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Working Papers

Working Paper No. 0117

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March 2017

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^a The authors are grateful for financial support from the University of Adelaide's EU Centre for Global Affairs.

Abstract

With increasing globalisation and interactions between cultures, countries are converging in many ways, including in their consumption patterns. The extent to which this has been the case in alcohol consumption has been the subject of previous studies, but those studies have been limited in scope to a specific region or group of high-income countries or to just one or two types of alcohol. The present study updates earlier findings, covers all countries of the world since 1961, introduces two new summary indicators to capture additional dimensions of the extent of convergence in total alcohol consumption and in its mix of beverages, and distinguishes countries according to whether their alcoholic focus was on wine, beer or spirits in the early 1960s as well as to their geographic region and their real per capita income. Also, for recent years we add expenditure data and compare alcohol with soft drink retail expenditure, and we show what difference it makes when unrecorded alcohol volumes are included as part of total alcohol consumption. The final section summarizes the findings and suggests further research could provide new demand elasticity estimates and use econometrics to explain the varying extents of convergence over time, space and beverage type.

Keywords: Globalization of preferences; National beverage consumption mix; Beverage consumption intensity index; Alcohol consumption mix similarity index

JEL Classifications: D12; L66; N10

Convergence in National Alcohol Consumption Patterns: New Global Indicators

I. Introduction

With increasing globalization and interactions between cultures, countries are converging in many ways, including in their consumption patterns. This raises concerns when consumers in developing countries copy trends in high-income countries that are considered undesirable from such viewpoints as human health consequences. Tobacco and sugar are perhaps the most frequently mentioned items, as tobacco consumption globally has doubled since the early 1960s and sugar has increased by nearly half and is contributing to the spread of obesity. But the other item closely monitored by health authorities is the level of consumption of both alcoholic and sweetened non-alcoholic drinks. Producers of beverages also seek to monitor consumer trends. They focus not only on overall levels of consumption, but also on its composition or mix to ascertain changes in consumer preferences or behaviour.

The extent to which alcoholic beverage consumption patterns are converging across countries has been the subject of many previous studies. Examples since the new millennium include Smith and Solgaard (2000), Bentzen, Eriksson and Smith (2001), Aizenman and Brooks (2008) and Colen and Swinnen (2016). However, those studies have limited the scope of their analysis to a specific region or group of high-income countries, or to just one or two types of alcohol. The present study updates earlier findings, covers all countries of the world since 1961 and key high-income countries since 1888, introduces new summary indicators to capture several dimensions of the extent of convergence in total alcohol consumption and in its mix of beverages, distinguishes countries according to whether their alcoholic focus was on wine, beer or spirits in the early 1960s as well as their geographic region and their real per capita income. Also, for recent years we add expenditure data and compare alcohol with soft drink retail spending; and we show what difference it makes when unrecorded alcohol volumes are included as part of total alcohol consumption.

In exploring alcohol consumption trends in European countries from 1960 to 2000, Smith and Solgaard (2000) find that the market shares for traditional beverages declined. In

the Nordic countries, for example, the dominance of spirits in 1960 diminished as beer and wine shares grew over those four decades. Bentzen, Eriksson and Smith (2001) use time series techniques to study alcohol consumption convergence in a number of European countries. They conclude from their unit root tests that differences in total alcohol consumption levels are diminishing. Aizenman and Brooks (2008) studied convergence during 1963 to 2000 across a larger sample of countries that included OECD and middle-income countries, but only for beer and wine. Colen and Swinnen (2016) analyse mainly beer but also wine consumption across a large sample of both high-income and developing countries. Echoing the conclusions of Smith and Solgaard (2000), they 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. They also show that beer consumption increased in developing countries with rising incomes but fell once higher levels of income were reached. However, spirits were omitted from their analysis.

The present paper first describes the data sources to be used. It then suggests a number of ways to indicate convergence over time in both total recorded alcohol consumption and in the mix of beverages. The main section then presents findings based on annual data assembled for a large number of countries and regional residual country groups spanning the world from 1961 to 2014 and for some high-income countries back to the late 19th century. The results from 1961 are shown also for groups of countries whose earlier focus was either wine, beer or spirits, as well as for various regions of the world and by per capita real income. Also shown is the relative importance of alcoholic versus various non-alcoholic drinks in total beverage consumption volumes and expenditure since 2001. Estimates of unrecorded alcohol consumption for the years 2000, 2005 and 2010 are then used to test the robustness of the convergence findings when these estimates are included as part of total alcohol consumption. The final section summarizes the findings and suggests further research could provide new demand elasticity estimates and use econometrics to explain the varying extents of convergence over time, space and beverage type.

II. Data Sources

The wine, beer and spirits consumption volume data in this study are sourced from two new annual databases: one that includes wine, beer and spirits volumes and stretches from 2014 back to the 1880s for eleven high-income countries and back to 1961 for all other countries

(Anderson and Pinilla 2017), and another that includes wine, beer and spirits average consumer expenditure data compiled for all countries back to 2001 and for some high-income countries back to the 1950s (Holmes and Anderson 2017).

The longer time series on volumes consumed (in litres of alcohol or LAL)¹ from 1961 includes 48 important wine-producing and/or wine-consuming countries plus five residual regions (treated here as five extra ‘countries’) which together make up the world. That database has a full panel of data for the period 1961 to 2014 apart from Croatia, Georgia, Moldova and Ukraine, data for which became available only after the breakup of the Soviet Union. The shorter times series (2001 to 2015) is available from Euromonitor International (2016) for 80 countries plus, again, five residual regions.

To estimate average prices for wine, beer and spirits for each of the countries that have expenditure data, we simply divide expenditure by the consumption volume. The value data are expressed in current US dollars converted from local currencies using each country’s annual average nominal exchange rate.

Euromonitor International (2016) also provides soft drink volume and expenditure data from 2001, and total expenditure on all products. Other key statistics used include ones compiled from the World Health Organization (WHO 2015) and, in the case of our proxy for real per capita disposable income back to 1961, the Maddison GDP estimates in 1990 International Geary-Khamis dollars.²

All the consumption data mentioned above refer only to what has been recorded by national governments. There is an additional amount of alcohol produced and consumed each year that is not recorded. WHO (2015) reports estimates of that unrecorded alcohol consumption volume for 98 countries for the three years 2000, 2005 and 2010. These are used to test, in Section V below, the robustness of our findings on convergence in recorded alcohol consumption levels and mixes.

¹ The average alcohol content by volume is assumed to be 4.5% for beer, 12% for wine and 40% for spirits. Ready-to-drink spirits mixers are converted to spirits assuming their alcohol content is 5%. Throughout, ‘wine’ refers to grape wine. Wine from others fruits is very minor in almost all countries. Rice ‘wine’, which is made in many Asian countries but each under a different name (sake in Japan, miju in China, cheongju in Korea, ...), is included in the spirits category: even though rice wine is fermented, it looks like a clear spirit, is brewed differently than beer, and is typically at least 15% alcohol.

² The Maddison numbers, from www.ggd.net/maddison/maddison-project/data.htm, have been updated to 2015 by taking the latest PPP estimates in 2011 dollars from the World Bank’s International Comparison Project at <http://icp.worldbank.org> and splicing them to the Maddison series.

III. Indicators of Convergence

To study convergence across countries in national alcohol consumption volumes and beverage mixes, we employ a number of different indicators. One is simply the coefficient of variation across countries each year. Then two indexes developed by Anderson (2014a) to study winegrape varietal patterns across countries and regions are adapted to beverage consumption to measure convergence over time in national beverage consumption mixes towards the (changing) world average mix.

A. Coefficient of variation

The coefficient of variation can be calculated across countries each year for total alcohol consumption volume, and for the share of each of the three main beverage types in the total volume of recorded alcohol consumption. The coefficient of variation (CoV) measures the concentration of data around the mean value: if it declines over time this serves as a simple indicator of cross-country convergence. It is calculated for each year by taking the level of consumption per capita across countries and dividing the standard deviation of the series, σ_t , by the mean value of the sample, \bar{X}_t :

$$CoV_t = \frac{\sigma_t}{\bar{X}_t} \quad (1)$$

B. Beverage consumption intensity index

The beverage consumption intensity index indicates the importance in a particular year of one type of alcoholic beverage in a country's alcohol consumption relative to the average share of that beverage in alcohol consumption by all countries of the world. We thus define the consumption intensity index for country i as:

$$V_{in} = \frac{f_{in}}{f_n} \quad (2)$$

where there are $i = 1, \dots, 53$ (or 85) countries, and $n = 1, 2, 3$ beverages corresponding to wine, beer and spirits. We define f_{in} as the fraction of wine, beer or spirits consumption in total national alcohol consumption volume or expenditure in country i such that $0 \leq f_{in} \leq 1$ and

$\sum_{n=1}^3 f_{in} = 1$. This is divided by the fraction for that same beverage in world total alcohol consumption, f_n , with $0 \leq f_n \leq 1$ and $\sum_n f_n = 1$. For brevity we tabulate weighted averages of intensity indexes for groups of countries, using as weights each country's consumption of that beverage as a fraction of the group's total consumption of that beverage.

C. Alcohol consumption mix similarity index

The similarity index is a variant of an index developed by Anderson (2014a) that in turn was adapted from one introduced by Griliches (1979) and Jaffe (1986). Anderson (2014a) uses it to measure the extent to which the winegrape varietal mix in the vineyards of one region or country matches that of another region or country or the world. Here we adapt it for the purposes of comparing the beverage consumption mix of any one country with that for any other country or the average for the world.

The index uses vector representation to project combinations of variables with lengths determined by the shares of wine, beer and spirits in a country's total alcohol consumption volume or expenditure. The vector f_{im} is again the fraction of beer, wine or spirits consumption in the national alcohol consumption volume or expenditure in country i , such that these fractions are between 0 and 1 and sum to 1. The index is defined as:

$$\omega_{ij} = \frac{\sum_{m=1}^M f_{im} f_{jm}}{\left(\sum_{m=1}^M f_{im}^2 \right)^{1/2} \left(\sum_{m=1}^M f_{jm}^2 \right)^{1/2}} \quad (3)$$

where $i = 1, \dots, 53$ (or 85) countries, $j = 1, \dots, 53$ (or 85) countries, and $m = 1, 2, 3$ beverages corresponding again to wine, beer and spirits and so $M = 3$. This makes it possible to indicate the degree of beverage mix "similarity" of any pair of countries. The index also can be generated for each country relative to the average of a sample of countries or of all of the world's N countries. In short, ω_{ij} measures the degree of overlap between f_i and f_j . The numerator of Equation (3) will be large when i 's and j 's beverage mixes are very similar. The denominator normalizes the measure to unity when f_i and f_j are identical. Hence, ω_{ij} will be close to 0 for pairs of countries with little similarity in their beverage mix, and 1 for pairs of countries with identical beverage consumption mixes. For cases in between those two extremes, $0 < \omega_{ij} < 1$.

This index is conceptually similar to a correlation coefficient. Like a correlation coefficient, it is completely symmetrical in that $\omega_{ij} = \omega_{ji}$. Thus the results can be summarized in a symmetrical matrix plus a vector that reports the index for each country relative to that for the world (as reported in Holmes and Anderson 2017).

In a hypothetical two-beverage case, where country i has 50% of its alcohol consumption consisting of beer and country j has 30%, then the index of consumption similarity is the cosine of the angle between the two vectors in Figure 1. Therefore, differences can be judged by the angular separation of the vectors f_i and f_j for the two countries (Jaffe 1986).

It is possible to generate the similarity index for groups of countries by again using as weights each country's consumption of that beverage as a fraction of the group's total consumption of that beverage.

IV. Findings

In this section, we examine two types of convergence across countries in their alcohol consumption patterns: in the aggregate level of alcohol consumed per capita per year, and in the mix of wine, beer and spirits. The volumes of consumption, measured in litres of alcohol, are compared where possible with values of consumption, since the latter also incorporate changes in prices paid by consumers, for example because of a desire for higher-quality beverages or a change in relative excise taxes.

Before examining our convergence indicators, it is worth reflecting on why consumption patterns might differ. If all products could be traded costlessly around the world, and there were no government interventions such as consumption (excise) or trade taxes or differences in value added tax rates across jurisdictions, then the retail prices of each type of beverage would be identical throughout the world. According to Stigler and Becker (1977), the key reason then for major differences in alcohol consumption patterns would be differences in per capita incomes. If all beverages were normal goods, we might then expect convergence in the level and mix of alcoholic (or indeed all) beverages consumed as convergence across countries occurs in national average per capita incomes (which has been happening in recent decades – see, for example, Baldwin 2016).

In reality, costs of trading beverages across national borders are not zero (even though they have declined greatly over the past 150 years), which means countries have

tended in the past 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 the 30° to 50° latitude range near maritime weather influences. Nor are excise and import taxes on beverages similar across countries and they vary greatly across beverage types too (Anderson 2010, 2014b), in some cases to protect local producers and so reinforcing climate-induced differences. Value-added taxes also vary across countries. Moreover, temperance movements have had different effects on the social acceptability of alcohol consumption at different times in various places (see, for example, Wilson 1940, Briggs 1985, and Pinney 1989, 2005). So too have concerns about human health: as per capita incomes rise, people can afford to spend more on alcohol consumption but 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. Given all the above possible influences on beverage consumption patterns, it would not be surprising if convergence in those patterns was not evident in the data.

A. Alcohol consumption and income

One way to begin to look for convergence in alcohol consumption patterns is to plot consumption per capita against real income per capita. That is done in Figure 2 for our 53 countries and residual regions spanning the world from 1961 to 2014, for the volume of total alcohol consumption as well as for each of wine, beer and spirits. Those charts suggest the volume of consumption first tends to rise with per capita incomes but then falls. This is the case for each of the three beverages. The peak consumption occurs at a real per capita income (in 1990 International Geary-Khamis dollars) of \$16,900 in the case of all alcohol. That is just slightly above the average per capita income of Western Europe in 1990. The peak consumption occurs at \$15,100 for wine, \$18,100 for beer, and \$16,350 for spirits. These inverted U-shaped figures suggest that income convergence alone (the gradual catching up of developing countries to the per capita incomes of high-income countries) would not necessarily lead to convergence in alcohol consumption patterns based on per capita volumes.

B. Long-term trends in alcohol consumption per capita, total and by type

Trends in the volume of total alcohol consumption per capita and in shares of overall alcohol consumption volume due to wine, beer and spirits are shown in Tables 1 and 2 for a sample of high-income countries for which we have data from the late 19th century, and in Table 3 for all of the world's 53 countries/regions since 1961. For the larger set of countries, consumption-weighted averages are shown for 7 regions and for the world as a whole in the final rows of Table 3.

In terms of total alcohol consumption, for the majority of the eleven countries in Table 1 with data back to the 19th century, their consumption was greater in the 1960s than around 1890. For all but France and Italy consumption rose even more by the 1980s; but then for all eleven countries their total alcohol consumption per capita fell over the subsequent three decades to well below the unweighted average in the 1970s and 1980s. Even in the global database, which includes numerous developing and transition economies, their weighted average was almost the same in 2010-14 as it was in 1961-64 (last row of Table 3) – having been higher than both of those period averages in each of the intervening decades. This is consistent with the inverted U-shaped trend of Figure 2(a).

As for the mix of alcohols, Table 2 shows that it was very different across the eleven high-income countries up to the 1960s, especially with respect to wine which ranged from 2% to 87% of all national alcohol sales during 1961-64 but also for beer (3-81%) and Spirits (10-78%). By 2010-14 the ranges had narrowed somewhat for beer (19-53%) but less so for wine (5-59%) and hardly at all for spirits (11-74%).

The mix across the global database changed very substantially over the past 55 years: wine's share more than halved from 34% to 15%, beer's rose by more than one-third from 29% to 42%, and spirits' rose but only a little from 37% to 43% (final row of Table 3). For eleven countries wine remained the main alcohol, for twelve countries beer continued to dominate, and for ten countries spirits retained the largest share (see the bold numbers in Table 3).

However, it is not possible to conclude from simply observing these per capita volume trends whether alcohol consumption patterns are converging across countries. Hence the need for better indicators, to which we now turn.

C. Coefficient of variation

Since 1961, the coefficient of variation has fallen for all three beverage groups, which implies some convergence. This can be seen in Figure 3, where the coefficient of variation across the full set of countries is shown for the per capita total volume of alcohol consumption and for the shares of wine, beer and spirits in that total for each country. The coefficient for the total volume of alcohol consumption has nearly halved over that half-century, declining steadily throughout the period. There is very little decline in the coefficient for the share of spirits, but there is a very steep decline for beer (falling from 0.8 to 0.4), while that for wine falls by more than one-quarter.

D. Beverage consumption intensity index

To examine trends in the beverage consumption intensity (and mix similarity) indexes, it is helpful to divide into groups our 48 countries plus one residual sub-group of countries for each of five geographic regions (called ‘countries’ too hereafter, for simplicity), so a total of 53. Two groupings are used here. One is according to which of the three beverages has the highest share of the volume of alcohol consumption in 1961-64. It turns out those three groups have almost the same number of countries (19 wine-focused and 17 each for beer-focused and spirits-focused, see footnote b of Figure 4). The other grouping is according to geography, with six regions identified. Those regions have a varying number of countries, ranging from 17 for Western Europe to 11 for Asia, 9 for Eastern Europe and Central Asia, 6 for Latin America, 6 for Africa and the Middle East, and 2 for North America. One ‘country’ in all but the last of those regions is the weighted average of all countries in the region that have not been separately identified. Australasia is omitted for space reasons.

The decrease in the share of wine in the overall volume of global alcohol consumption has been faster than the decrease in wine’s share of consumption in a number of wine-focused countries, so that country group’s wine consumption intensity index has risen over the past half-century, from 2.2 to around 3.0. That group’s spirits intensity index has not risen much (at around 0.5), but its beer intensity index has nearly doubled, from less than 0.4 to 0.75 (Figure 4(a)).

For the beer-focused countries, their beer intensity index has nearly halved, from close to 2.0 down to 1.2, while their wine intensity index has trebled and is now slightly above that for beer, and their spirits intensity index has fallen from just below a little further below 1.0 (Figure 4(b)).

For the spirits-focused countries, their spirits intensity index has nearly halved in falling to 1.25, their beer intensity index has risen from 0.5 to 0.9, and their wine intensity index trend has remained flat at a little below 0.5 (Figure 4(c)).

Turning to the regions (Figure 5), the clearest convergence on intensity indexes of unity for the three beverages is found in Eastern Europe, and the next clearest region is North America. In Western Europe, by contrast, the beer and spirits intensity indexes have changed little from around 1.0 and 0.5, respectively, while the wine intensity index has risen from 1.6 to 2.7. The indexes for Africa/Middle East also have diverged, with beer's rising further above 1.0 and spirits' falling further below 1.0 while wine's remains just below 1.0. In Latin America, wine and spirits have converged to just below 1.0 (wine from above, spirits from below) while beer has risen from 1.0 to 1.5. And in Asia, beer's index has doubled to 0.8, the spirits index has fallen from 2.4 to 1.5, and the wine index has risen from almost zero to 0.2.

These volume indexes suggest there are still major differences across these region of the world in their consumers' beverage focus based on volumes. But what do value-based indexes suggest, given that, as shown in Figure 6, tax-inclusive retail prices of alcoholic beverages vary enormously across those regions? We do not have expenditure data for all countries for the 20th century, but we do have them for recent years. Table 4 shows the differences by region between the consumption volume and value intensity indexes for the period 2013-15. For three of the regions (Western Europe, Eastern Europe and North America), all three value intensity indexes are closer to unity than are their volume indexes; for two regions (Australasia and Africa/Middle East), two of the three value indexes are closer to unity than are their volume indexes; 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.

E. Alcohol consumption mix similarity index

The alcohol consumption mix similarity indexes for various country groups are plotted in Figure 7. The beer- and spirits-focused countries converged rapidly towards the world average (that is, the indexes approached 1.0) from the early 1960s to the mid-1980s, and then more slowly during the past two decades. By contrast, the consumption mix similarity index for the wine-focused countries has not converged over this period. This again reflects

the fact that many of the wine-focused countries have reduced the share of wine in their consumption mix less than has occurred in the rest of the world. This is the same conclusion that was reached above by inspecting the intensity index for wine-focused countries in Figure 4(a).

The same convergence toward unity in consumption mix similarity indexes is evident when countries are differentiated by geographic region, as in Figure 7(b). The convergence has been fastest for Asia and Latin America, albeit from a low base, but it is also evident for the other five regions – including North America and Eastern Europe, even though their indexes were already above 0.9 in the 1960s.

Even over the relatively short period of the 21st century for which we have data for 80 countries plus the 5 residual regions, it is evident from Figure 8(a) that the distribution of similarity indexes is becoming more skewed over time toward unity.

The volume-based distributions are comparable with those for value-based similarity indexes for the same three five-year periods. The latter distributions are even more skewed toward unity than the volume-based similarity indexes (compare Figures 8(a) and 8(b)). Together these findings indicate a general if not rapid global convergence in national beverage mixes.

F. Alcohol consumption and aggregate expenditure

The moderating impact on indicators of the differences across countries in retail prices of alcoholic beverages (both absolute and relative, see Figure 6) suggests the need to re-visit the finding from Figure 2 of an inverted U-shaped relationship between national per capita alcohol consumption volume and real GDP per capita. This is done for our larger sample of 85 countries for the years 2001 to 2015 in Figure 9, for both volumes and values of total alcohol consumption per capita which are plotted against aggregate expenditure per capita in 2015 US dollars. An inverted U-shape prevails for volume but not for value of alcohol consumption as national aggregate expenditure rises.

Also revealed in Figure 9 is the wide variance in per capita alcohol expenditure across equally affluent countries. Partly that is due to differences across countries in value-added or goods-and-services taxes and in alcohol excise or consumption taxes (Table 5).

When the expenditure data are disaggregated into the three beverage types, Figures 10(a) and 10(b) reveal that both wine and beer expenditures rise with aggregate expenditure. However, Figure 10(c) suggests expenditure on spirits peaks at an aggregate

national expenditure level of US\$27,800 per capita (in 2015 dollars) and declines thereafter.

G. Alcoholic versus non-alcoholic beverages

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 widely across regions though (Table 6). This is in part because again retail prices vary between countries: for all soft drinks they 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 degree of substitutability between alcoholic and soft drink consumption also may vary across countries. So too does the availability of low-cost reticulated potable water. These facts suggest further reasons to expect differences across countries in alcohol consumption volumes and mixes.

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). That difference between the volume and value increases for alcohol consumption is not inconsistent with the findings of the previous sub-section in which the volume of alcohol consumption traces a much more-pronounced inverted U-shape as total expenditure rises than does the value of alcohol consumption.

V. Robustness test

It needs to be kept in mind that all the consumption data reported above refer only to what has been recorded by national governments. There is an additional amount of alcohol produced and consumed each year that is not recorded. WHO (2015) has compiled estimates of those amounts for 98 countries for 2000, 2005 and 2010.

Evidently, the share of unrecorded in total alcohol consumption declines with real GDP per capita (Figure 11 and Table 7).³ This exposes another aspect of convergence across countries in alcohol consumption, namely, in the share of national consumption that is unrecorded, which converges toward zero as per capita incomes grow.

Another implication of this phenomenon is that the inverted U-shaped relationship between per capita alcohol consumption and real GDP per capita is flatter once unrecorded consumption is included, as shown by the quadratic fitted regression lines in Figure 12 for the three years and 98 countries for which estimates are available.

A more-specific implication is that the share of wine in total alcohol consumption globally is lower than its share of recorded alcohol consumption, since very little of that unrecorded alcohol is wine.⁴ But as Figure 13 shows, when unrecorded consumption is included, the quadratic fitted regression line tracing wine's share of total alcohol consumption against real GDP per capita tends to plateau rather than turn down at high per capita income.

VI. Conclusions

The above global data show big changes in national, regional and global alcohol consumption patterns. At the global level it was noted that during 1961-2014, wine's share of the total volume of alcohol consumption more than halved from 34% to 15%, beer's rose by more than one-third (from 29% to 42%), and spirits' rose but only a little (from 37% to 43%). That reveals a trend away from equal global shares of the three beverages. At the national level, the above analysis provides a number of indicators of convergence in national alcohol consumption patterns toward that changing global average mix, but also some anomalies. Key findings include the following:

- The *volume* of total alcohol consumption per capita first rises as per capita income rises, but beyond a threshold income level it falls

³ That share declined globally by one-eighth over the first decade of this century, and by 2010 was just under 25%.

⁴ The exceptions are a dozen transition economies of Eastern Europe: Albania, Armenia, Azerbaijan, Bosnia & Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Moldova, Romania and Slovenia.

- However, that inverted U-shaped curve is flatter for per capita *expenditure* on alcohol (at least for 2001-15), and when unrecorded consumption is taken into account by adding it to recorded consumption;
- Each of the three types of alcohol consumption per capita also traces out an inverted U-shaped curve over the per capita income spectrum in *volume* terms, but that is true in *value* terms (at least for 2001-15) only for spirits;
- The coefficient of variation across countries in the total volume of alcohol consumption, and in the shares of each beverage in that total consumption, fell considerably over the 1961-2014 period (but least so for spirits);
- When countries are grouped by their main beverage focus as of 1961-64, the share of that focus beverage in the total volume of alcohol consumption for that sub-group of countries fell over the next five decades
 - However, the consumption intensity index *rose* rather than fell for wine in the wine-focused group of countries, due to the wine share falling less for that group of countries than for the world as a whole;
- In beer-focused countries, it was wine's share that grew rapidly, whereas in wine- and spirits-focused countries it was beer that rose in importance;
- When countries are grouped by geographic region, all three beverage consumption volume intensity indexes converged toward unity for North America and Eastern Europe, but they *diverged* for Western Europe and Africa/Middle East;
- The consumption mix similarity indexes moved closer to one during 2001 to 2015 for most regional country groups, and also for beer-focused and spirits-focused countries – but not for wine-focused countries and only barely for Western Europe.

In short, we find strong but not unequivocal indications of convergence in national alcohol consumption patterns across the world. It remains to draw out their implications for demand elasticity estimates and to explain these evolving patterns econometrically now that we have a comprehensive global database. So our next step is to build on and extend the seminal work by Selvanathan and Selvanathan (2007) to see to what extent income, own-price, and cross-price elasticities of demand for alcoholic and non-alcoholic beverages differ across countries and over time. Subsequent work could focus on explaining econometrically the cross-country differences in our two indexes in terms of such variables as beverage consumer tax rates, per capita incomes, and trade costs.

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Table 1: Total alcohol consumption volume per capita,^a high-income countries, 1888 to 2014 (litres of alcohol per year)

	1888-92	1920s	1960s	1970s	1980s	1990s	2000s	2010-14
Australia	5.9	3.8	7.1	9.5	9.7	8.1	8.1	7.3
Austria			8.7	10.8	11.1	11.0	10.3	10.4
Belgium	13.1	10.7	8.9	11.3	11.5	9.9	10.0	9.6
Canada			5.1	7.5	7.6	6.1	6.5	6.7
Denmark		5.0	5.6	8.3	9.8	9.9	9.1	8.0
Finland			1.9	4.3	5.1	5.9	7.0	6.9
France	16.3	22.1	17.7	15.9	13.3	11.2	10.3	9.2
Germany	9.8	4.4	10.3	12.9	12.7	11.3	10.2	9.6
Italy	11.8	14.5	14.3	14.0	10.8	8.4	7.5	6.1
Japan			4.3	5.6	6.5	7.2	5.8	5.6
Netherlands	5.7 ^b	2.3 ^c	3.8	7.5	8.6	8.1	7.9	7.4
New Zealand	3.8		6.7	8.9	9.1	7.6	6.5	6.4
Norway			4.0	5.5	5.2	5.0	6.2	6.3
Sweden			5.2	6.5	5.9	5.9	5.5	6.1
Switzerland	13.3	8.6	10.3	11.0	11.4	9.6	8.7	8.3
UK	8.7	4.5	5.7	7.7	8.0	7.5	8.8	8.0
United States	5.3		5.8	7.4	7.7	6.5	6.7	7.0
<i>Unweighted average of above</i>			7.7	9.4	9.3	8.3	8.0	7.6

^a On average the alcohol content by volume is assumed to be 4.5% for beer, 12% for wine and 40% for spirits. Ready-to-drink spirits mixers are converted to spirits assuming their alcohol content is 5%.

^b 1898-1902.

^c 1920-23.

Source: Compiled from data in Anderson and Pinilla (2017).

Table 2: Shares of wine, beer and spirits in total alcohol consumption volume, high-income countries, 1888 to 2014 (% , five-year averages)

	Wine %					Beer %					Spirits %				
	1888-92	1925-29	1961-64	1980-84	2010-14	1888-92	1925-29	1961-64	1980-84	2010-14	1888-92	1925-29	1961-64	1980-84	2010-14
Australia	10	19	12	24	40	47	62	75	64	46	43	20	13	12	14
Austria	na	na	30	37	35	na	na	55	49	51	na	na	15	14	14
Belgium	3	8	13	21	35	62	81	77	61	51	35	12	11	18	14
Canada	na	na	6	14	25	na	na	60	48	49	na	na	34	38	26
Denmark	na	4	8	19	47	na	55	77	65	38	na	42	15	16	16
Finland	na	na	13	12	21	na	na	21	42	53	na	na	66	46	26
France	68	82	78	69	59	6	6	10	16	19	26	12	13	16	23
Germany	7	na	18	51	53	49	na	57	56	53	44	na	24	20	19
Italy	95	95	87	80	65	0	1	3	8	23	5	4	10	12	11
Japan	na	na	2	4	5	na	na	20	29	21	na	na	78	67	74
Netherlands	4 ^a	8 ^b	9	22	35	25 ^a	47 ^b	48	49	48	71 ^a	45 ^b	43	29	17
New Zealand	2	na	4	17	38	32	na	78	64	43	66	na	18	20	19
Norway	na	na	4	9	29	na	na	27	34	35	na	na	69	58	36
Sweden	na	na	9	20	48	na	na	39	39	37	na	na	52	41	15
Switzerland	63	49	42	49	47	17	25	38	31	34	20	27	20	20	19
UK	2	4	4	11	41	68	78	81	69	37	30	17	15	20	22
United States	4	na	8	13	18	47	na	48	51	49	49	na	44	36	34
WORLD av.	na	na	34	24	15	na	na	29	33	43	na	na	37	43	42

^a 1898-1902. ^b 1920-23.

Source: Compiled from data in Anderson and Pinilla (2017).

Table 3: Alcohol per capita consumption volume and shares of beer, wine and spirits,^a 53 countries, 5 regions and the world, 1961-64 and 2010-14 (LAL and %)

	Consm (LAL/capita) ^a		1961-64 (%) ^b			2010-14 (%) ^b		
	1961-64	2010-14	Wine	Beer	Spirits	Wine	Beer	Spirits
Algeria	0.9	0.4	64	28	8	48	39	13
Argentina	11.9	5.5	84	3	13	50	44	5
Australia	6.5	7.3	12	75	13	40	46	14
Austria	7.6	10.4	30	55	15	35	51	14
Bel-Lux	8.5	9.6	13	77	11	35	51	14
Brazil	1.1	5.6	22	37	41	5	61	34
Bulgaria	5.2	9.7	48	17	35	18	37	44
Canada	4.7	6.7	6	60	34	24	50	26
Chile	8.5	5.4	85	7	8	35	37	28
China	0.4	3.3	1	1	98	4	44	52
Croatia		9.9				51	39	11
Denmark	5.1	8.0	8	77	15	47	38	16
Finland	1.4	6.9	13	21	66	21	53	26
France	18.3	9.2	78	10	13	59	19	23
Georgia		5.8				49	21	31
Germany	9.7	9.6	18	57	24	28	53	19
Greece	7.1	6.8	46	23	31	53	27	20
Hong Kong	0.8	1.9	2	37	62	29	53	17
Hungary	7.1	9.5	48	28	24	30	36	34
India	0.3	0.9	0	2	98	0	15	85
Ireland	5.1	8.2	5	76	19	28	52	21
Italy	14.0	6.3	87	3	10	65	23	11
Japan	4.0	5.6	0	20	78	5	21	77
Korea	2.2	4.2	0	26	74	2	2	96
Malaysia	0.3	0.4	2	65	33	5	74	21
Mexico	1.5	3.7	4	67	29	3	75	22
Moldova		8.0				43	22	35
Morocco	0.7	0.4	58	21	21	48	36	15
Netherlands	3.2	7.4	9	47	43	35	48	17
New Zealand	6.2	6.4	4	78	18	38	43	19
Norway	6.4	7.9	3	27	69	29	35	36
Philippines	0.6	3.2	0	47	53	0	26	74
Portugal	12.1	9.2	96	2	2	65	27	8
Romania	4.8	7.9	64	13	23	31	53	16
Russia	4.2	8.9	16	15	69	11	39	49
Singapore	0.9	1.5	2	70	28	15	71	14
South Africa	2.6	4.4	43	13	44	21	68	11
Spain	10.1	8.0	71	9	21	22	48	29
Sweden	4.8	6.1	9	39	52	49	37	15
Switzerland	9.3	8.0	42	38	20	47	34	19

Table 3 (continued): Alcohol per capita consumption volume and shares of beer, wine and spirits,^a 53 countries, five regional residuals and the world, 1961-64 and 2010-14 (LAL and %)

	Consm (LAL/capita) ^a		1961-64 (%) ^b			2010-14 (%) ^b		
	1961-64	2010-14	Wine	Beer	Spirits	Wine	Beer	Spirits
Taiwan	0.9	2.1	0	6	94	4	42	54
Thailand	0.4	5.1	0	5	95	0	26	74
Tunisia	0.8	1.0	68	26	5	29	67	4
Turkey	0.3	1.1	39	26	35	9	58	34
Ukraine		7.0				9	39	52
UK	5.6	8.0	4	81	15	41	37	22
US	5.4	7.0	8	48	44	18	49	34
Uruguay	5.4	4.6	69	25	9	56	33	11
O W. Europe ^c	4.2	5.4	6	42	52	33	45	22
O E. Europe ^c	5.0	4.8	17	43	40	9	52	39
O L. America ^c	1.9	2.0	2	84	14	5	59	36
Other Asia	0.2	0.2	2	5	93	3	13	84
O Africa/MEast ^c	0.4	0.4	12	52	36	9	70	22
Wted averages:								
W. Europe	12.3	8.4	55	29	16	42	38	20
E. Europe	1.9	7.2	22	22	56	14	42	44
North America	5.4	7.0	8	49	43	18	49	33
Latin America	6.5	5.1	48	34	18	11	60	29
Aust. & NZ	6.5	7.1	10	76	14	39	46	15
Asia (incl. Pacific)	1.9	3.2	1	12	87	4	34	62
Africa & M East	1.0	1.7	27	38	35	14	67	19
WORLD	2.5	2.7	34	29	37	15	43	42

^a These data are volume-based in litres of alcohol (LAL) per year, five-year averages.

^b The bold numbers indicate which beverage has the highest share in total alcohol consumption volume in the period shown.

^c 'O' refers to 'Other', for the residual sub-group of countries, for each of five geographic regions, that is not separately identified (each sub-group is treated like an extra country).

Sources: Compiled from data in Anderson and Pinilla (2017).

Table 4: Wine, beer and spirits consumption volume and value intensity indexes,^a 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

^a The intensity index is defined as the fraction of wine, beer or spirits consumption in total national alcohol consumption volume in country *i* divided by the fraction for that same beverage in world total alcohol consumption.

Source: Compiled from data in Holmes and Anderson (2017).

Table 5: Per capita income, excise taxes on alcohol consumption by type, and VAT/GST, high-income countries, 2014 (% ad valorem equivalent)

	Per capita income (US\$'000)	Commercial wine excise tax (%)	Beer excise tax (%)	Spirits excise tax (%)	VAT/ GST (%)
Australia	26.6	29	117	211	10
Austria	24.8	2	18	46	20
Canada	26.1	8	75	30	5
Finland	22.8	65	116	176	24
France	22.5	1	27	66	20
Japan	22.7	14	35	14	8
New Zealand	20.2	34	66	127	15
Norway	34.8	114	179	292	25
Sweden	25.9	49	70	213	25
United Kingdom	25.2	66	87	136	20
United States	32.1	7	58	28	0
<i>Unweighted average of above</i>	25.8	35	77	122	16

Source: Anderson and Pinilla (2017) and Anderson (2014b).

Table 6: Shares of beverage household expenditure by beverage type, seven regions spanning the world, 2010-14 (%)

	Budget shares of alcohol expend. (%)			Budget shares of all beverage expenditure (%)				Alcohol as % of all beverage expend.
	Beer	Wine	Spirits	All alcohol	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 (2017).

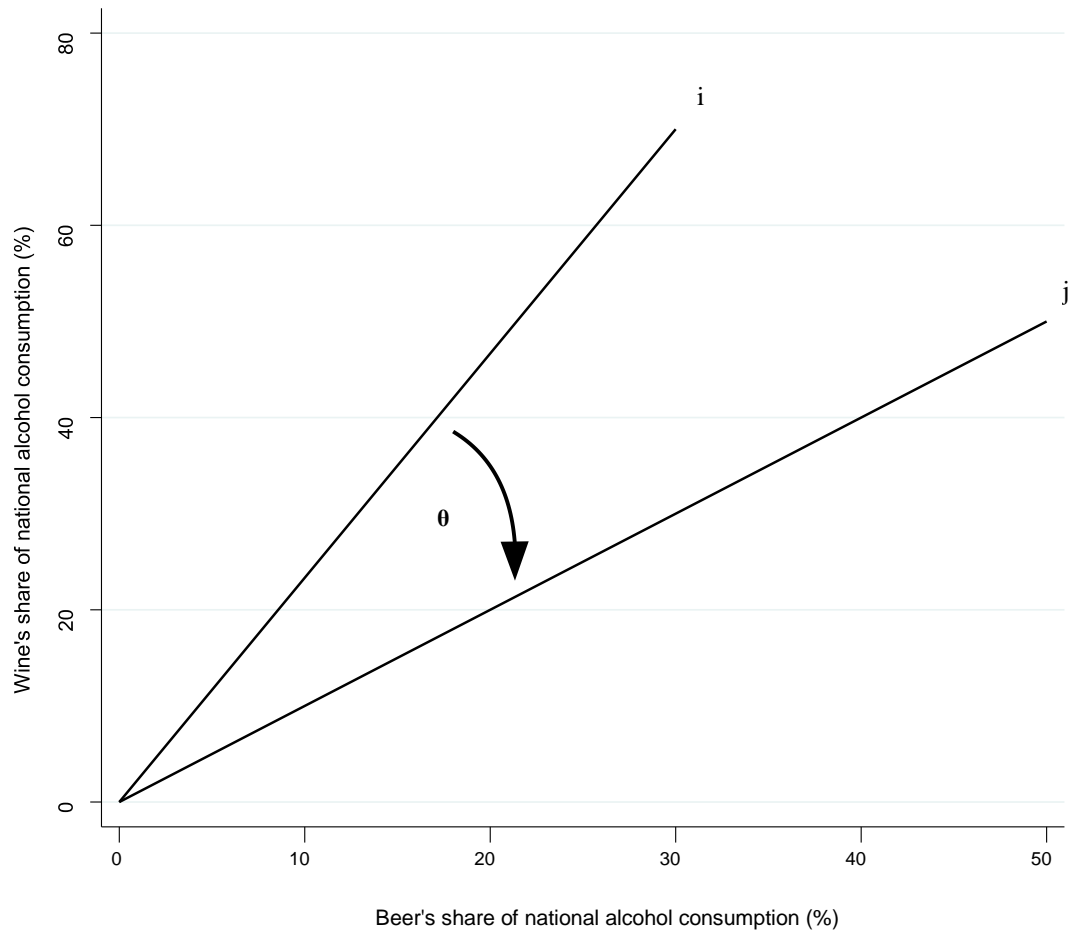
Table 7: Importance of unrecorded in total alcohol consumption volume, by region, 2000, 2005 and 2010 (litres of alcohol (LAL) per capita)

	Real GDP per capita ^a	Recorded consumption (LAL per capita)	Unrecorded consumption (LAL per capita)	Total consumption (LAL per capita)	Unrecorded as % of total alcohol consumption
2000					
Western Europe	19.3	9.4	1.3	10.7	12
Eastern Europe	6.0	8.3	4.3	12.6	34
Australasia	20.6	8.1	0.1	8.2	1
North America	28.1	8.0	1.1	9.1	12
Latin America	5.9	5.2	2.5	7.6	32
Africa & Middle East	2.3	2.2	1.4	3.6	37
Asia	3.8	1.7	1.4	3.1	38
WORLD	6.1	3.5	1.6	5.1	45
2005					
Western Europe	20.6	9.2	1.3	10.5	13
Eastern Europe	7.3	9.4	4.5	13.9	33
Australasia	22.9	7.8	0.2	8.0	2
North America	30.2	8.3	1.1	9.4	12
Latin America	6.3	4.6	2.6	7.2	36
Africa & Middle East	2.6	2.2	1.3	3.4	37
Asia	4.9	1.8	1.6	3.4	47
WORLD	7.0	3.4	1.7	5.2	33
2010					
Western Europe	20.9	8.4	0.8	9.2	9
Eastern Europe	8.7	9.5	3.2	12.7	25
Australasia	24.5	7.7	1.8	9.4	19
North America	29.9	8.4	0.7	9.0	7
Latin America	6.8	5.0	1.7	6.7	25
Africa & Middle East	3.0	2.3	1.1	3.4	33
Asia	6.3	2.1	1.7	3.8	44
WORLD	7.8	3.6	1.5	5.1	30

^a Real GDP per capita are in thousands of 1990 International Geary-Khamis dollars from www.ggd.net/maddison/maddison-project/data.htm, updated to 2010 by taking the latest PPP estimates in 2011 dollars from the World Bank's International Comparison Project at <http://icp.worldbank.org> and splicing them to the Maddison series.

Source: Compiled from data in Holmes and Anderson (2017).

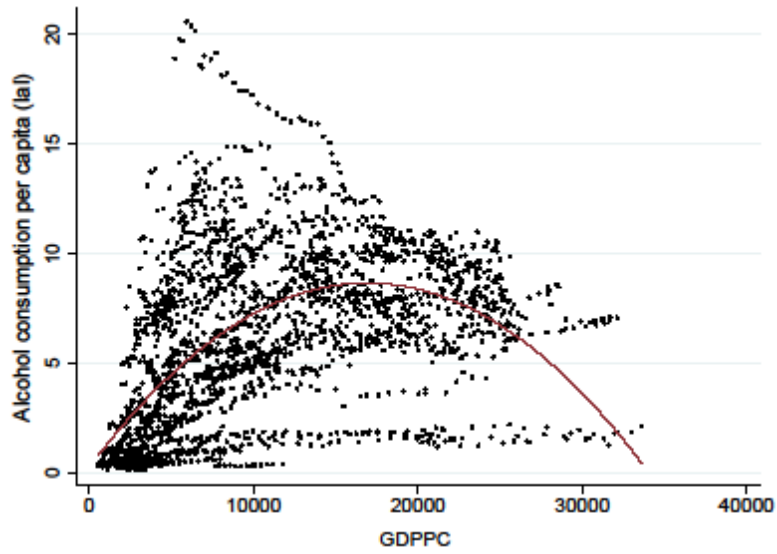
Figure 1: Angular separation between two countries (i and j), each consuming just two beverages (beer and wine)



Source: Authors' compilation.

Figure 2: Relationship between recorded alcohol consumption volume and real GDP per capita, 53 countries/regions,^a 1961 to 2014 (one dot per country-year)

(a) All alcohol



(b) Wine

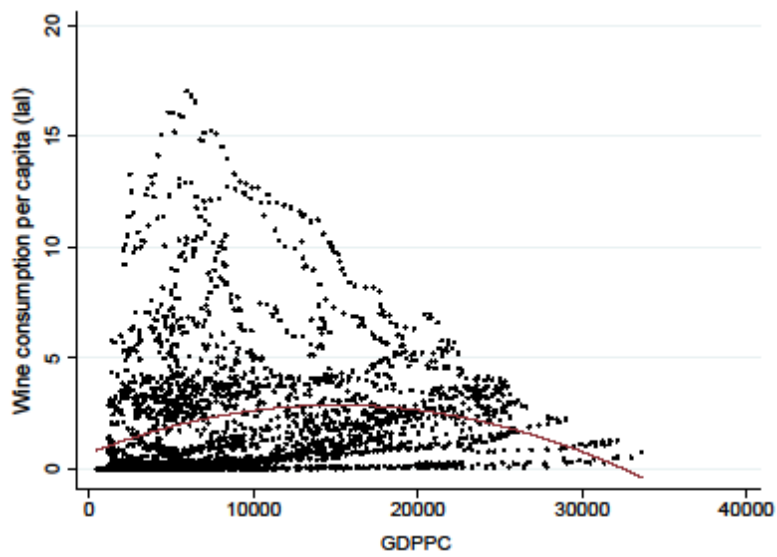
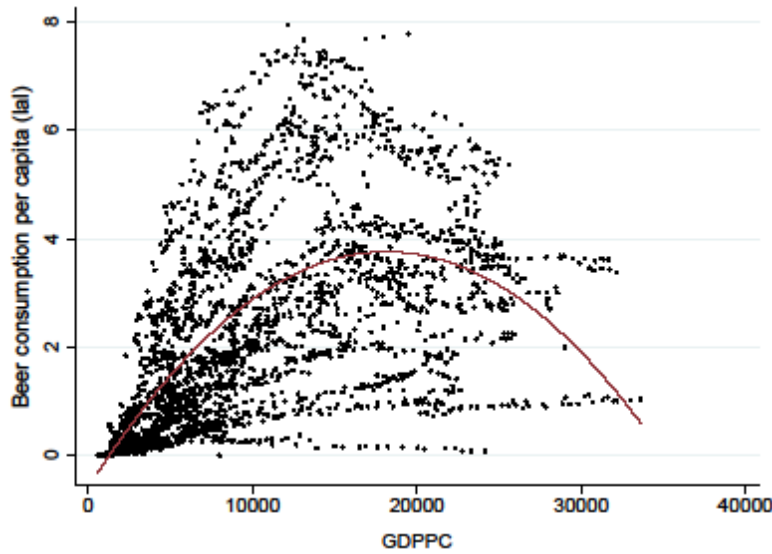
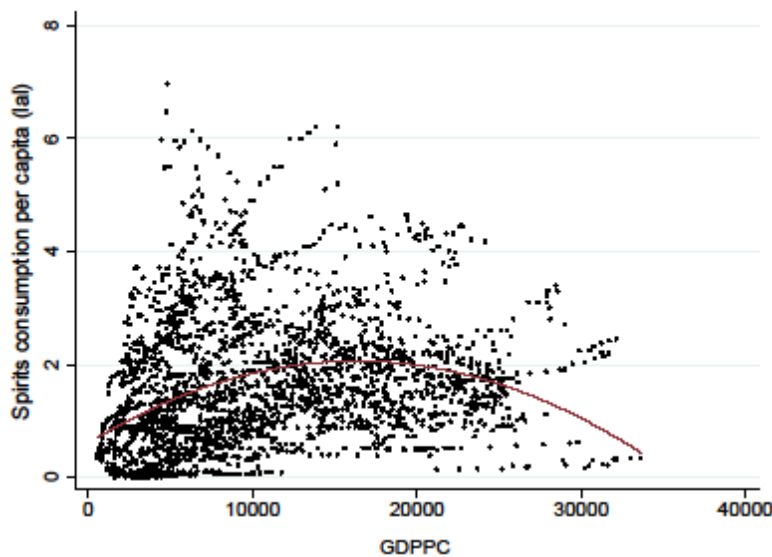


Figure 2 (continued): Relationship between recorded alcohol consumption volume and real GDP per capita,^a 53 countries/regions, 1961 to 2014 (one dot per country-year)

(c) Beer



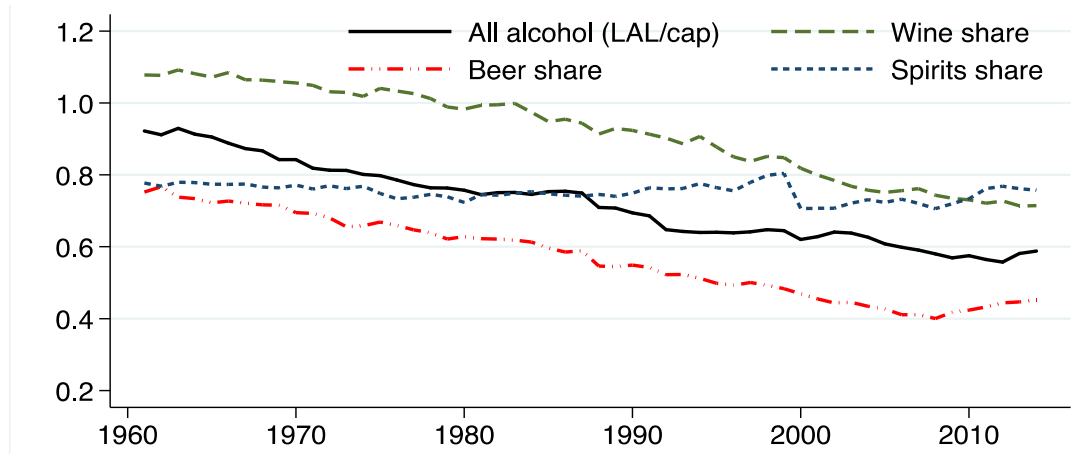
(d) Spirits



^a Real GDP per capita are in 1990 International Geary-Khamis dollars from www.ggd.net/maddison/maddison-project/data.htm, updated to 2014 by taking the latest PPP estimates in 2011 dollars from the World Bank's International Comparison Project at <http://icp.worldbank.org> and splicing them to the Maddison series. The curved line is a fitted quadratic regression line.

Source: Compiled from data in Anderson and Pinilla (2017).

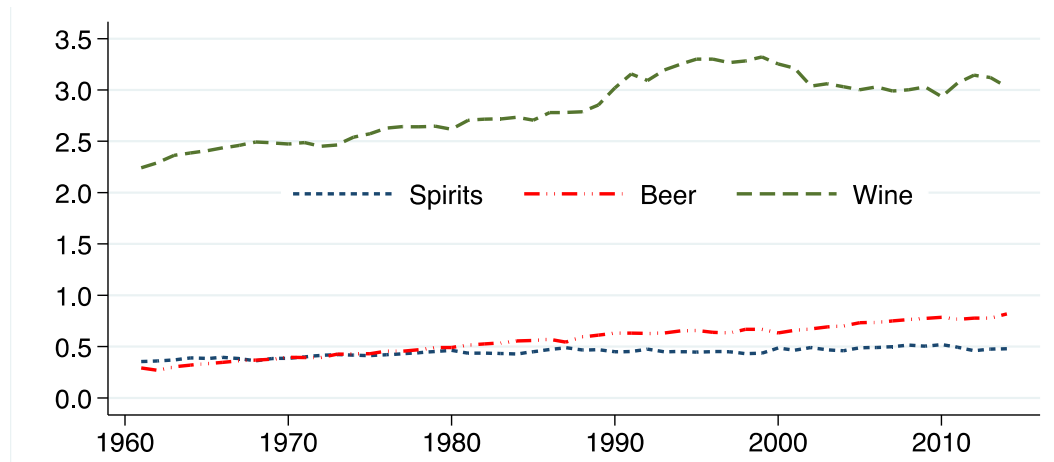
Figure 3: Coefficient of variation in total alcohol consumption per capita, and in shares of each beverage in that total consumption, across 53 countries/regions, 1961 to 2014



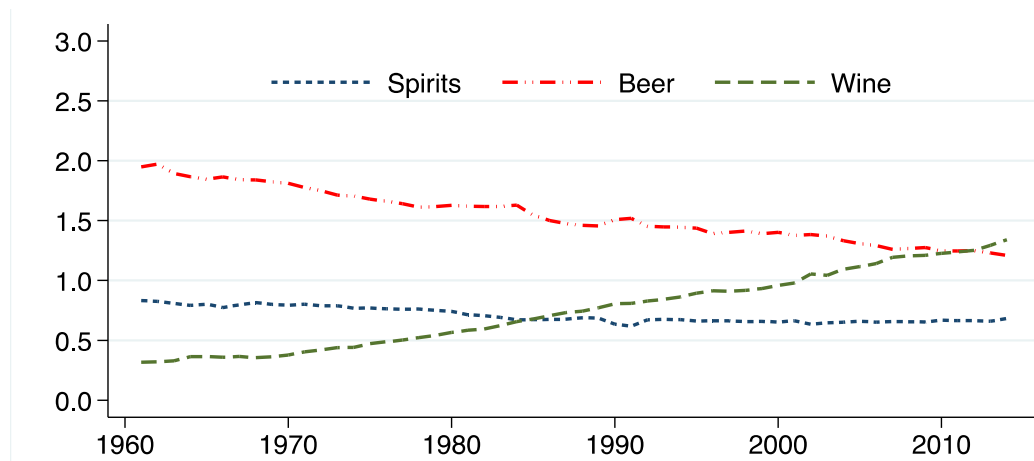
Source: Compiled from data in Anderson and Pinilla (2017) and tabulated in Holmes and Anderson (2017).

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

(a) Wine-focused countries



(b) Beer-focused countries



(c) Spirits-focused countries

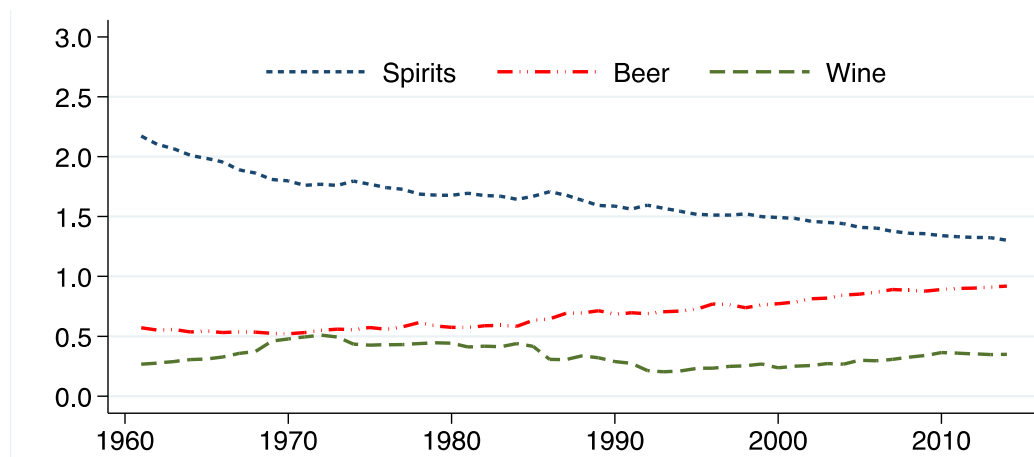


Figure 4 (continued): Wine, beer and spirits consumption volume intensity indexes for subsets of 53 countries/regions, by main focus in 1961-64,^a 1961 to 2014

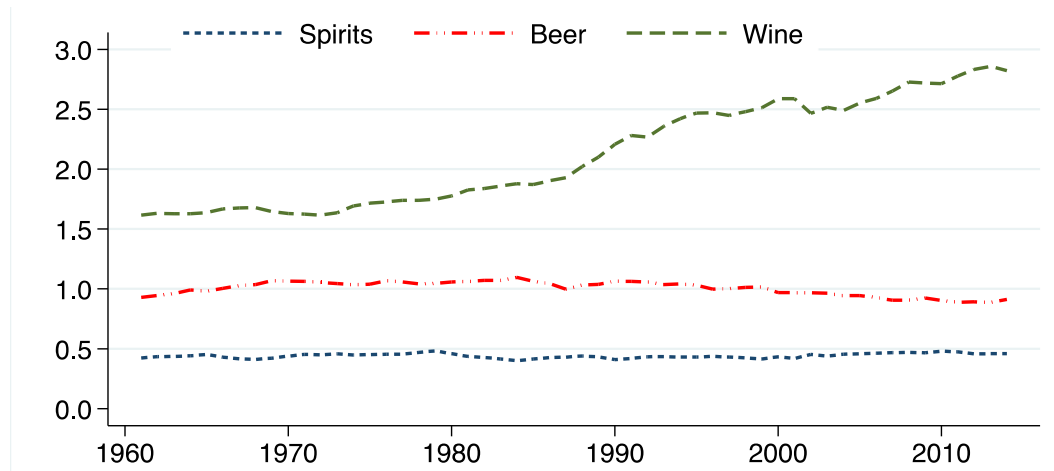
^a The intensity index is defined as the fraction of wine, beer or spirits consumption in total national alcohol consumption volume in country *i* divided by the fraction for that same beverage in world total alcohol consumption.

^b **Wine-focused:** Algeria, Argentina, Bulgaria, Chile, Croatia, France, Georgia, Greece, Hungary, Italy, Moldova, Morocco, Portugal, Romania, Spain, Switzerland, Tunisia, Turkey, Uruguay; **Beer-focused:** Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Germany, Ireland, Malaysia, Mexico, Netherlands, New Zealand, Singapore, United Kingdom, United States, Other Eastern Europe, Other Latin America, Other African and Middle East; **Spirits-focused:** Brazil, China, Finland, Hong Kong, India, Japan, Korea, Norway, Philippines, Russia, South Africa, Sweden, Taiwan, Thailand, Ukraine, Other Western Europe, Other Asia.

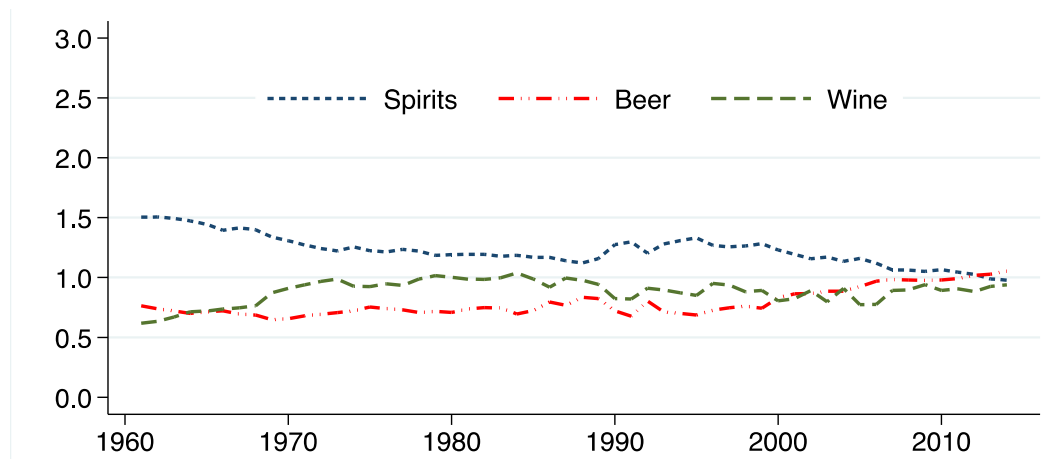
Source: Compiled from data in Anderson and Pinilla (2017) and tabulated in Holmes and Anderson (2017).

Figure 5: Wine, beer and spirits consumption volume intensity indexes for three sub-sets of 53 countries, by region, 1961 to 2014

(a) Western Europe



(b) Eastern Europe



(c) North America

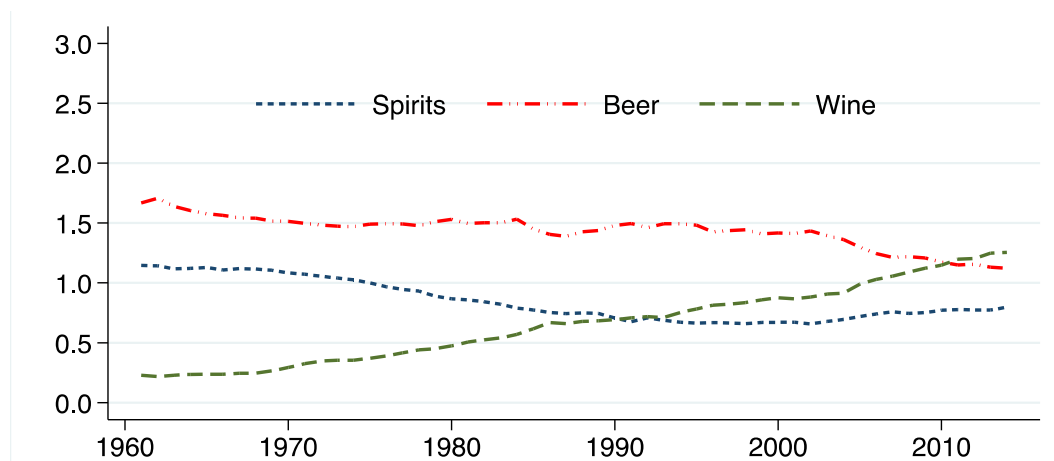
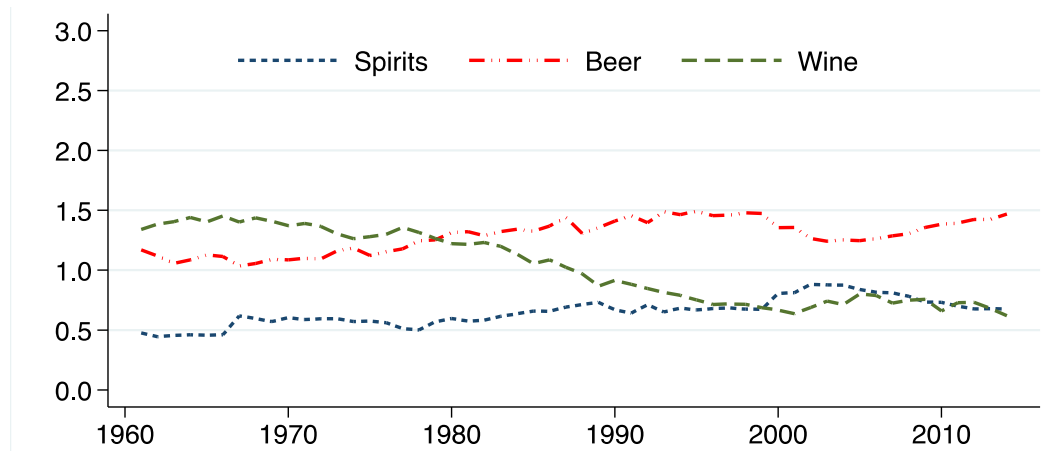
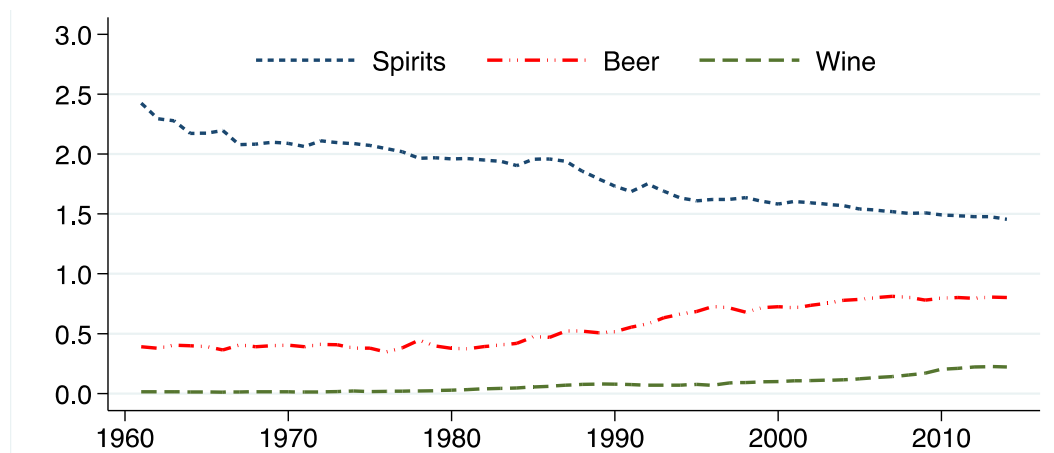


Figure 5 (continued): Wine, beer and spirits consumption volume intensity indexes for subsets of 53 countries, by region, 1961 to 2014

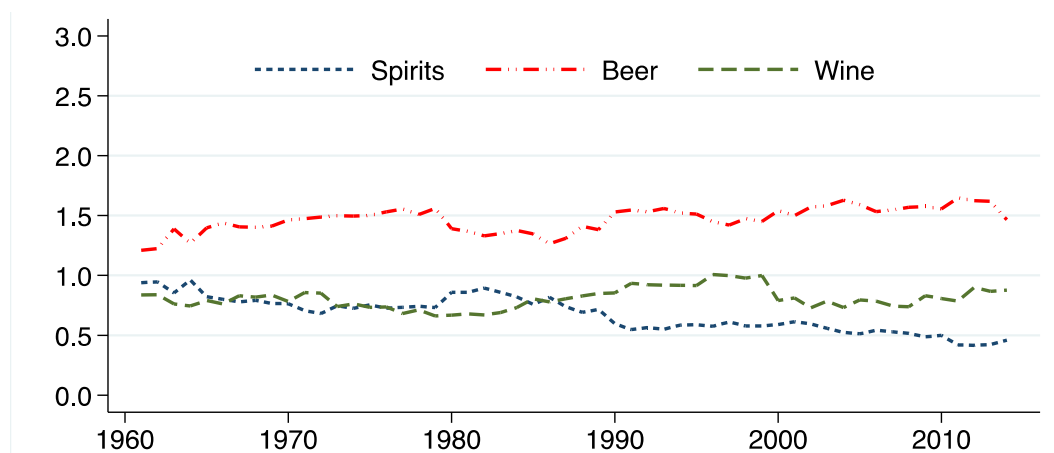
(d) Latin America



(e) Asia



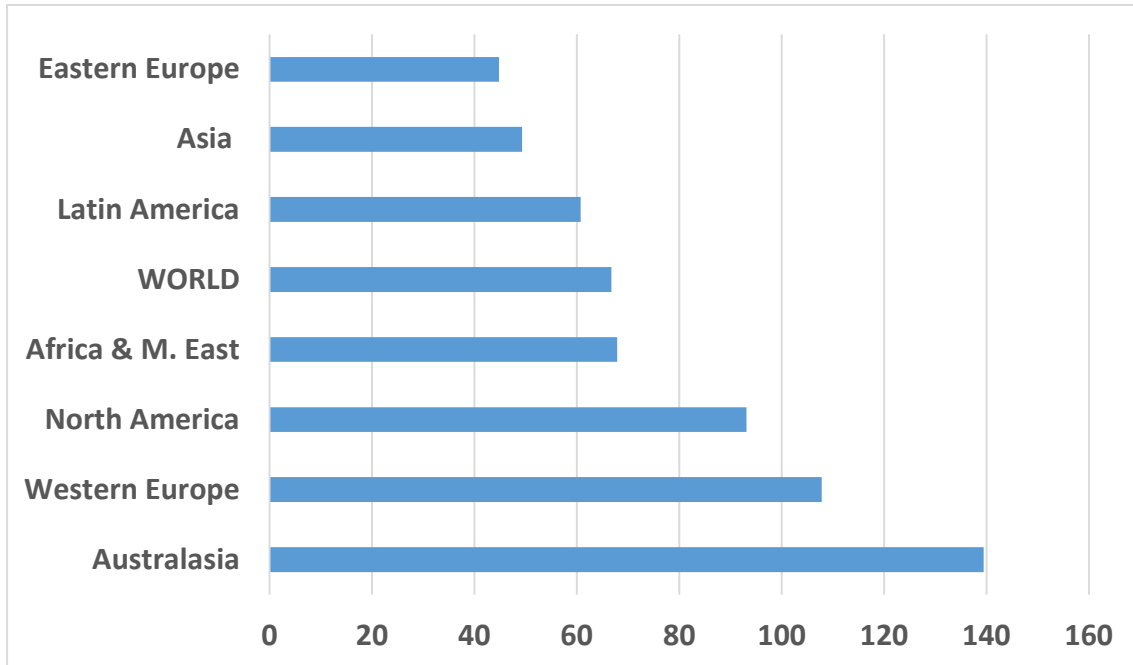
(f) Africa and Middle East



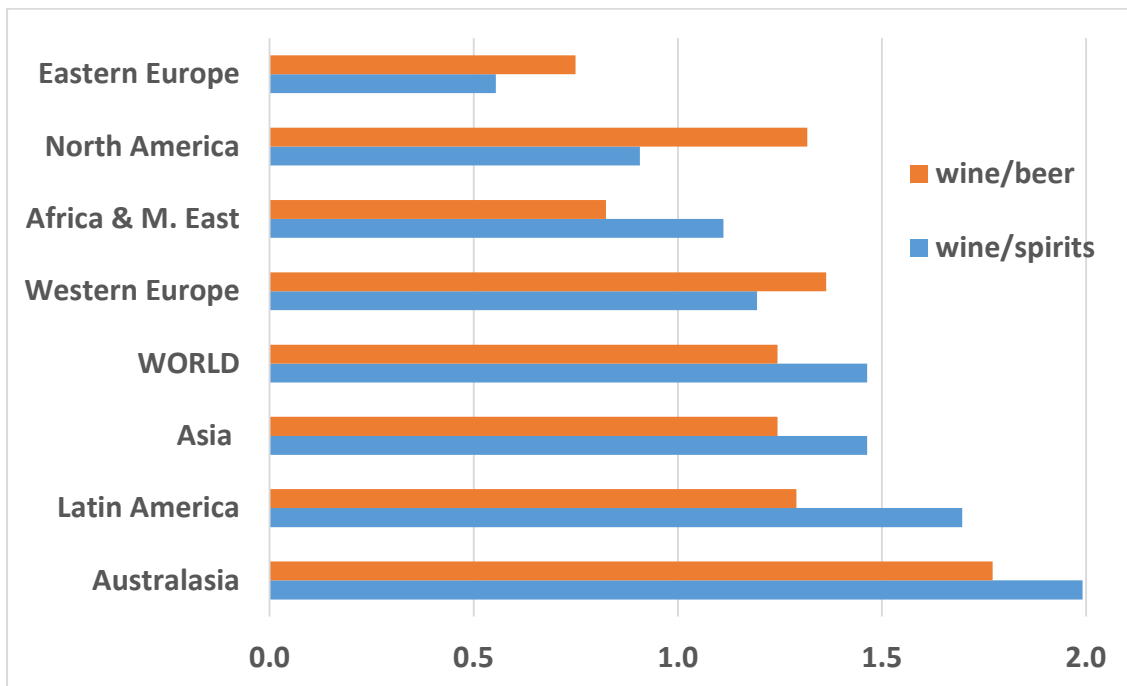
Source: Compiled from data in Anderson and Pinilla (2017) and tabulated in Holmes and Anderson (2017).

Figure 6: Weighted average tax-inclusive retail prices of alcoholic beverages, by region, 2013-15

(a) Price of all alcohol (current US\$ per litre of alcohol)



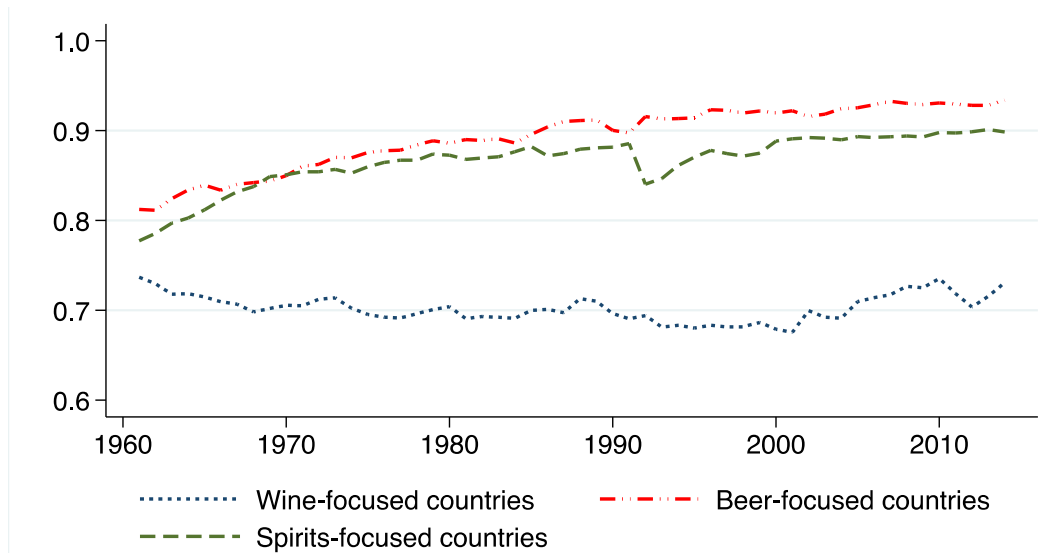
(b) Price of wine per litre of alcohol relative to that for beer and for spirits



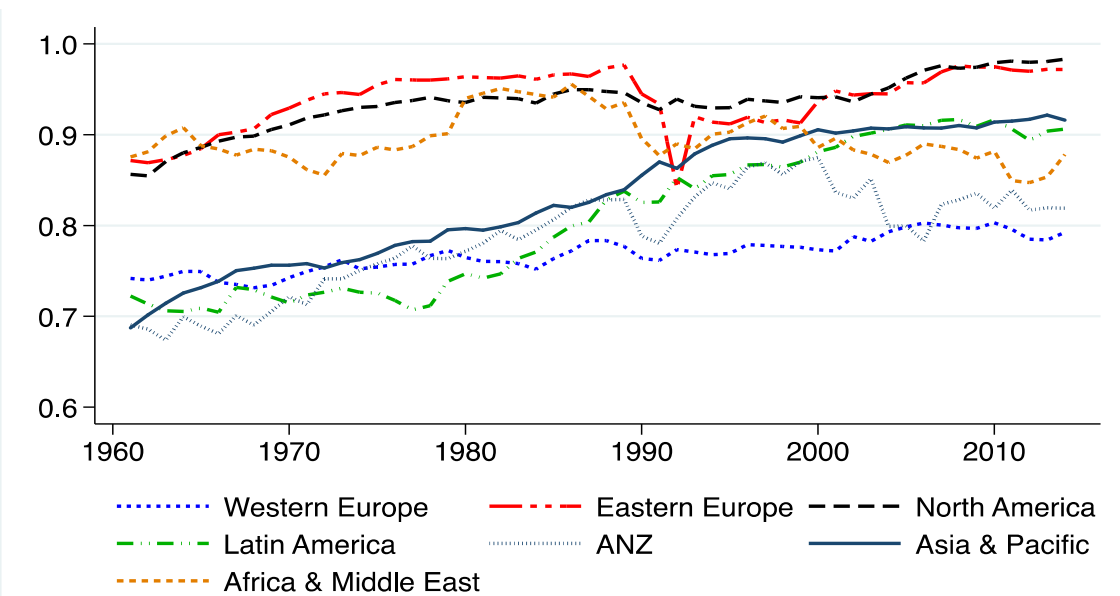
Source: Compiled from data in Holmes and Anderson (2017).

Figure 7: Consumption mix similarity index, volume-based, by sub-sets of 53 countries/regions, 1961 to 2014

(a) By main beverage focus as of 1961-64



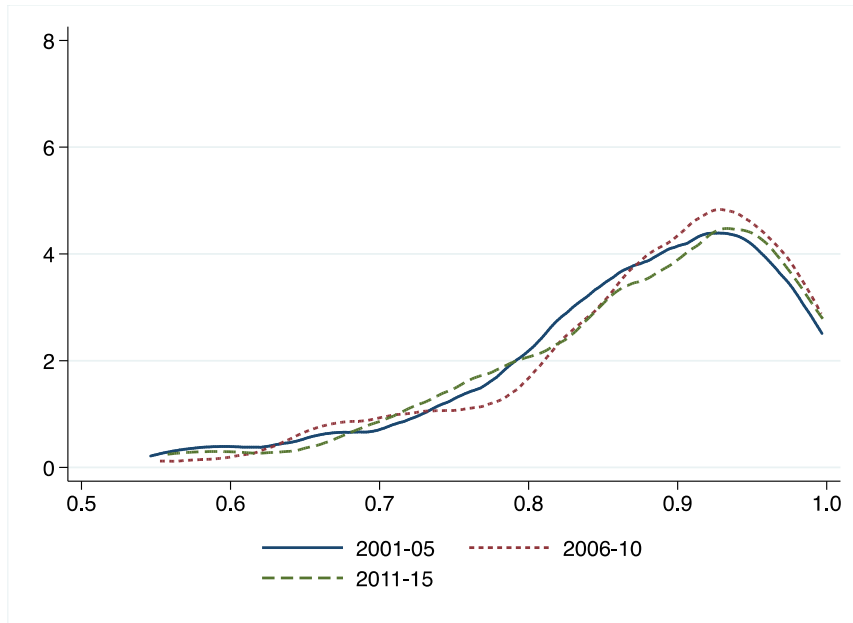
(b) By region



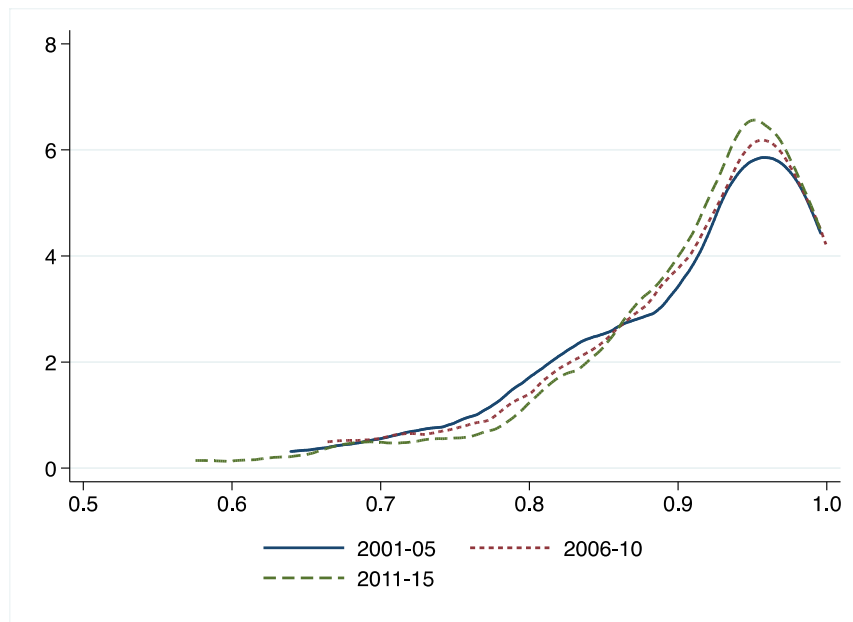
Source: Compiled from data in Anderson and Pinilla (2017) and tabulated in Holmes and Anderson (2017).

Figure 8: Convergence of volume- and value-based similarity mix indexes for all 85 countries/regions 2001 to 2015

(a) Histogram of volume-based similarity mix indexes, 85 countries



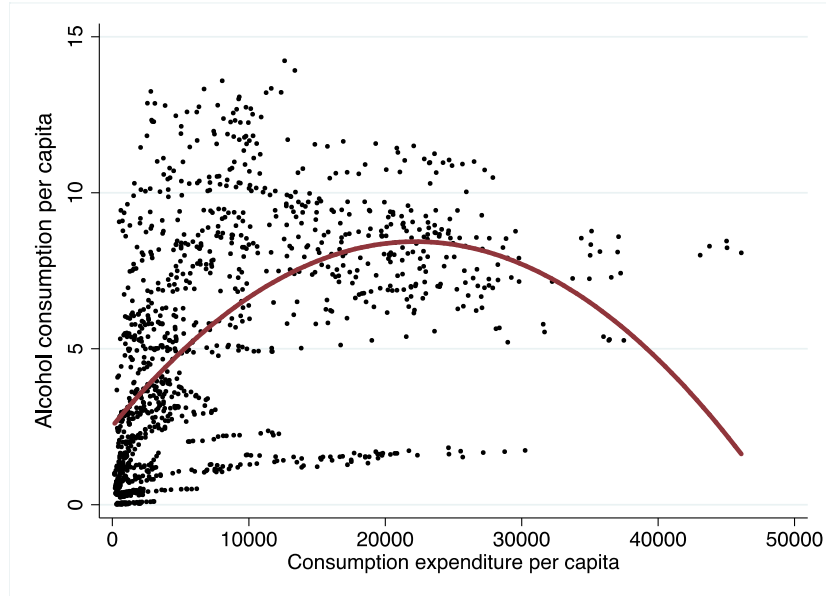
(b) Histogram of value-based similarity mix indexes, 85 countries



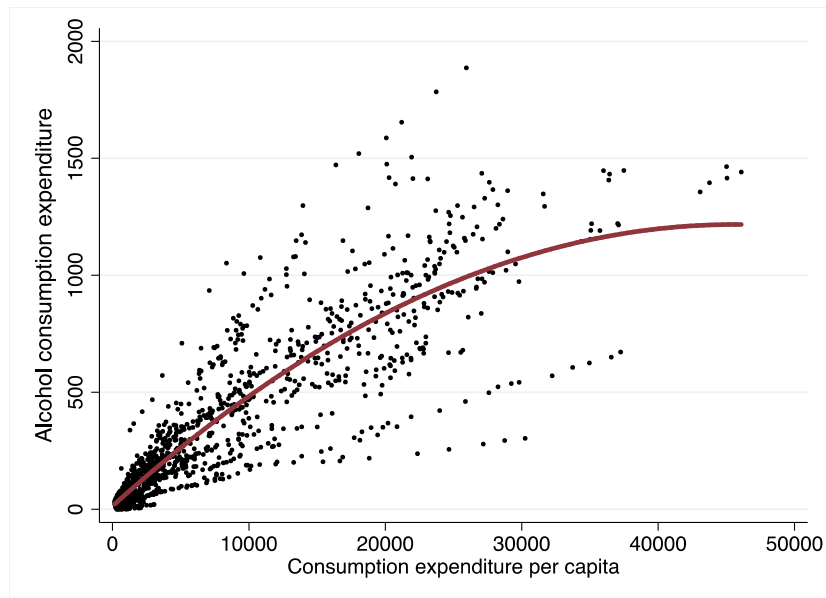
Source: Compiled from data tabulated in Holmes and Anderson (2017).

Figure 9: Relationship between per capita aggregate expenditure and recorded alcohol consumption volume and value, 80 countries,^a 2001 to 2015 (one dot per country-year)

(a) Alcohol volume consumed per capita (litres of alcohol)



(b) Alcohol expenditure per capita (US\$/year)

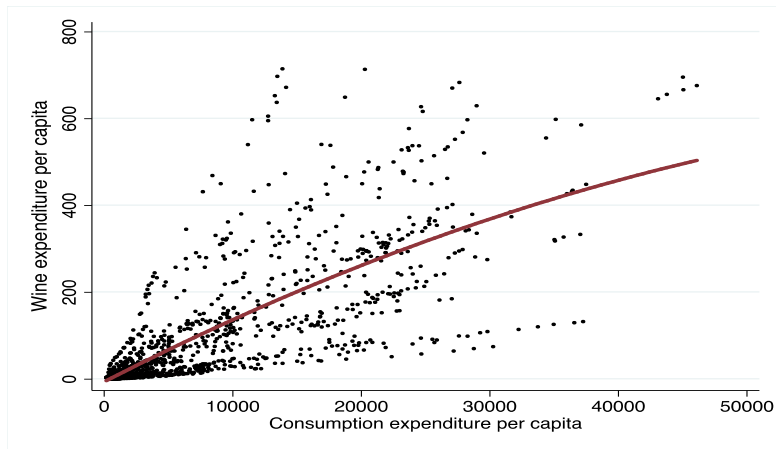


^a Excluding the 5 residual regions. Expenditures are inflated to 2015 dollars using the US CPI, 2015 = 1.00.

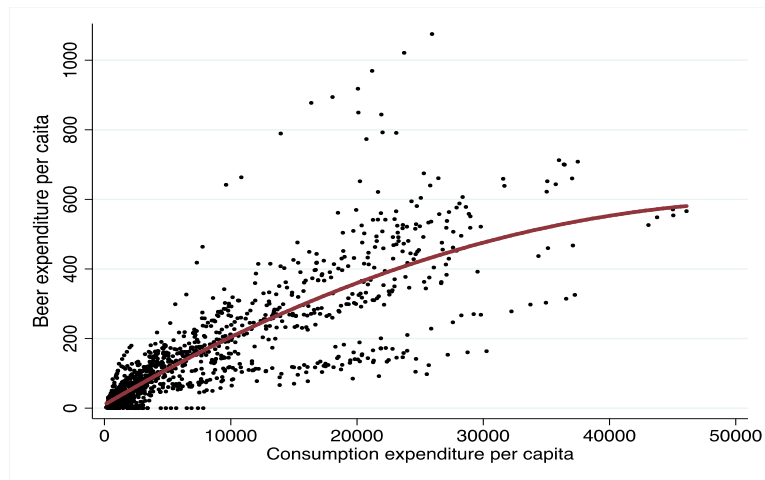
Source: Compiled from data tabulated in Holmes and Anderson (2017).

Figure 10: Relationship between per capita aggregate expenditure and value of recorded alcohol consumption, 80 countries,^a 2001 to 2015

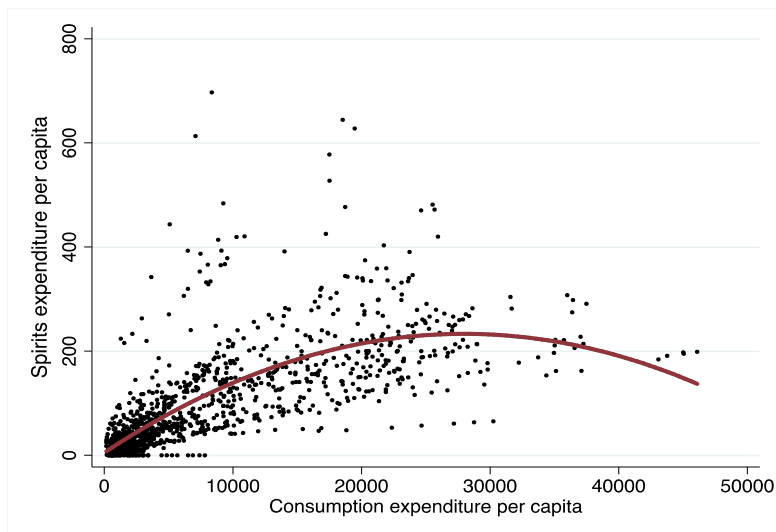
(a) Wine expenditure per capita (US\$/year)



(b) Beer expenditure per capita (US\$/year)

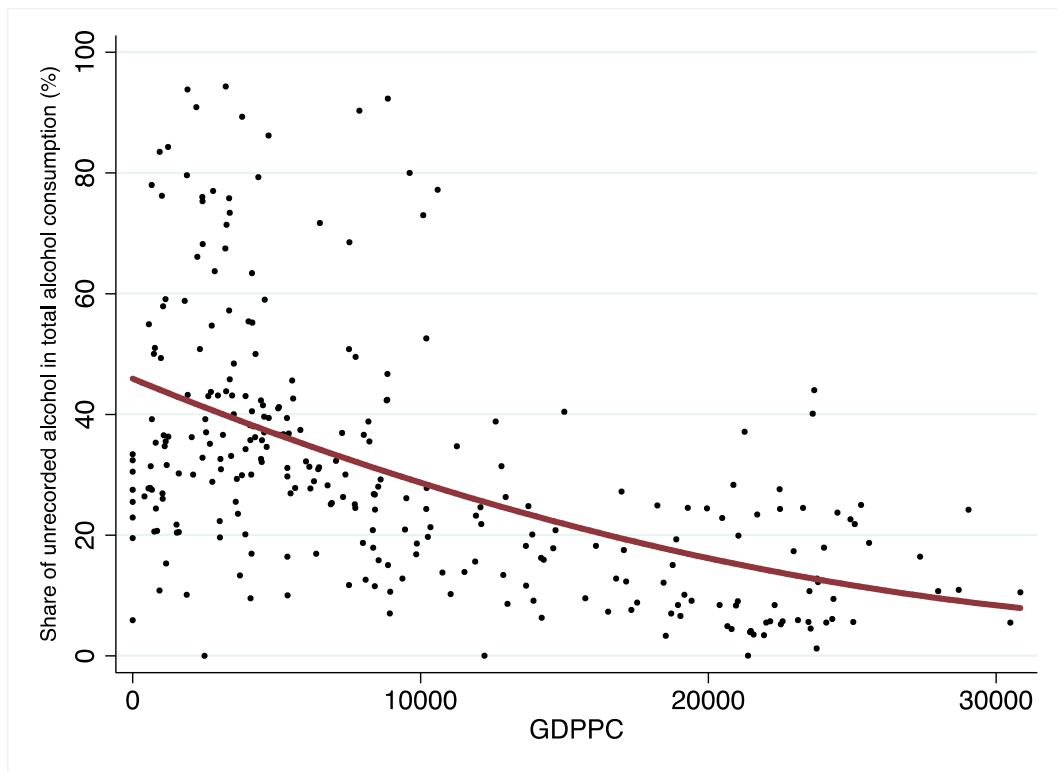


(c) Spirits expenditure per capita (US\$/year)



^a Excluding the 5 residual regions. Expenditures are inflated to 2015 dollars using the US CPI. Source: Compiled from data in Holmes and Anderson (2017).

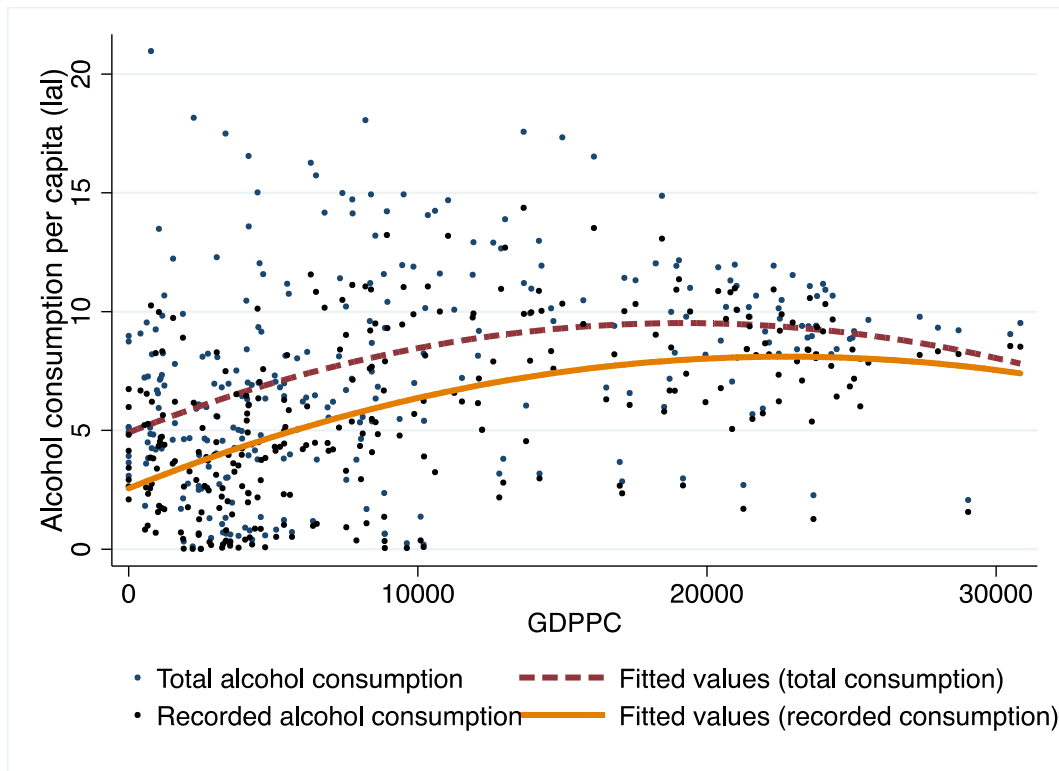
Figure 11: Relationship between share of unrecorded alcohol in total alcohol consumption volume and real GDP per capita,^a 98 countries, 2000, 2005 and 2010 (one dot per country-year)



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

Source: Compiled from data in Anderson and Pinilla (2017).

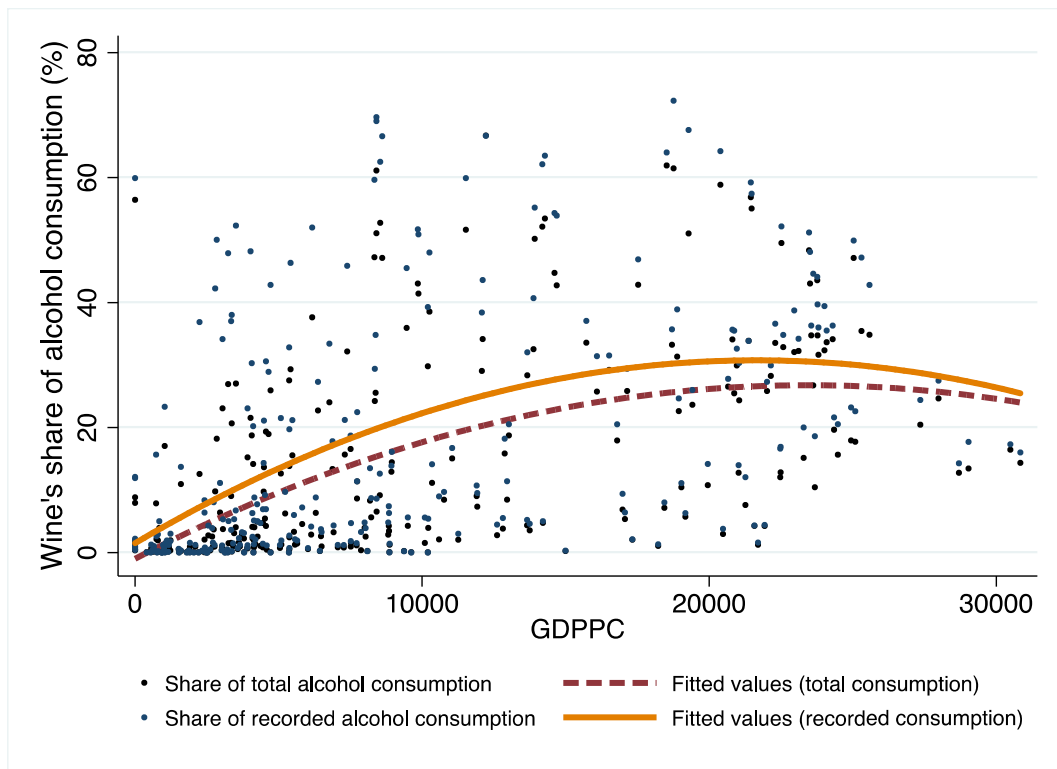
Figure 12: Relationships between alcohol consumption volume and real GDP per capita,^a recorded and total (recorded plus unrecorded), 98 countries, 2000, 2005 and 2010 (one dot per country-year)



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

Source: Compiled from data in Anderson and Pinilla (2017).

Figure 13: Relationships between wine's share of alcohol consumption volume and real GDP per capita, recorded and total (recorded plus unrecorded), 98 countries, 2000, 2005 and 2010 (one dot per country-year)^a



^a Assumes none of the unrecorded alcohol consumption is grape wine except in Albania, Armenia, Azerbaijan, Bosnia & Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Moldova, Romania and Slovenia.

Source: Compiled from data in Anderson and Pinilla (2017).