



Developments in the structure of alcohol consumption in OECD countries

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Abstract:

During the recent decades convergence in alcohol consumption has taken place among a large number of OECD countries in the sense that former differences in the level of per capita intake of beer, wine and spirits have diminished. Usually, the level of consumption is defined or measured as the simple sum of the per capita consumption of the respective beverages, i.e. beer, wine and spirits, measured in liters of pure alcohol. An obvious problem with this definition of 'total alcohol consumption' is the adding together of the specific beverages as though these were perfect substitutes. Therefore, the present analysis takes an alternative point of departure with the purpose of analyzing structural effects related to alcohol consumption. The basic idea is to let total alcohol consumption be represented by a 3-element vector including beer, wine and spirits and the length of this vector in Euclidian space is perceived as the alternative measurement of 'total consumption'. This alcohol consumption vector can be exhibited in the 3-dimensional space as long as only beer, wine and spirits are involved – the concept can be extended to the n -dimensional space - and differences in the angles among the vectors for the countries involved represent structural deviations concerning the consumption pattern of beer, wine and spirit. The analysis includes alcohol consumption data for 21 OECD countries covering the time span from 1961 to 2003. Generally, convergence seems to have taken place concerning the structure of alcohol consumption, but there are still some differences among the OECD countries concerning both the level and structure of alcohol consumption which indicate that the process of changes in consumption patterns will continue in the coming decades.

Keywords: Aggregate alcohol consumption, beverage structure convergence.

1. Introduction

During the decades since the 1960s, the level of alcohol consumption as well as the structure of alcohol consumption has changed to a great extent in many OECD countries. The demand for alcohol is of particular interest as it seems that the large, observed changes may reflect shifting preferences of consumers and will also influence producers of the alcoholic beverages. The old, traditional wine producing countries have experienced a heavy decline in domestic wine consumption and additionally, there have in some cases been a shift towards increased beer consumption, e.g. the beer consumption is exceeding the wine consumption in Spain. In the northern European countries a decline has been observed in for example the share of beer and spirits in alcohol consumption. All these shifts concerning alcohol consumption may to some extent be due to changes in relative prices, income levels and new consumers entering the market, but the magnitude of the changes suggests that changes in consumers' preferences might also play a role. Concerning especially the European Union a process of indirect tax harmonization has taken place during recent years and along increasing integration in general, consumption patterns concerning alcohol may have been in a process of convergence.

The present paper addresses primarily the changes in the structure of alcohol consumption, i.e. the specific beverages as beer, wine and spirits, in twenty-one OECD countries. The absolute level of alcohol consumption seems to develop in a direction of similar levels of alcohol intake in many of the countries, but also similar drinking habits with respect to the specific beverages seem to develop, which may be partly explained by increased globalization affecting consumption patterns. Especially concerning the consumption of wine a process of convergence seems to have taken place – and is still ongoing in some countries – which heavily influences the total demand for wine, including influencing the wine producers strongly. In this process there seems to evolve a 'balanced' structure concerning the total alcohol consumption in the sense of more equal shares concerning the beverages beer and wine. The purpose of the analyses is to analyze the development in the structure of alcohol consumption using empirical data covering the last four decades, and thereby also gain some insights into the development in the alcohol consumption structure in the coming decades.

Firstly, in part 2, the data for alcohol consumption covering the 21 OECD countries are presented. Then part 3 deals with a concept capturing the structure of alcohol consumption with respect to beer, wine and spirits. The empirical results concerning the structural development in alcohol

consumption are reported in part 4 and finally, part 5 concludes.

2. Data and the development in alcohol consumption

The data used for the analysis is mainly from the WHO database, where per capita levels of consumption of beer, wine and spirits are available back to 1961, and covering the time span up till 2003. There are some missing observations in the WHO data and therefore data from *World Drink Trends* (1999, 2005) have been added to the data set.

For the majority of the OECD countries there has been relatively big changes in the overall level of alcohol consumption – measured in litres of pure alcohol per capita – as revealed by the first columns in table 1.

Table 1. Total alcohol consumption and wine consumption in 21 OECD countries, 1961 and 2003 (pure alcohol litres per capita, +15 years)

	Total alcohol		Wine	
	1961	2003	1961	2003
Austria	10.95	11.08	3.21	3.91
Belgium	8.5	10.63	1.24	3.06
Denmark	6.54	11.71	0.53	4.45
Finland	2.91	9.31	0.32	2.41
France	26.03	11.43	20.56	6.55
Germany	11.03	11.99	1.86	3.05
Greece	10.87	9.01	5.74	4.35
Ireland	4.94	13.69	0.32	2.12
Italy	19.24	8.02	17.24	6.08
Netherlands	3.97	9.68	0.40	2.64
Norway	3.74	6.00	0.21	1.84
Portugal	18.92	11.54	16.48	5.55
Spain	14.64	11.68	10.49	3.93
Sweden	6.04	7.00	0.55	2.22
Switzerland	12.33	10.83	5.77	5.41
UK	7.14	11.75	0.28	2.71
USA	7.80	8.61	0.87	1.32
Canada	7.39	7.70	0.40	1.50
Australia	9.16	9.02	0.88	2.81
NewZealand	9.40	9.68	0.38	2.64
Japan	4.03	7.59	0.02	0.37
Average	9.79	9.90	4.17	3.28
Std.err.	(1.28)	(0.43)	(1.39)	(0.36)

Notes: Alcohol consumption is the number of (pure) alcohol litres per inhabitant (+15 years). Due to missing observations (for spirits consumption in 1961) the data for Greece, Portugal and Spain relate to the most recent data from 1976, 1964 and 1962, respectively.

Sources: The World Health Organization (the WHOSIS database), World Drink Trends (1999, 2005), Nordic Alcohol Statistics 2003-2007, Stakes (2009).

The average (un-weighted) level of alcohol intake has not changed since 1961 but the standard deviation has decreased from 1961 to 2003 as exhibited in table 1 and thus so-called σ -convergence has taken place, cf. Sala-i-Martin (1995). Especially for wine, relatively big shifts in the consumption levels have taken place with decreases for the traditional wine countries as France, Italy and others, and for some of the ‘beer or spirits’ countries there have been strong increases in the level of wine consumption – in the latter case almost from a zero level of wine intake in 1961, e.g. Denmark, the UK, and other countries. The overall average level of wine consumption has declined, but the standard deviation has decreased relatively more, and there seems to be some tendency towards convergence in the wine consumption levels as well as wine consumption shares – the latter comprising less than fifty per cent of the total intake of alcohol. The level of the per capita consumption regarding beer, wine and spirits is reported in Appendix 1.

The empirical literature on the determinants of the demand for alcoholic beverages pays attention to the price sensitivity of alcohol demand, including questions as the effectiveness of alcohol taxation; see the review by Leung et al. (1993), Cook and Tauchen’s (1982), Clemens and Johnson (1983), Johnson et al. (1992) and Walsh (1982) – and Bentzen et al. (1998) concerning the question of convergence in the levels of alcohol consumption. Many of the studies focus on single country issues and as such do not address the international trends in alcohol consumption. The review in Fogarty (2008) is a meta-analysis of the alcohol demand literature and concludes that there is only little support concerning the idea that alcohol demand should vary considerably across countries. Aizenman and Brooks (2008) find convergence of wine consumption in relation to beer, and the most quick convergence taking place among countries with a high degree of integration. The latter questions will also be addressed in the following analysis trying to quantify the ‘structural development’ in alcohol consumption – with special focus on wine, which seems to be the beverages mostly fluctuating concerning consumption.

3. Measuring the structure of alcohol consumption

Usually, alcohol consumption is measured in litres of pure alcohol per capita for the respective beverages and thus, total alcohol consumption is the simple sum of beer, wine and spirits:

$$A = B + W + S \tag{1}$$

An implicit assumption is therefore full substitutability among the beverages concerning the

aggregation as the structure of total consumption – defined by the relative size of the beverage components - does not matter as beer, wine and spirits are just added as stated in (1).

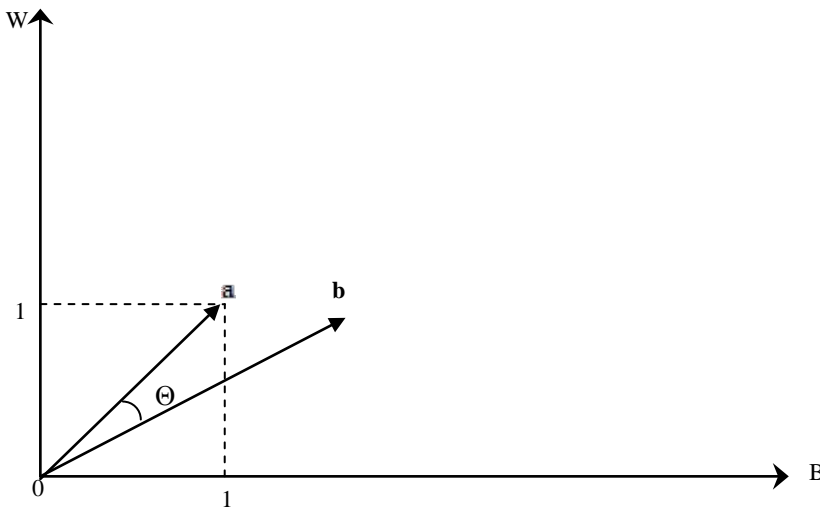
An alternative measure of total alcohol consumption might be the length of the vector (B, W, S) defined from the respective beverages. Hereby, alcohol consumption is defined by A_L :

$$A_L = \sqrt{B^2 + W^2 + S^2} \quad (2)$$

With this definition the structure of alcohol consumption will also influence the measure A_L in (2), but the result will not have an intuitive interpretation as A from (1).

One possibility of evaluating or assessing the structural component is to ‘measure’ the angle between the vector $\mathbf{b} = (B, W, S)$ and a vector of unit values $\mathbf{a} = (1, 1, 1)$. In the two dimensional space, in the present case beer and wine, the structure is defined by cosine to Θ from the graph.

Figure 1. Measuring the beverage structure: Cos Θ .



Hence, the measure of the structural component will be defined from the *dot product* between \mathbf{a} and \mathbf{b} , and the length of the vectors:

$$\text{Cos } \Theta = \frac{\mathbf{a} \cdot \mathbf{b}}{|\mathbf{a}| \cdot |\mathbf{b}|} \quad (3)$$

The concept can be expanded to the n -dimensional space where the measure¹ is denoted the *angular separation* – and with no obvious graphical exposition when n exceeds 3. In the present case n equals 3 and the structural component calculated from (3) is simplified due to unit values in the

¹ The use of angular separation comes from Jaffe (1989), applied in relation to R&D topics, and also used by Anderson (2009) concerning grape varieties.

vector \mathbf{a} , and becomes:

$$A_S = \frac{B+W+S}{\sqrt{3} \sqrt{B^2+W^2+S^2}} \quad (4)$$

Combining (1), (2) and (4) gives:

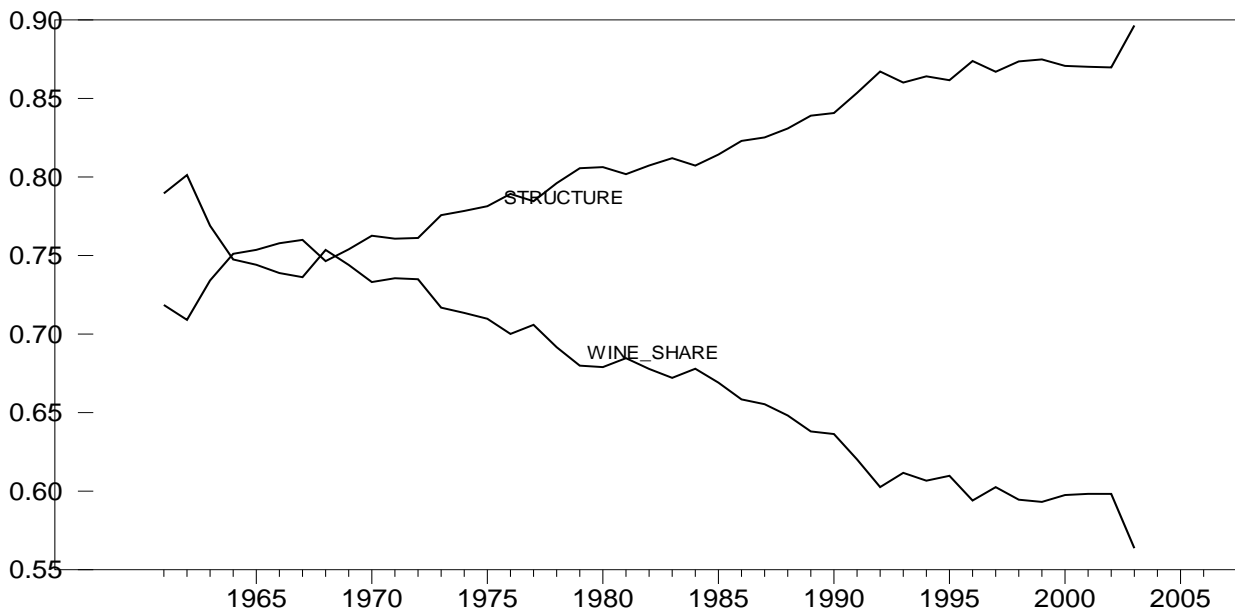
$$A = \sqrt{3} \cdot A_L \cdot A_S \quad (5)$$

The total consumption of alcohol (A) can thereby be decomposed into a component reflecting the length of the beverage vector \mathbf{b} and a structural component A_S having a value between zero and unity.

4. Developments in the structure of alcohol consumption: empirical evidence

From the country-specific time series data for the consumption of beer, wine and spirits the structural component A_S can easily be calculated. Figure 1 depicts the result for France where also the share of wine in total alcohol consumption, calculated from (1), is included.

Figure 1. The structure of alcohol consumption (A_S) and the share of wine, France, 1961-2003.



Notes: 'Structure' is calculated from (4) and the share of wine as: $W / (B+W+S)$.

Wine consumption has been steadily declining in France since the 1960s, and the structural measure

A_S increasing towards 0.9 which indicates a more balanced structure in the alcohol consumption. In Appendix 2 scatter plots between the structure and the wine share are found for some selected countries and generally, there is a development towards relatively high values of the structural component - and consistent with this some degree of converge for the share of wine consumption is also involved, with some exceptions, like the USA.

In table 2 the results from calculating A_S for 1961 and 2003 for the 21 OECD countries are reported.

Table 2. The structure of alcohol consumption (A_S) and the share of wine, 1961 and 2003.

	Structure, A_S		Share of wine	
	1961	2003	1961	2003
Austria	0.97	0.89	0.29	0.32
Belgium	0.73	0.90	0.13	0.29
Denmark	0.73	0.90	0.08	0.38
Finland	0.79	0.96	0.11	0.26
France	0.72	0.90	0.79	0.56
Germany	0.88	0.90	0.17	0.25
Greece (1976)	0.87	0.94	0.55	0.51
Ireland	0.76	0.87	0.06	0.21
Italy	0.64	0.76	0.90	0.73
Netherlands	0.90	0.93	0.10	0.28
Norway	0.86	0.93	0.06	0.26
Portugal	0.62	0.92	0.94	0.52
Spain (1962)	0.72	0.98	0.77	0.35
Sweden	0.78	0.93	0.09	0.33
Switzerland	0.94	0.93	0.47	0.50
UK	0.70	0.90	0.04	0.24
USA	0.90	0.88	0.11	0.15
Canada	0.83	0.92	0.06	0.20
Australia	0.75	0.84	0.10	0.23
NewZealand	0.73	0.93	0.04	0.28
Japan	0.77	0.79	0.01	0.06

Notes: Alcohol consumption is the number of (pure) alcohol litres per inhabitant (+15 years).

Sources: The World Health Organization (the WHOSIS database), World Drink Trends (1999, 2005), Nordic Alcohol Statistics 2003-2007, Stakes (2009).

The results for the structural measure A_S in table 2 reveal a slowly increasing value for this magnitude indicating some development towards a more 'balanced' pattern of alcohol consumption. As evident from table A1 in the Appendix this development is not accompanied with greater changes in the overall average level of consumption of the respective beverages. The structural developments are country-specific and probably also reflecting necessary adjustments in traditional consumption levels, e.g. the former high levels of wine consumption in Southern Europe which are not compatible with the present economic and social structure.

5. Conclusions

During the last decades a number of OECD countries have seen large changes both in the levels of alcohol consumption and in structural changes concerning the relative shares of beer, wine and spirits. With narrowing cross-country differences in alcohol consumption levels this has to a high degree influenced the consumption of wine where traditional wine producing countries have experienced dramatic declines in wine consumption – and the opposite tendency appearing in other cases, e.g. some of the Northern European countries. A common feature seems to be some development towards a more ‘balanced’ structure of alcohol consumption in the respective countries, i.e. diminishing differences concerning the shares of beer, wine and spirits in the total intake of alcohol. This process has been slowly evolving during the last decades and may continue, but still beer and wine will probably be the major beverages.

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World Drink Trends 1999, Henley on Thames: NTC, 1999.

World Drink Trends 2005, Henley on Thames: NTC, 2005.

Appendix 1.

Table A1. The consumption of beer, wine and spirits, 1961 and 2003 (litres per capita, +15 years).

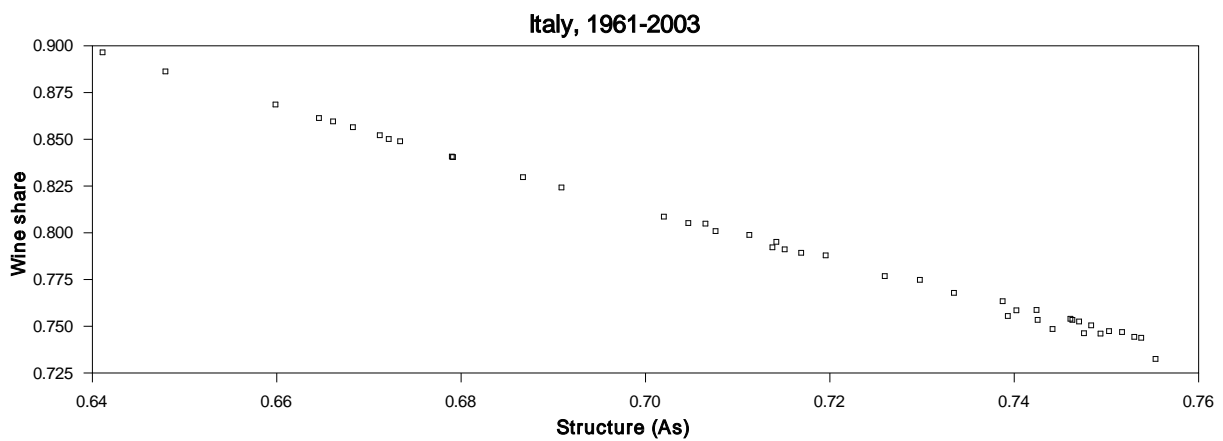
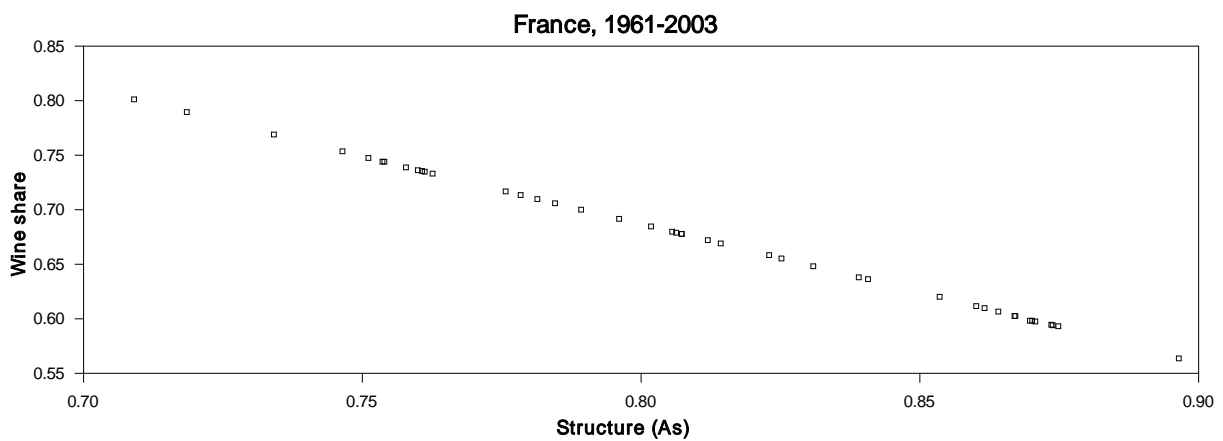
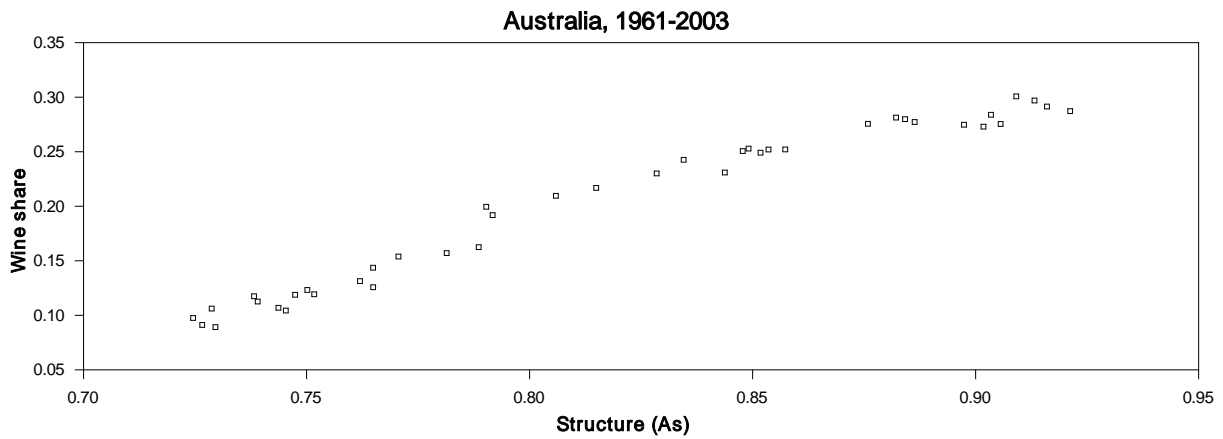
	1961			2003		
	Beer	Wine	Spirits	Beer	Wine	Spirits
Austria	4.97	3.21	2.77	6.59	3.91	1.62
Belgium	7.57	1.24	0.94	5.81	3.06	1.64
Denmark	5.03	0.53	0.99	5.93	4.45	1.38
Finland	0.57	0.32	2.02	4.37	2.41	2.53
France	2.53	20.56	2.95	2.18	6.55	2.89
Germany	6.47	1.86	2.70	6.90	3.05	2.35
Greece	0.98	5.74	3.67	2.36	4.35	1.87
Ireland	4.23	0.32	1.25	8.95	2.12	2.53
Italy	0.40	17.24	1.59	1.75	6.08	0.47
Netherlands	1.88	0.40	1.69	4.82	2.64	1.84
Norway	1.75	0.21	1.78	3.16	1.84	1.22
Portugal	0.39	16.28	0.71	3.53	5.55	1.68
Spain	1.05	10.49	3.10	4.57	3.93	2.80
Sweden	2.35	0.55	3.14	3.30	2.22	1.12
Switzerland	4.49	5.77	2.07	3.50	5.41	1.93
UK	5.81	0.28	1.04	6.21	2.71	2.20
USA	3.71	0.87	3.26	5.16	1.32	2.54
Canada	4.10	0.40	2.31	4.20	1.50	2.10
Australia	6.36	0.88	1.19	5.73	2.81	1.50
NewZealand	6.71	0.38	1.58	4.82	2.64	1.84
Japan	0.99	0.02	2.08	1.59	0.37	4.16
Average	3.44	4.17	2.04	4.54	3.28	2.01
Std.err.	(0.51)	(1.39)	(0.19)	(0.41)	(0.36)	(0.17)

Notes: Alcohol consumption is the number of (pure) alcohol litres per inhabitant (+15 years). Due to missing observations (spirits consumption in 1961) the data for Greece, Portugal and Spain relate to the most recent data from 1976, 1964 and 1962, respectively.

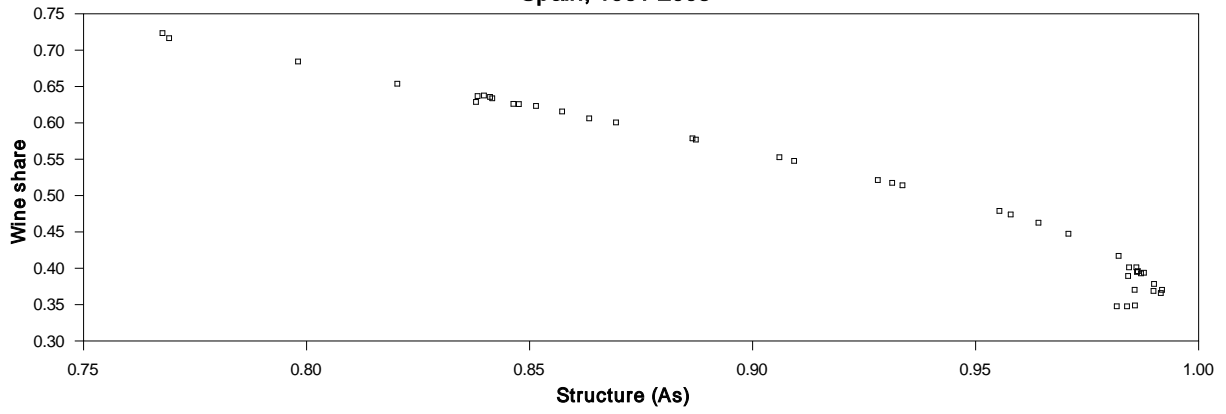
Sources: The World Health Organization (the WHOSIS database), World Drink Trends (1999, 2005), Nordic Alcohol Statistics 2003-2007, Stakes (2009).

Appendix 2.

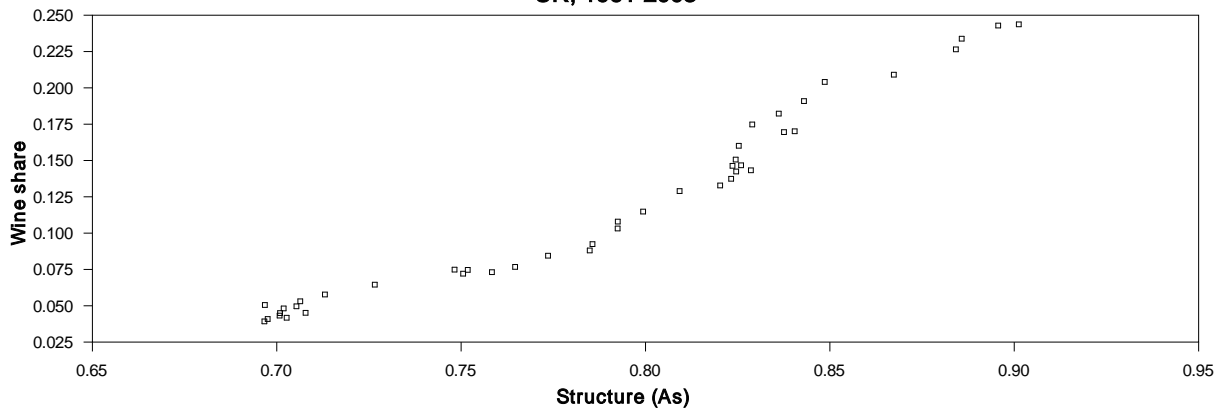
Scatter plots of the structure of alcohol consumption (A_S) and the share of wine in total alcohol consumption, selected countries (1961-2003).



Spain, 1961-2003



UK, 1961-2003



USA, 1961-2003

