seems to have been correlated with substantial changes in beer consumption globally and seems to contribute to converging patterns of alcohol consumption.

Determinants of the Demand for Beer

In the rest of this paper we try to explain these patterns of beer consumption both across countries and over time.

Conceptual issues and literature

Economic theory predicts that an individual consumer's demand for beer is a function of the price of beer, the prices of substitutes and complements, the consumer's income, the product's characteristics, and the consumer's level of consumption capital (Tremblay and Tremblay 2005). Important substitutes for beer include other alcoholic beverages, such as wine and distilled spirits, and soft drinks. The fact that beer, like other alcoholic beverages, is potentially addictive, also affects the demand for beer. Addiction will influence demand directly and will vary with an individual's consumption capital (Stigler and Becker 1977). For an addictive commodity, current consumption may be higher when past and expected future consumption are higher (Becker and Murphy 1988; Akerlof 1991). Finally, peer pressure and advertising that promotes the image that drinking alcohol is the social norm, may encourage alcohol consumption (Akerlof and Kranton 2000).

As far as we are aware, there are no earlier econometric studies analyzing changes in global beer consumption across many countries and over a long period of time. There are, however, many studies analyzing the determinants of alcohol consumption, including beer, in various countries.

Studies find that the estimated price elasticities are consistent with theoretical expectations (i.e. negative own price elasticities and positive cross-price elasticities) but that the elasticities are relatively small. Fogarty (2010) and Tremblay and Tremblay (2005) summarize more than 150 studies, most of which are on OECD countries. Although there is variability in the estimates, most indicate that the demand for beer is inelastic. The mean estimate of price elasticity of demand is about -0.5 in various studies for the US, the UK and Ireland (Fogarty 2010). That is, a 10 percent increase in the price reduces the quantity of beer demanded by about 5 percent. Regarding cross-price effects, most studies show that wine, spirits, and soft drinks are imperfect substitutes for beer, as the cross-price elasticity estimates are small, close to zero (Tremblay and Tremblay 2005).

The majority of studies conclude that beer is a normal good but that income has a relatively small effect on demand. The mean income elasticity is between 0.35 and 0.90 for most countries (Fogarty, 2010). A few studies find a negative income elasticity (e.g. Niskanen 1962; Gallet and List 1998; Nelson 2003 for the US). However, the vast majority of the studies find income elasticity to be positive. In the light of our earlier graphical analysis, it is interesting to note that none of the studies identifies the apparent non-linearity of the relationship between beer consumption and income.

Demographic factors also affect the demand of beer. Typically, men are more likely to drink beer than women and beer is more popular for consumers aged 18-44 than for those aged 45 and over. Studies that control for demographics find that demand rises with growth in the young adult population (Ornstein and Hanssens 1985; Lee and Tremblay 1992; Larivière et al. 2000; Nelson 2003).

Studies also find country effects as well as regional differences within large countries. For example, in the US, residents of the Northeast and the West are more likely to be beer drinkers than

residents of other regions. Per capita beer consumption is much lower in Utah, where many Mormons live, and highest in Nevada (Tremblay and Tremblay 2005).

Empirical Model

We now estimate the relationship between beer consumption and a series of variables, such as income, climatic and religious effects, and the impact of global integration over the past decades, across a large group of countries[6]. To measure impacts and differences in beer consumption between countries and over time, we use a pooled approach, looking at both the variation *between* and *within* the countries, and an approach that focuses at the variation over time *within* countries only. First, we look at how beer consumption and the share of beer in total alcohol consumption varies between and within countries, making use of a pooled OLS regression and we calculate cluster-robust standard errors. We estimate the following regression, using annual data for 104 countries for 35 years (1970 till 2005):

$$y_{it} = \alpha + x_{it}'\beta_1 + z_i'\beta_2 + u_{it}$$

where the dependent variable y_{it} is an indicator of beer consumption;
α is a constant term;
x_{it} represents a vector of time varying explanatory variables;
z_i represents a vector of explanatory variables that do not vary over time; and
u_{it} is the error term.

Second, using a fixed effects analysis, we isolate the within-effect. We try to explain the evolution of beer consumption and its share in total alcohol consumption within countries over a period of 35 years (1970-2005). We include time dummies and use cluster-robust standard errors. We estimate the following fixed effects regression model:

$$y_{it} = \alpha_i + x_{it}'\beta + \gamma_t + u_{it}$$

[6] Due to lack of data, we can not account for (changes) in different types of beer (e.g. between ales, lagers, light beers, premium beers, etc.).

where the dependent variable y_{it} is an indicator of beer consumption;
α_i represents the country fixed effects;
x_{it} represents a vector of time varying explanatory variables;
γ_t are the time dummies; and
u_{it} is the error term.

We use two different indicators of beer consumption as dependent variables: average per capita beer consumption and the percentage of beer in total pure alcohol consumption. Average per capita consumption of beer is calculated based on production, trade and population statistics from FAO (FAO 2010). We compared our consumption indicators with data from the Commission for Distilled Spirits (2005) and found them to be generally consistent. FAO statistics are available for longer periods (1961-2005). Percentages of beer, wine and spirits in total pure alcohol consumption are taken from the Global Alcohol Database (WHO 2010).

The first explanatory variable is income. We include this variable also in squared terms to capture possible non-linear effects. We use nominal GDP in per capita terms in US dollars for our main results because the time series is long for this indicator (1970-2005). We also include robustness checks with GDP per capita based on purchasing power parity (PPP) in constant 2005 international dollars. This indicator is available from 1980 onwards only. Data for both indicators are taken from the World Development Indicators (WDI 2010).

The second explanatory variable is "openness" as an indicator capturing potential effects of globalization. Openness is measured as the share of trade in GDP. Trade and GDP data are also from the World Development Indicators database (WDI 2010).

Third, to account for the impact of relative price effects we created a country-specific proxy for the relative price of beer to wine. There are no good price datasets available covering many countries and such long periods. The proxy variable we use is measured as the ratio of unit import prices for beer over wine. FAO data on import values and volumes for beer and wine are used (FAO

2010). We should emphasize that there may be endogeneity problems with this variable: countries with a high demand for beer are often countries where own beer production is high while wine is imported, which could be the reason for a lower relative beer-to-wine price. Hence, we should interpret the estimated coefficients of this variable with care – for several reasons.

Fourth, we use the minimum and maximum temperature and average rainfall as indicators for the environmental and climatic conditions which affect beer production. Country-level aggregated climate data are taken from the Tyndall Centre for Climate Change Research (Mitchell et al. 2004).

Fifth, we include a set of indicators to measure the impact of religion on beer consumption. Specifically, we use data on the share of different religions among the countries' population in the year 1970, taken from the Religion Adherence Database constructed by Barro and McCleary (2005). Since we expect religion to have an impact on the volume of alcohol consumption but not on the share of different types of alcohol, we include the religion shares only in the regression with 'beer consumption per capita' as the dependent variable.

Finally, to measure possible convergence effects we included a variable which indicates whether the country was initially a "beer-drinking country". A dummy (0-1) variable "beer-drinking country" equals 1 when the share of beer in total alcohol consumption was higher than that of wine and spirits in the first available data on the shares of different alcoholic drinks (WHO 2010). In the fixed effects analyses, this dummy is interacted with the openness variable.

Regression results

The results are presented in Tables 3 and 5 for the pooled OLS regressions and in Tables 4, 6 and 7 for the fixed effects regressions. Tables 3 and 4 have beer consumption per capita as the dependent variable. In Tables 5, 6 and 7 the dependent variable is beer as a percentage of total alcohol

consumption. The first column in each table shows the simple regression analysis with only per capita income and its square as explanatory variables. In the following columns other explanatory variables are added.

Our first important result is that we do indeed find an inverted-U shaped relation between income and per capita beer consumption in all pooled OLS ánd fixed effects specifications. From the pooled OLS regressions (Table 3), we find that countries with higher levels of income initially consume more beer. Yet, the second order coefficient on income is negative, indicating that from a certain income level onwards, higher incomes lead to lower per capita beer consumption. The first and second order effects for income are strongly significant and the coefficients are quite robust across the different specifications.

The fixed effects regression results confirm this (Table 4), so the non-linear relationship for income holds not only between countries, but also *within* individual countries over time. As a country becomes richer, beer consumption rises, but when incomes continue to grow, beer consumption starts to decline at some income level. We calculated the turning point, i.e. the point where beer consumption starts declining with growing incomes, to be approximately 22,000 US dollars per capita.

A similar non-linear relationship with income is found in the regressions with the percentage of beer in alcohol as the dependent variable (Table 4 and 6). So up to a certain income level, rising incomes correspond to a higher share of beer in the consumption of alcoholic drinks, but after that point the share of beer becomes less.

The coefficients for the globalization-indicator suggest that increased openness corresponds to higher beer consumption, but they are not significantly different from zero (Tables 3 and 4). We do find a significant effect of openness on the share of beer in total alcohol consumption (Table 5).

This share reduces with increased openness. In Table 6 we see that the interaction term of openness with the dummy indicating whether or not the country was initially "beer-drinking", has a significantly negative coefficient. If we divide the sample into a low income and a high income group (Table 7), we see that this effect is present in both income groups. This result partially confirms earlier studies stating that countries converge in their alcohol drinking patterns. In countries where beer was the most important alcoholic drink, increased openness is correlated with a fall in the relative importance of beer in alcohol consumption. However, we do not find a significant effect of increased openness on the share of beer for those countries where beer was initially not the most important alcoholic drink.

For the other variables the results are according to expectations. For the price of beer relative to wine a negative effect is found in the OLS regressions (Tables 3 and 4), which corresponds to the intuition that consumption of beer is lower when its price relative to a substitute – wine – is higher. As expected, a higher relative price of beer corresponds to a lower share of beer in total alcohol consumption. From the fixed effects regression we see that the evolution in the indicator of the relative price of beer and wine is not correlated with beer consumption over time (Tables 5 and 6).

The climatic variables indicate that beer consumption is higher where minimum temperatures are not too low and maximum temperatures not too high, corresponding to temperate climatic regions, though multicollinearity causes the effect to disappear once the variables on religion shares are inserted. The climatic variables do not seem to affect the share of beer in total alcohol consumption (Tables 3 and 4).

The importance of different religions also affects beer consumption. High shares of Jews and Muslims in a country correspond to lower levels of beer consumption, while countries with high percentages of Catholics and Protestants consume more beer (Table 3).

Robustness tests

In Table 8 and 9 we test whether the results hold for the different continents separately. In the pooled OLS regressions, we find the same inverted-U shape for the income variable for the continents separately as for the overall regression, except for Africa. In the fixed effects regressions, the coefficients have the expected signs for Europe, America and Asia, but are mostly not significantly different from zero if we use cluster-robust standard errors. Randomly joining these continents two by two does result in significant coefficients that are positive for the income variable and negative for its square[7]. For Africa results are different and beer consumption exponentially increases with income, which is probably related to the fact that income in African countries is still low.

We checked whether our results hold when using GDP per capita in PPP terms, which is a preferable income indicator but for which data is only available from 1980 onwards. In Table 10 we show the results from our main regression using GDP in PPP terms, instead of nominal GDP. In the first column, we show the results from the fixed effects regression with beer consumption as the dependent variable, which strongly confirm the existence of a non-linear relationship between income and beer consumption. In the second column the results from the fixed effects regressions with the share of beer in alcohol consumption as the dependent variable are reported. Also here we see a pattern of convergence: in countries that were initially "beer drinking", the share of beer in total alcohol consumption goes down with increasing globalization. Also the results from the pooled OLS-regressions using GDP in PPP terms as the income indicator are consistent with earlier results and can be found in Table A.2 in Appendix.

[7] Results are not shown but available upon request to the authors.

Conclusion

In this paper we study the evolution of beer consumption between countries and over time. An overview of the historic evolution of beer consumption in the world indicates that consumption of beer has changed importantly over time. Also over the past 50 years consumption patterns in beer have changed strongly, with decreasing consumption in the traditional “beer drinking nations” and strong growth in emerging economies.

We analyzed the determinants for beer consumption and estimate an empirical model to explain “what makes a country a beer drinking nation”. Our first empirical result is that the relationship between income and beer consumption is non-linear. Beer consumption initially increases with rising incomes, but at higher levels of income beer consumption falls with further income growth. Second, we find that in countries that were originally “beer drinking”, the share of beer in total alcohol consumption reduces with opening of trade and increasing globalization, while this is not the case in the “non-beer drinking nations”. These findings are partially consistent with the idea that there is convergence in the consumption patterns of alcoholic beverages, as suggested in the literature.

Finally, other factors that can explain the different levels of beer consumption between countries are the climatic conditions, the importance of different religions in the country and the relative price of beer to other alcoholic drinks.

References

Aizenman, J. and E. Brooks (2008). 'Globalization and Taste Convergence: The Cases of Wine and Beer'. *Review of International Economics*, 6: 217-233.

Akerlof, G.A. (1991). 'Procrastination and Obedience', *The American Economic Review*, 81/2: 1-19.

Akerlof, G. A. and R. E. Kranton (2000). 'Economics and Identity', *Quarterly Journal of Economics*, 115: 715-753.

Arora, A., A. Bhaskar, B. Minten and A. Vandeplas (2011). 'Opening the Beer Gates: How Liberalization Caused Growth in India's Beer Market', in: Swinnen, J. F. M. (ed.), *The Economics of Beer*, Oxford: Oxford University Press.

Bai, J., J. Huang, S. Rozelle and M. Boswell (2011). 'Beer Battles in China: The Struggle Over the World's Largest Beer Market', in: Swinnen, J. F. M. (ed.), *The Economics of Beer*, Oxford: Oxford University Press.

Barro, R.J. and R.M. McCleary (2005). 'Which Countries Have State Religions'? *Quarterly Journal of Economics* 120/4: 1331-1370.

Becker, G. S. and K. M. Murphy (1988). 'A Theory of Rational Addiction', *The Journal of Political Economy*, 96/4: 675-700.

Bentzen, J. and V. Smith (2009). *Developments in the Structure of Alcohol Consumption in OECD Countries*. Paper for the pre-AARES conference workshop, Adelaide, February 2010.

Commission for Distilled Spirits (2005). *World Drink Trends 2005*. World Advertising Research Center Ltd, UK.

Deconinck, K. and J. F. M. Swinnen (2011). 'From Vodka to Baltika: A Perfect Storm in the Russian Beer Market', in: Swinnen, J. F. M. (ed.), *The Economics of Beer*, Oxford: Oxford University Press.

FAOstat, Statistics of the Food and Agriculture Organization of the United Nations, http://faostat.fao.org, last accessed August 2010.

Fogarty, J. (2010). 'The Demand for Beer, Wine and Spirits: A survey of the literature', *Journal of Economic Surveys* 24/3: 428-478

Gallet, C.A. and List, J.L. (1998). 'Elasticity of Beer Demand Revisited', *Economics Letters*, 61/1: 67–71.

Larivière, E., B. Larue and J. Chalfant (2000). 'Modeling the demand for alcoholic beverages and advertising specifications', *Agricultural Economics*, 22: 147–162.

Lee, B. and V.J. Tremblay (1992) 'Advertising and the U.S. market demand for beer', *Applied Economics*, 24/1: 69–76.

Leifman, H. (2001). 'Trends in Population Drinking', in: T. Norström (ed.), *Alcohol in Post-War Europe: Consumption, Drinking Patterns, Consequences and Policy Responses in 15 European Countries*, Stockholm: National Institute of Public Health, 49–81.

McDevitte, W. A. and W. S. Bohn (1869). *Caesar's Gallic War*, translated from *De Bello Gallico*, Julius Caesar, New York: Harper & Brothers. Provided by The Internet Classics Archive at http://classics.mit.edu//Caesar/gallic.html.

Meloni, G. and J. F.M. Swinnen (2010). *The Political Economy of European Wine Regulation*, presented at the Fourth Annual Conference of the American Association of Wine Economists, UC Davis, California, USA on June 27, 2010.

Mitchell, T., T.R. Carter, P. Jones, and M. Hulme (2004). 'A Comprehensive Set of High-Resolution Grids of Monthly Climate for Europe and the Globe: The Observed Record (1901-2000) and 16 Scenarios (2001-2100)', *Tyndall Centre Working Paper 55,* Tyndall Centre for Climate Change Research, http://www.cru.uea.ac.uk/cru/data/hrg/.

Nelson, J. (2003). 'Advertising bans, monopoly, and alcohol demand: testing for substitution effects using state panel data', *Review of Industrial Organization*, 22/1: 1–25.

Nelson, M. (2005). *The Barbarian's Beverage. A History of Beer in Ancient Europe*. UK: Routledge.

Niskanen, W.A. (1962) *The demand for alcoholic beverages*. PhD thesis, University of Chicago, Department of Economics, Chicago, IL.

Nye, J. V.C. (2011). 'Brewing Nation: War, Taxes and the Growth of the British Beer Industry in the 18th and 19th Centuries', in: Swinnen, J. F. M. (ed.), *The Economics of Beer,* Oxford: Oxford University Press.

Okrent, D. (2010). *Last Call: The Rise and Fall of Prohibition*, New York: Scribner, Simon & Schuster.

Ornstein, S.I. and D.M. Hanssens (1985). 'Alcohol control laws and the consumption of distilled spirits and beer'. *Journal of Consumer Research*, 12/2: 200–213.

Persyn, D., J. F. M. Swinnen and S. Vanormelingen (2011). 'Belgian Beers: Where History Meets Globalization', in: Swinnen, J. F. M. (ed.), *The Economics of Beer,* Oxford: Oxford University Press.

Poelmans, E. and J. F. M. Swinnen (2011). 'A Brief Economic History of Beer', in: Swinnen, J. F. M. (ed.), *The Economics of Beer,* Oxford: Oxford University Press.

Stigler, G. J. and G. S. Becker (1977). 'De Gustibus Non est Disputandum', *American Economic Review* 67/2: 76-90.

Tremblay, C.H. and V.J. Tremblay (2011). 'Recent Economic Developments in the Import and Craft Segments of the U.S. Brewing Industry', in: Swinnen, J. F. M. (ed.), *The Economics of Beer,* Oxford: Oxford University Press.

Tremblay, V. J. and C.H. Tremblay (2005). *The US brewing industry: Data and economic analysis*, MIT Press Books.

Unger, R.W. (2004). *Beer in the Middle Ages and the Renaissance*, University of Pennsylvania Press.

WDI, World Development Indicators, http://databank.worldbank.org, last accessed August 2010.

WHO, World Health Organization, Global Alcohol Database, http://apps.who.int/globalatlas/default.asp, last accessed August 2010.

Table 1. Structure of the global beer market.

	1961		2005	
	billion liters	%	billion liters	%
US	11.2	26.01	25.81	16.86
Germany	6.79	15.77	8.45	5.52
UK	4.70	10.92	6.04	3.95
USSR/Russia[a]	2.69	6.25	9.12	5.96
France	1.71	3.97	1.67	1.09
Brazil	0.63	1.46	7.46	4.87
Belgium	0.61	1.42	1.06	0.69
China	0.15	0.35	31.76	20.74
India	0.01	0.02	0.26	0.17
Other countries	15.18	35.25	62.53	40.84
Total (World)	43.06	100	153.1	100

[a] The 1961 numbers are for the former Soviet Union, the 2005 numbers are for the Russian Federation. All countries that together composed the Soviet Union consumed 13.13 billion liters of beer in 2005, which corresponds to 5.58 % of global consumption.

Source: FAOstat (2010)

Table 2. Share of beer, wine and spirits in total alcohol consumption.

	1961			2005		
	beer	wine	spirits	beer	wine	spirits
US	**47.05**	11.15	41.79	**52.71**	16.04	31.25
Germany	**57.14**	17.32	25.54	**53.30**	26.99	19.71
UK	**80.95**	4.32	14.73	**45.35**	32.47	22.17
Czech Republic	**69.01**	19.05	11.94	**58.97**	16.15	24.88
Belgium	**71.28**	15.06	13.67	**56.83**	36.75	6.42
France	11.25	**74.41**	14.33	17.67	**62.28**	20.05
Spain	11.04	**65.39**	23.58	**47.98**	38.11	13.91
Greece	6.86	**86.14**	7.00	24.20	**49.61**	26.18
Russia	14.61	17.14	**68.26**	33.24	0.91	**62.66**
Poland	27.66	12.24	**60.10**	**55.65**	12.99	31.36
China	1.52	0.00	**98.48**	36.06	3.61	**60.34**

The **bold** numbers indicate which beverage has the highest share in total alcohol consumption. Based on this criterion we classify the country as a "beer-drinking", "wine-drinking" or "spirit-drinking country" in that period.

Source: WHO Global Alcohol Database (2010)

Table 3. Pooled OLS regression – Beer consumption per capita

Beer consumption per capita	(1)	(2)	(3)	(4)	(5)
GDP/cap	6.631***	6.689***	5.079***	5.092***	4.163***
(in 1000 USD)	(0.873)	(0.866)	(0.950)	(0.727)	(0.730)
(GDP/cap)^2	-0.125***	-0.127***	-0.0996***	-0.101***	-0.0840***
(in 1000 USD)	(0.0219)	(0.0218)	(0.0215)	(0.0160)	(0.0160)
Openness		0.0839			0.0736
		(0.0725)			(0.0504)
Relative price		-0.0713**			-0.0720**
		(0.0324)			(0.0299)
Minimum temperature			2.889*		1.603
			(1.556)		(1.586)
Maximum temperature			-3.606**		-1.985
			(1.429)		(1.468)
Annual precipitation			-0.00143		-0.00704
			(0.00382)		(0.00436)
% Catholics [a]				23.78***	24.95***
				(4.804)	(4.576)
% Protestants				52.75***	46.59**
				(17.73)	(18.99)
% Orthodox				26.59*	7.822
				(15.61)	(13.32)
% Jews				-31.37***	-30.73***
				(6.859)	(8.190)
% Muslims				-6.458*	-3.703
				(3.780)	(5.281)
Observations	3320	2854	3320	3320	2854
R^2	0.513	0.542	0.577	0.629	0.671

Cluster-robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[a] Percentage of population adhering the Catholic religion in 1970. Same for other religions.

Table 4. Fixed effects analysis – Beer consumption per capita

Beer consumption Per capita	(1)	(2)	(3)
GDP/cap	1.141*	1.131*	1.126*
(in 1000 USD)	(0.621)	(0.660)	(0.633)
(GDP/cap)^2	-0.0259**	-0.0255**	-0.0255**
(in 1000 USD)	(0.0116)	(0.0121)	(0.0119)
Openness		0.0140	0.0132
		(0.0176)	(0.0155)
Openness*			0.0148
Beer-drinking country			(0.133)
Relative price		-0.00286	-0.00288
		(0.00629)	(0.00631)
Observations	3731	2943	2943
R^2*(within)*	0.089	0.083	0.083

Year dummies included
Cluster-robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5. Pooled OLS regression – % beer in total alcohol consumption

% beer in total alcohol consumption	(1)	(2)	(3)	(4)
GDP/cap	0.00294	0.00171	0.0164***	0.0124***
(in 1000 USD)	(0.00444)	(0.00429)	(0.00419)	(0.00394)
(GDP/cap)^2	-0.0000449	-0.0000100	-0.000277***	-0.000196**
(in 1000 USD)	(0.000104)	(0.0000998)	(0.000101)	(0.0000928)
Openness		-0.000842***		-0.000585
		(0.000306)		(0.000359)
Relative price		-0.00103***		-0.000776**
		(0.000301)		(0.000325)
Minimum temperature			-0.0226	-0.0185
			(0.0150)	(0.0148)
Maximum temperature			0.0283**	0.0225*
			(0.0123)	(0.0125)
Annual precipitation			0.0000454	0.0000336
			(0.0000440)	(0.0000411)
Observations	3292	2803	3292	2803
R^2	0.003	0.019	0.087	0.066

Cluster-robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6. Fixed effects analysis – % beer in total alcohol consumption

% beer in total alcohol consumption	(1)	(2)	(3)
GDP/cap	0.00931**	0.00512*	0.00934**
(in 1000 USD)	(0.00372)	(0.00281)	(0.00395)
(GDP/cap)^2	-0.000231***	-0.000131**	-0.000239***
(in 1000 USD)	(0.0000739)	(0.0000567)	(0.0000753)
Openness		-0.0000106	0.0000138
		(0.000137)	(0.0000937)
Openness*			-0.00235**
Beer-drinking country			(0.00109)
Relative price		-0.000286	-0.000182
		(0.000232)	(0.000166)
Observations	3292	2803	2803
R^2	0.087	0.005	0.118

Year dummies included
Cluster-robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7. Fixed effects analysis – % beer in total alcohol consumption for two income groups

The sample is divided in two groups: the low income group contains the countries with an income of less than 5000 US dollar per capita in 2005, and the high income groups contains the countries with an income higher than that threshold.

% beer in total alcohol consumption	(1)	(2)
GDP/cap	0.0402	-0.00533
(in 1000 USD)	(0.0377)	(0.00453)
(GDP/cap)^2	-0.00296	-0.00000468
(in 1000 USD)	(0.00449)	(0.0000625)
Openness	0.0000551	0.000213
	(0.0000933)	(0.000656)
Openness*	-0.00257*	-0.00275**
Beer-drinking country	(0.00142)	(0.00117)
Relative price	-0.0000997	-0.0121
	(0.000138)	(0.0165)
Observations	1753	1050
R^2	0.180	0.184

Year dummies included
Cluster-robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8. Robustness check: Pooled OLS-regression per continent

This regression is based on specification (5) in Table 3.

Beer consumption/cap	(1) Europe	(2) America	(3) Africa	(4) Asia
GDP/cap	1.655**	3.164***	4.828	4.121***
(in 1000 USD)	(0.687)	(0.986)	(3.298)	(0.700)
(GDP/cap)^2	-0.0398***	-0.0735***	0.618	-0.0838***
(in 1000 USD)	(0.0128)	(0.0195)	(0.766)	(0.0162)
Openness	0.473***	-0.153*	-0.00100	0.0154
	(0.158)	(0.0853)	(0.00427)	(0.0432)
Relative price	-8.283	-3.907**	0.312	-0.0209
	(5.839)	(1.707)	(0.236)	(0.0160)
Observations	792	598	932	357
R^2	0.475	0.879	0.734	0.838

(Oceania and Middle East are not reported since they include only 2 and 5 countries respectively)
Cluster-robust standard errors in parentheses
$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This regression is based on specification (4) in Table 5.

% beer in total alcohol consumption	(1) Europe	(2) America	(3) Africa	(4) Asia
GDP/cap	0.00839**	0.0167	-0.141	0.0300*
(in 1000 USD)	(0.00363)	(0.0141)	(0.110)	(0.0162)
(GDP/cap)^2	-0.000198***	-0.000313	0.0441	-0.000740**
(in 1000 USD)	(0.0000692)	(0.000335)	(0.0275)	(0.000345)
Openness	0.00133*	-0.00135	-0.00104***	0.000443
	(0.000710)	(0.00180)	(0.000298)	(0.00140)
Relative price	-0.0662	-0.0617	0.00494	-0.000890**
	(0.0410)	(0.0388)	(0.0328)	(0.000392)
Observations	789	598	921	322
R^2	0.368	0.155	0.070	0.171

(Oceania and Middle East are not reported since they include only 2 and 5 countries respectively)
Cluster-robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Only coefficients for GDP per capita, openness and relative price are reported here. Variables on climate and religion are included in the regressions but not shown.

Table 9. Robustness check: Fixed effects regression per continent

This regression is based on specification (2) in Table 5.

Beer consumption per capita	(1) Europe	(2) America	(3) Africa	(4) Asia
GDP/cap (in 1000 USD)	1.363 (1.689)	1.129 (0.985)	0.468 (4.502)	1.864*** (0.539)
(GDP/cap)^2 (in 1000 USD)	-0.0304 (0.0232)	-0.0395** (0.0173)	1.669** (0.792)	-0.0333** (0.0130)
Openness	0.204 (0.209)	-0.0239 (0.0865)	-0.000847 (0.00314)	0.165* (0.0846)
Relative price	-0.795 (3.248)	-0.642 (0.586)	0.244* (0.130)	-0.00241 (0.00410)
Observations	792	598	932	357
R^2 *(within)*	0.154	0.371	0.321	0.390

(Results for Oceania and Middle East are not reported since they include only 2 and 5 countries respectively)
Year dummies included
Cluster-robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This regression is based on specification (2) in Table 6.

% beer in total alcohol consumption	(1) Europe	(2) America	(3) Africa	(4) Asia
GDP/cap (in 1000 USD)	-0.00482 (0.00426)	0.00335 (0.00848)	0.0463 (0.127)	-0.00499 (0.00608)
(GDP/cap)^2 (in 1000 USD)	-0.0000288 (0.0000568)	-0.0000324 (0.000177)	0.0136 (0.0216)	-0.0000950 (0.000108)
Openness	0.000894 (0.000690)	-0.000925 (0.00129)	0.000153 (0.000104)	0.00105 (0.00182)
Openness* Beer-drinking country	-0.00232** (0.000884)	-0.00365** (0.00171)	-0.00292* (0.00162)	-0.00487*** (0.00124)
Relative price	-0.0159 (0.0135)	-0.00911 (0.0136)	-0.0168 (0.0249)	-0.0000876 (0.000225)
Observations	789	598	921	322
R^2*(within)*	0.242	0.083	0.344	0.288

(Results for Oceania and Middle East are not reported since they include only 2 and 5 countries respectively)
Year dummies included
Cluster-robust standard errors in parentheses
$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

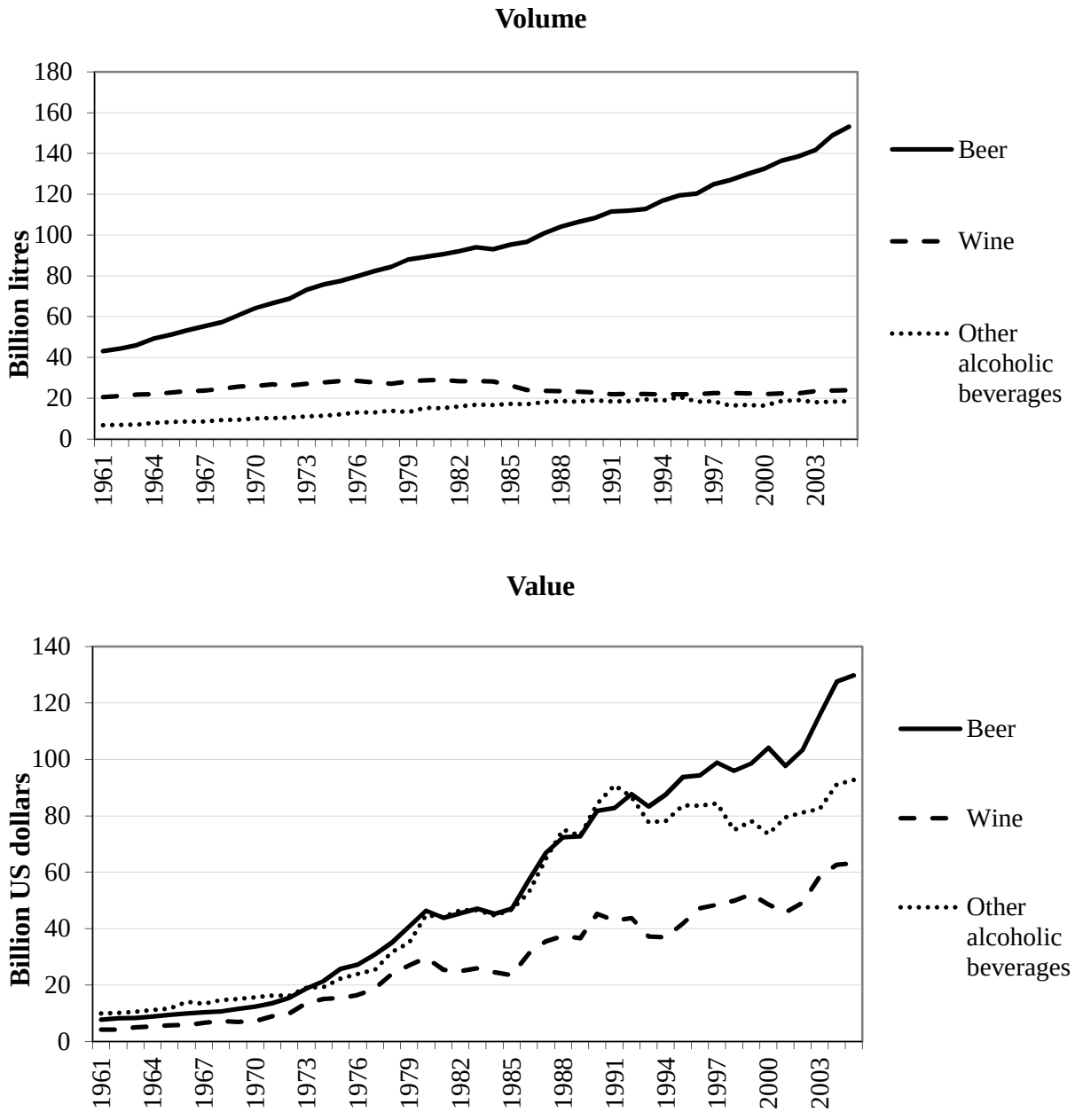
Table 10. Robustness check: Fixed effects regressions using GDP per capita based on PPP as income indicator

The regressions in the first and second column are based on specification (3) in Table 4 and Table 6 respectively. Instead of GDP in nominal terms, we use GDP per capita based on PPP, in constant 2005 international dollars as the income indicator. Data for GDP per capita in PPP terms is available only from 1980 onwards, while data on nominal GDP is available since 1970 for most countries in the sample.

	beer consumption per capita	% beer in total alcohol consumption
GDP/cap	5.299***	-0.0128
(in 1000 int. dollar)	(1.777)	(0.0109)
GDP/cap)^2	-0.0908***	-0.0000258
(in 1000 int. dollars)	(0.0248)	(0.000152)
Openness	0.0133	-0.000112
	(0.0104)	(0.000127)
Openness*	0.0294	-0.00236**
Beer-drinking country	(0.101)	(0.00118)
Relative price	-0.000110	-0.0000847
	(0.00452)	(0.000120)
Observations	2148	2107
R^2	0.173	0.156

Year dummies included
Cluster-robust standard errors in parentheses
$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

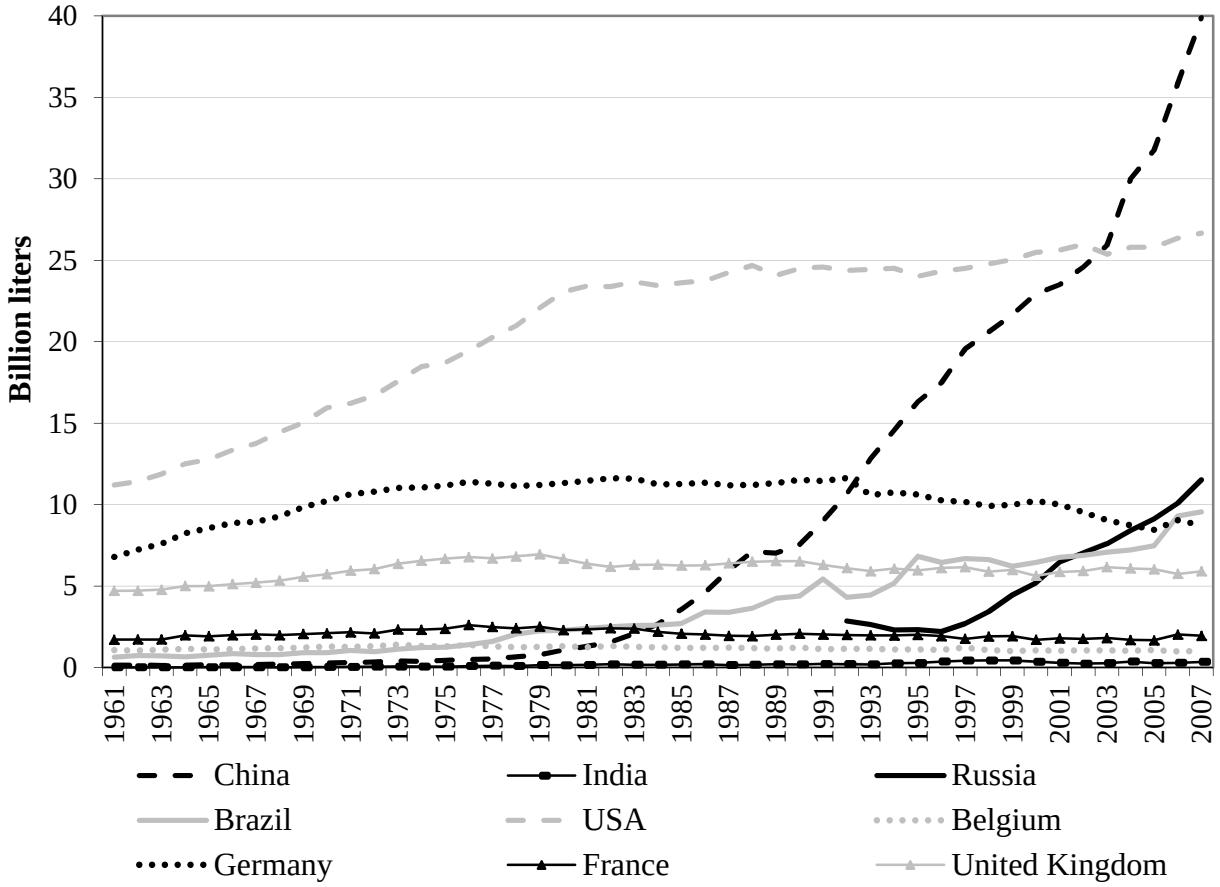
Figure 1. Global consumption of beer, wine and other alcoholic beverages in volume[(a)] (billion liters) and value[(b)] (billion US dollars), 1961-2005



Source : FAOstat (2010)

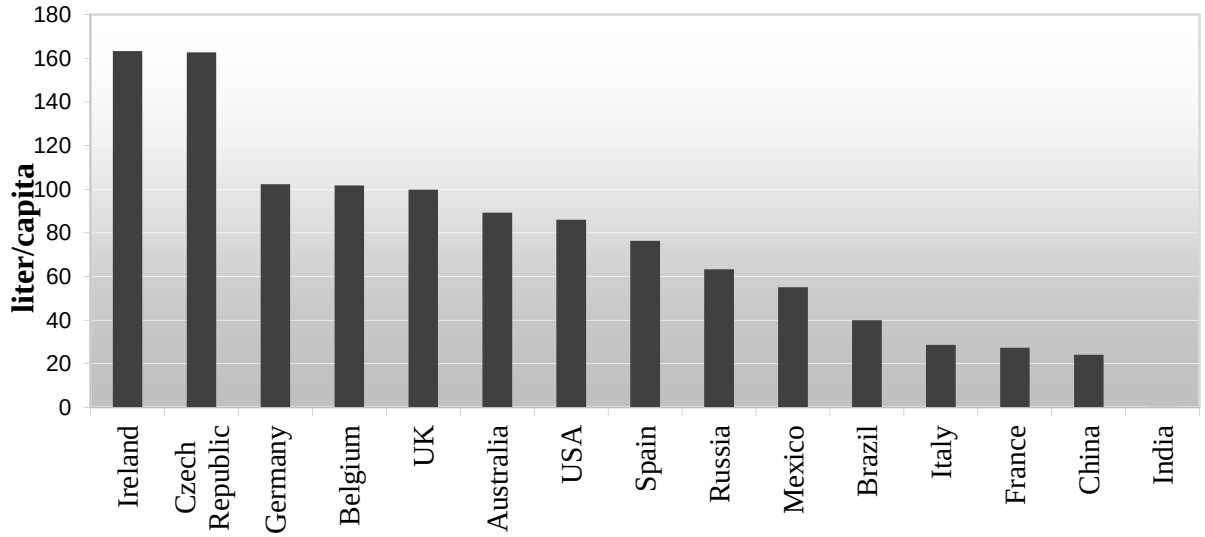
[(a)] Data on volumes in kg have been converted to liters, assuming 1 kg of liquid equals1 liter.
[(b)] Values are calculated using the average of global import and export prices (calculated from world trade value and volume) multiplied by volume.

Figure 2. Beer consumption in the world (billion liters), 1961-2007



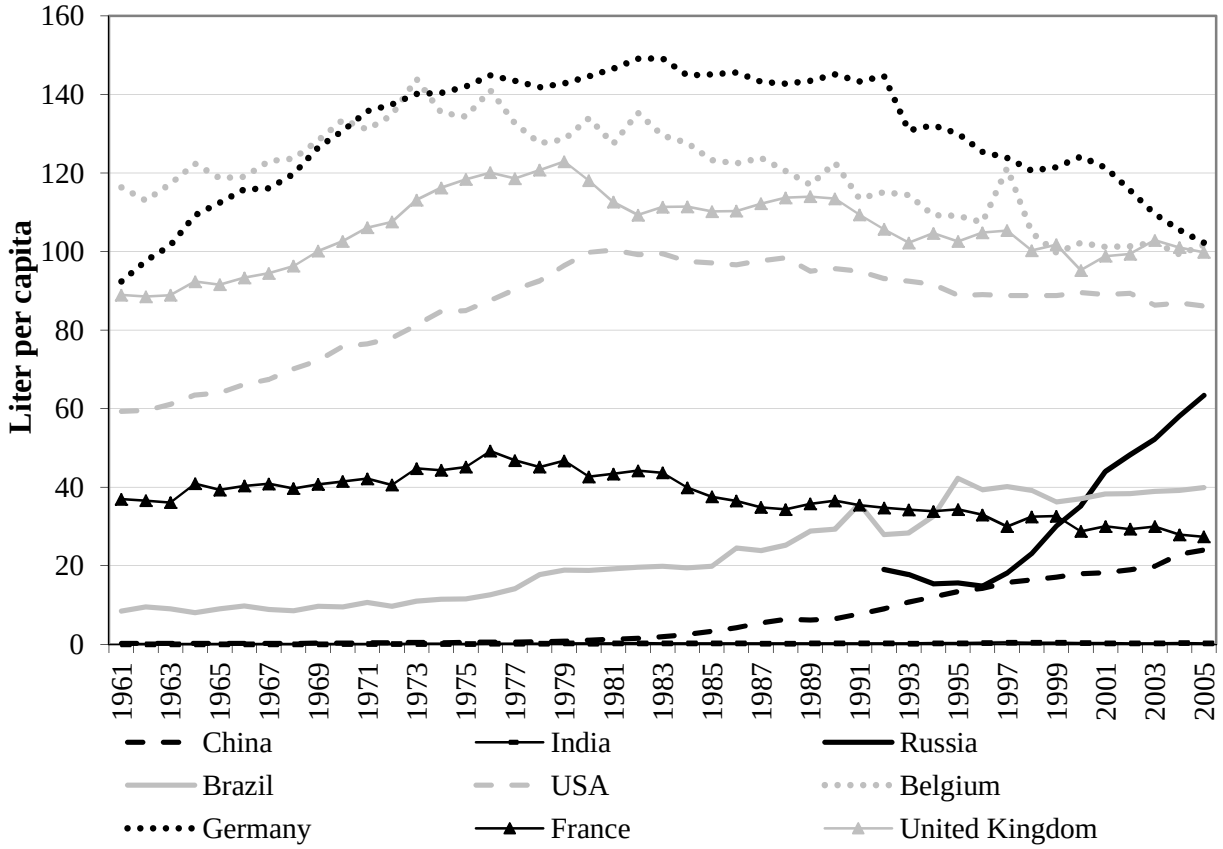
Source : FAOstat (2010)

Figure 3. Per capita beer consumption in 2005 (liter/capita)



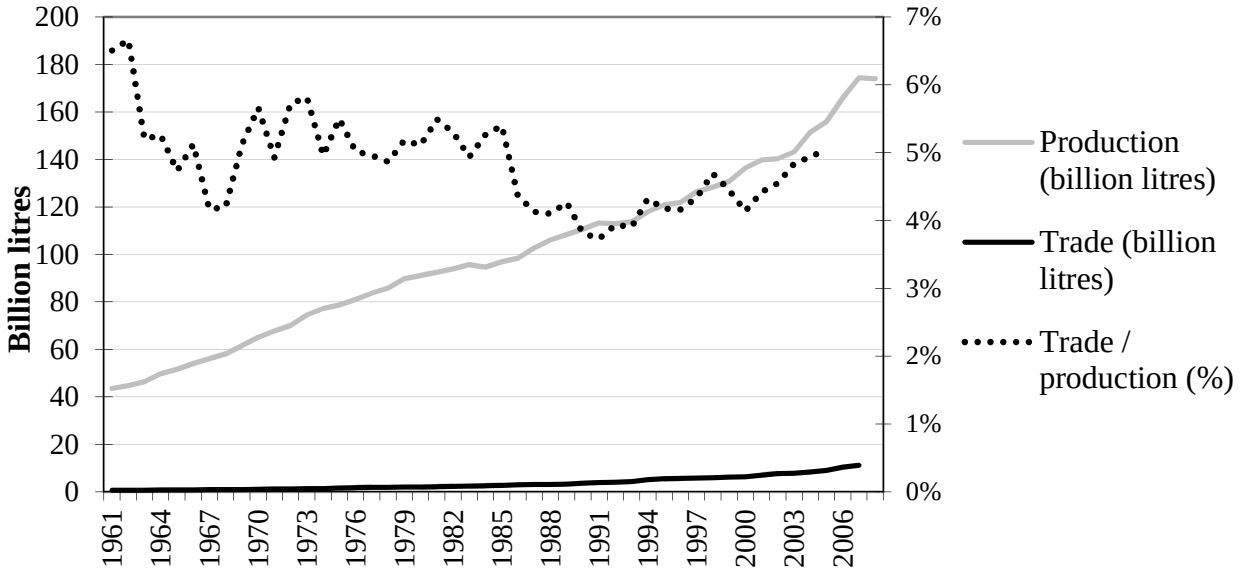
Source : FAOstat (2010)

Figure 4. Beer consumption per capita (liter/capita), 1961-2005



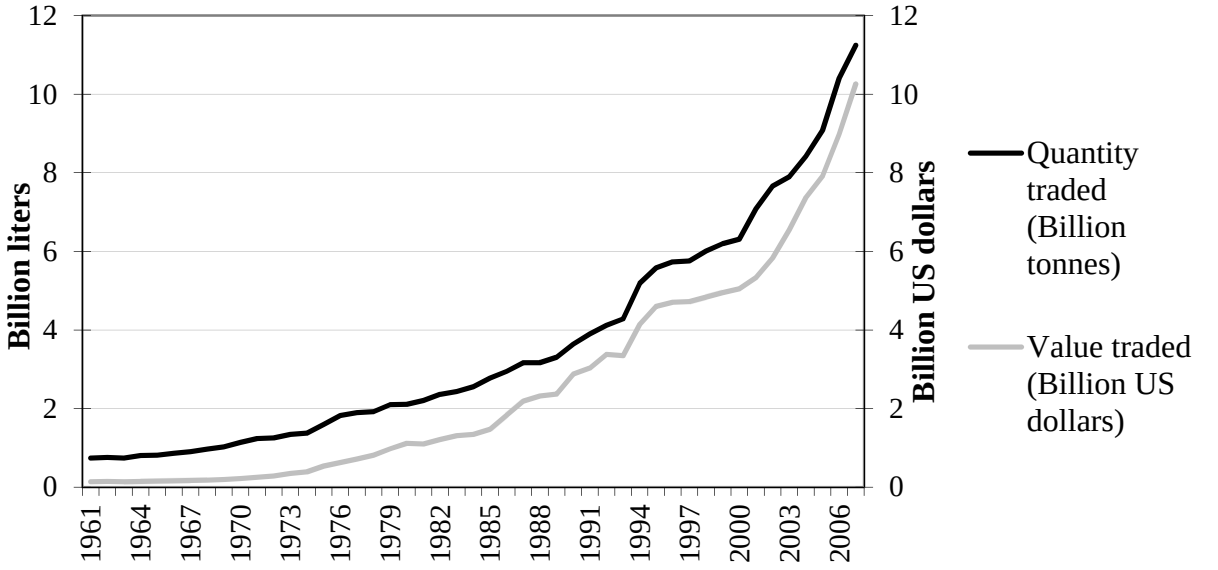
Source : FAOstat (2010)

Figure 5. Production and trade of beer in the world (billion liters), 1961-2007



Source: FAOstat (2010)

Figure 6. Volume and value of beer traded in the world (billion liters, US dollars), 1961-2007



Source : FAOstat (2010)

Appendix

Table A.2 Total and per capita beer consumption, total pure alcohol consumption per capita and beer consumption as percentage of total alcohol consumption per country in 2005

For each column, the 15 countries with the highest level for that variable are indicated in bold.

	1965					2005				
	Total beer consumption	**Beercons per cap**	**Total alcohol cons per cap**	**Share of beer in total alcohol consumption**	**Classification as " "-drining countriy**	**Total beer consumption**	**Beercons per cap**	**Total alcohol cons/cap**	**Share of beer in total alcohol consumption**	**Classification as " "-drinkint countriy**
Country	million liters	liters per cap	eq.liter alc per cap	%		million liters	liters per cap	eq.liter alc per cap	%	
China	154260	0.21	1.66	1.515152	spirits	**31759792**	24.05	32.11	36.05769	spirits
United States of America	**12770580**	**64.05**	72.37	45.81395	beer	**25809640**	**86.08**	97.75	52.71226	beer
Russian Federation	.	.	34.38	14.60507	spirits	**9116660**	63.33	81.13	34.33678	spirits
Germany	**8542644**	**112.46**	**128.82**	57.14285	beer	**8449973**	**102.24**	**133.01**	53.29906	beer
Brazil	**757612**	8.98	13.09	66.34616	beer	**7462116**	39.94	45.55	54.36893	beer
United Kingdom	**4993435**	**91.6**	**95.54**	80.94594	beer	**6036807**	**99.83**	**124.08**	45.35418	beer
Mexico	**1106130**	24.91	26.41	**97.69231**	beer	**5738973**	55.04	55.86	**78.1065**	beer
Japan	**2003163**	20.26	34.87	48.60558	spirits	**3864341**	30.21	46.07	31.97026	spirits
Spain	**735321**	22.94	**89.16**	11.03496	wine	**3309877**	76.27	**115.08**	47.98301	beer
Poland	**755787**	24.04	34.39	27.66296	spirits	**3006564**	**78.71**	92.77	55.64942	beer
South Africa	172001	8.68	63.07	18.30664	spirits	**2580030**	53.82	83.86	62.88	beer
Canada	**1341664**	**68.18**	73.07	63.16615	beer	**2437548**	75.53	103.7	53.24675	beer
Ukraine	.	.	.	.		**2169726**	46.25	59.66	31.7217	spirits
Australia	**1241978**	**107.76**	**115.71**	78.15482	beer	**1811786**	**89.21**	**114.48**	51.58371	beer
Italy	**526666**	10.11	**121.37**	3.094462	wine	**1681079**	28.67	76.51	20.28136	wine
France	**1916745**	39.31	**173.61**	11.25375	wine	**1668444**	27.36	92.77	17.67406	wine
Czech Republic	**1417339**	**152.65**	**167.03**	69.0093	beer	1659219	**162.8**	**180.28**	57.4224	beer
Colombia	**685357**	35.05	36.66	**100**	beer	1649038	36.69	40.29	64.0662	beer
Thailand	16066	0.5	1.97	3.305785	spirits	1598936	25.38	36.43	27.08978	spirits
Romania	274000	14.4	44.31	12.46719	wine	1400000	64.73	87.33	38.6148	spirits

Argentina	249146	11.18	**104.23**	5.085784	wine	1344960	34.71	64.58	32.63434	wine
Netherlands	466182	37.92	43.29	44.44444	spirits	1273469	**77.99**	101.17	49.47589	beer
Nigeria	69967	1.47	41.58	**92.42424**	beer	1179572	8.35	68.41	**94.73684**	beer
Belgium	**1114449**	**118.67**	**132.21**	71.2825	beer	1057437	**101.71**	**131.96**	56.8323	beer
Viet Nam	112922	2.96	3.9	29.62963	spirits	923957	10.87	15.28	**97.4138**	beer
Austria	**722945**	**99.43**	**133.38**	45.66869	beer	897698	**108.26**	**145.33**	54.03226	beer
Philippines	241306	7.64	9.92	38.78788	spirits	888592	10.51	15.34	30.56872	spirits
Turkey	76000	2.38	4.31	25.71428	wine	821022	11.25	12.32	59.54198	beer
Hungary	448800	**44.2**	79.7	30.22036	wine	720000	71.39	**111.33**	35.70275	wine
Peru	172626	15.05	24.53	44.22442	spirits	713456	26.16	31.82	69.90291	beer
Ireland	175927	**61.17**	67.18	74.93473	beer	676521	**163.29**	**183.92**	57.23577	beer
Portugal	47164	5.24	80.5	2.12766	wine	607971	57.75	**119.48**	32.13367	wine
Ethiopia	.	10.09	13.91	**100**	beer	598921	7.58	11.32	57.57576	beer
Denmark	382500	**80.39**	87.18	73.57143	beer	470000	**86.76**	**119.96**	44.89796	beer
Finland	117997	25.85	33.21	23.78049	spirits	466796	**88.98**	107.64	47.56477	beer
Chile	165000	19.08	74.06	19.44444	wine	449486	27.58	44.9	29.941	wine
Dominican Republic	20114	5.09	7.16	24.19355	spirits	438293	46.28	52.12	46.78261	spirits
Sweden	319580	**41.32**	52.43	39.02439	spirits	434475	48.07	65.67	39.39394	wine
Slovakia	423361	**97.3**	**138.897**	61.1967	beer	431000	**80.01**	95.53	35.4545	spirits
Kazakhstan	.	.	.	.	.	430494	28.3	34.41	27.34628	spirits
Bulgaria	175823	21.43	54.72	19.03448	wine	415928	53.7	72.71	32.53456	spirits
Switzerland	451987	**77.17**	**124.32**	38.19379	wine	411013	55.36	99.03	31	wine
Côte d'Ivoire	9128	2.13	21.35	32.20339	wine	408370	21.97	47.64	61.61616	beer
Greece	53975	6.31	38.63	6.855439	wine	397727	35.83	64.91	24.20242	wine
Angola	29558	5.37	28.27	17.85714	wine	378396	23.51	35.08	42.09302	beer
Croatia	.	.	.	.	.	351650	77.27	**108.56**	37.67179	wine
New Zealand	277488	**105.59**	**111.45**	76.83983	beer	314994	76.88	90.55	48.11765	beer
Belarus	.	.	.	.	.	312824	31.94	51.55	27.38096	spirits
Lithuania	.	.	.	.	.	300923	**87.86**	107.56	47.05882	beer
Kenya	41841	4.39	40.26	**88.30769**	beer	265911	7.47	16.13	61.31387	beer
Cuba	99300	12.49	14.68	45.33333	spirits	265346	23.57	29.99	33.10962	spirits
Paraguay	7825	3.59	11.2	49.29577	spirits	263564	44.64	53.95	55.94855	beer
India	17561	0.04	0.35	0	spirits	261843	0.23	1.11	10.34483	spirits
Ecuador	42500	8.26	9.49	46.85315	spirits	260715	19.96	21.42	56.65025	beer
Norway	103487	27.8	31.09	48.17708	beer	259255	55.89	75.3	47.60383	beer
Azerbaijan	.	.	.	.	.	250231	29.96	35.66	**87.5**	beer
Bolivia	24902	6.64	8.35	23.52941	spirits	222668	24.25	26.98	76.40845	beer

Egypt	20344	0.65	0.75	9.433963	spirits	199996	2.75	2.84	55.55555	beer
Cameroon	53257	8.81	48.88	83.16151	beer	197057	11.07	39.51	**97.61905**	beer
Slovenia	.	.	.	.	.	193760	**96.93**	**113.72**	38.93637	wine
Panama	29271	22.46	25.62	49.04632	beer	172972	53.52	56.29	63.52739	beer
Uganda	20454	2.55	**170.12**	.	.	145060	5.01	**122.68**	73.91304	beer
Latvia	.	.	.	.	.	144058	62.58	75.84	32.96804	spirits
Bosnia and Herzegovina	.	.	.	.	.	143577	36.67	53.63	23.02905	spirits
Indonesia	3728	0.04	0.08	0	spirits	138789	0.61	0.73	**100**	beer
Ghana	32220	3.94	16.05	**97.52066**	beer	131088	5.82	21.02	**80**	beer
Zimbabwe	11204	2.54	55.7	83.77823	beer	130921	9.98	29.12	**79.33885**	beer
Estonia	.	.	.	.	.	124627	**92.73**	**115.28**	34.97787	spirits
Uruguay	64600	23.99	58.35	24.8974	wine	122192	36.74	65.53	20.49307	wine
Algeria	38000	3.19	3.31	54.71698	beer	121095	3.69	3.73	**80**	beer
El Salvador	13345	4.43	6.58	21.76471	spirits	119667	17.95	21.5	35.34136	spirits
Honduras	18963	8.06	9.52	43.63636	spirits	109950	16.09	18.58	40.3125	spirits
Namibia	.	.	.	.	.	106908	52.93	61.1	70.96248	beer
Uzbekistan	.	.	.	.	.	97955	3.68	6.7	15.81921	spirits
Burundi	20000	6.23	87.79	**98.6755**	beer	97419	12.4	51.95	**99.1453**	beer
Guatemala	22624	4.78	7.5	18.58407	spirits	96215	7.57	9.69	47.65957	spirits
Israel	28092	10.96	22.58	22.96138	wine	94864	14.18	17.9	39.59184	spirits
Republic of Congo	.	.	.	.	.	88042	24.39	26.87	**94.11765**	beer
Morocco	39846	2.99	4.86	26.78572	spirits	75851	2.49	3.62	50	beer
Lao PDR	1533	0.68	6.45	1.515152	spirits	75632	13.35	20.05	24.48276	spirits
Mozambique	14486	1.71	8.48	11.56069	wine	73469	3.58	5.81	37.14285	spirits
Macedonia	.	.	.	.	.	68920	33.88	50.7	36.31669	beer
Madagascar	9059	1.49	6.65	5.042017	spirits	68205	3.66	4.5	44.15585	beer
Tunisia	37016	8	12.5	22.72727	wine	62756	6.21	6.81	63.80952	beer
Georgia	.	.	.	.	.	60839	13.6	18.79	18.31325	spirits
Jamaica	27882	15.84	17.98	60.86957	beer	57103	21.29	26.01	43.82353	spirits
Burkina Faso	3605	0.73	43.08	**97.11192**	beer	55675	4	55.72	44.56522	spirits
Zambia	22896	6.28	**113.94**	**98.69977**	beer	53565	4.67	27.04	60	beer
Benin	5000	1.97	7.9	52.22222	beer	52046	6.13	11.18	62.82051	beer
Sri Lanka	7248	0.66	1.08	16.66667	spirits	51412	2.69	2.94	5.714285	spirits
Moldova	.	.	.	.	.	51386	13.25	41.85	.	.
Albania	10600	5.67	7.13	48.07692	beer	48643	15.42	22.65	33.19588	spirits
Nicaragua	13805	6.73	11.05	16.87658	spirits	48424	8.86	10.81	30.45822	spirits
Luxembourg	46435	**115.47**	**128.49**	58.3452	beer	46694	76.72	**123.21**	13.5319	wine

Kyrgyzstan	.	.	.	.	.	44061	8.47	12.62	16.01423	spirits
Rwanda	10000	3.12	70.36	**100**	beer	42726	4.63	51.47	**98.18182**	beer
Myanmar	2510	0.11	0.77	2.5	spirits	39347	0.82	1.34	26.31579	spirits
Sierra Leone	4266	1.74	58.8	86.66667	beer	34171	6.12	44.73	**93.87755**	beer
Eritrea	.	.	.	**100**	beer	33800	7.47	10.14	69.1358	beer
Senegal	10610	2.81	4.74	30.76923	wine	32866	2.79	3.42	53.57143	beer
Togo	4062	2.36	34.78	83.06189	beer	32024	5.13	9.48	53.08642	beer
Malawi	2664	0.67	29.84	**99.4898**	beer	29004	2.19	12.35	38.88889	spirits
Nepal	.	.	.	.	.	26073	0.96	1.18	38.09524	spirits
Lebanon	7600	3.48	5.6	8	spirits	20186	5.03	9.58	21.17647	spirits
Central African Republic	10266	6.09	18.18	73.33333	beer	16315	3.89	19.03	**80.76923**	beer
Mongolia	1700	1.55	3.34	6.557377	spirits	15757	6.11	10	33.33333	spirits
Turkmenistan	.	.	.	.	.	14771	3.06	8.23	9.012876	spirits
Guinea	6500	1.89	1.95	**93.75**	beer	13446	1.49	1.62	77.27273	beer
Syrian Arab Republic	2950	0.55	0.69	35.71429	spirits	12308	0.65	0.89	3.809524	spirits
Chad	2361	0.71	3.86	55	beer	11110	1.1	3.13	**88.46154**	beer
Liberia	5659	4.7	6.34	24.18301	spirits	10446	3.04	7.32	8.645534	spirits
Armenia	.	.	.	.	.	8921	2.96	8.02	50.23924	beer
Yemen	44770	7.72	7.76	**96.8254**	beer	7711	0.37	0.39	.	.
Pakistan	5160	0.1	0.25	50	beer	6349	0.04	0.1	.	.
Tajikistan	.	.	.	.	.	6338	0.97	1.51	20.51282	spirits
Niger	1376	0.38	0.67	27.27273	wine	4746	0.36	0.45	55.55555	beer
Gambia	.	.	.	.	.	3092	1.91	32.66	65.51724	beer
Bangladesh	.	.	.	.	.	1360	0.01	0.02	.	.
Haiti	235	0.06	10.69	0	spirits	1300	0.14	8.26	0.191571	spirits
Mali	586	0.13	6.25	**95.83333**	beer	951	0.08	6.06	**87.5**	beer
Mauritania	.	.	.	.	.	21	0.01	0.03	0	spirits
Saudi Arabia	.	.	.	.	.	0		0	0	spirits
Sudan	7575	0.59	18.82	**97.54099**	beer	.	.	.	.	.

Source: FAOstat (2010) and WHO Global Alcohol Database (2010)

Table A.1 Robustness check: Pooled OLS regressions using GDP per capita based on PPP as income indicator

The regressions in the first and second column are based on specification (5) in Table 2 and specification (4) in Table 5 respectively. Instead of GDP in nominal terms, we use GDP per capita based on PPP, in constant 2005 international dollars as the income indicator. Data for GDP per capita in PPP terms is available only from 1980 onwards, while data on nominal GDP is available since 1970 for most countries in the sample.

	beer consumption per capita	% beer in total alcohol consumption
GDP/cap	4.485***	0.0105**
(in 1000 int. dollars)	(0.831)	(0.00529)
GDP/cap)^2	-0.0708***	-0.0000772
(in 1000 int. dollars)	(0.0214)	(0.000126)
Openness	0.0774	-0.000504*
	(0.0509)	(0.000283)
Relative price	-0.00555	-0.000559*
	(0.0251)	(0.000311)
Minimum temperature	1.117	-0.0231*
	(1.426)	(0.0125)
Maximum temperature	-1.000	0.0279**
	(1.277)	(0.0108)
Annual precipitation	-0.00507	0.0000406
	(0.00394)	(0.0000384)
% Catholics	12.38**	
	(6.192)	
% Protestants	27.32	
	(17.89)	
% Orthodox	-0.537	
	(16.78)	
% Jews	-54.46***	
	(11.94)	
% Muslims	-8.089	
	(5.418)	
Observations	2148	2107
R^2	0.733	0.096

Cluster-robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[a] Percentage of population adhering the Catholic religion in 1970. Same for other religions.