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ABSTRACT

The demand for alcohol literature is vast and much conflicting information about the nature of the demand for alcoholic beverages has been published. This article presents a survey of the literature, and then uses the technique of meta-regression analysis to establish insights into the nature of the demand for beer, wine, and spirits. Unlike previous meta-studies of the demand for alcoholic beverages this study adjusts for the precision of each elasticity estimate. The analysis presented suggests reported elasticity estimates will be influenced by such factors as estimation technique, data frequency, and time period under consideration. With respect to time, the findings suggest that the demand for alcoholic beverages has become less inelastic since the mid-1950s and that the income elasticity has been falling since the mid-1960s. The analysis also found support for the idea that alcohol as a commodity group is a necessity, and that consumers respond to price discounting with inventory behaviour rather than true substitution behaviour. Little support is found for the idea that the demand for alcoholic beverages varies fundamentally across most countries, although wine may be an exception.

KEY WORDS: meta-regression analysis, price elasticity, income elasticity, alcohol

JEL CLASSIFICATION: C81, D12

1. Introduction

Alcohol production and consumption are important global economic activities that have been studied extensively. In the economics literature particular attention has been focused on estimating demand relationships for alcoholic beverages. While applied researchers generally no longer conduct demand analysis in terms of double-log single-equation models that naturally give rise to elasticity estimates, researchers still report the elasticity values implied by the demand models they estimate. As such, there now exists a substantial, perhaps overwhelming, number of empirical own-price and income elasticity estimates for the alcoholic beverage groupings: beer, wine, and spirits. For there to be an informed debate with respect to public policy and alcohol consumption it is necessary that sense be made of this vast literature.

With each new alcohol demand study authors seek to explain the differences between the findings of their own empirical work and the existing literature by noting differences in estimation technique, data frequency, or time period under consideration. So, despite the large number of own-price elasticity estimates reported in the literature it remains difficult to obtain a clear understanding of the nature of the demand for alcoholic beverages. Given the size of the literature it is not surprising that authors have begun to use meta-analysis approaches to summarise the literature. There have been two recent attempts to summarise the demand for alcohol literature using the meta-analysis approach, Fogarty (2006) and Gallet (2007). The current study presents a comprehensive review of the demand for alcohol literature, and differs from the previous meta-studies in a number of important areas. First, the current paper sets out a formal framework of analysis that considers the precision of each elasticity estimate as well as the point estimate. Such an approach represents a structural break with the two previous attempts to summarise the demand for alcohol literature, and as will be shown in the empirical section of the paper, the decision to weight elasticity estimates by estimate precision has important implications for the conclusions that are drawn from the meta-analysis. Second, summary details relating to each demand study considered are provided. This information is provided in the hope that it will serve as a useful reference for those wishing to further explore or contribute to the alcohol demand literature. Third, unlike previous meta-studies, the current study devotes considerable space to exploring and interpreting both the raw data and the meta-regression results.

The reminder of the paper is structured as follows. Section 2 first sets out background information relating to alcohol consumption, and then discusses some of the issues that cause the study of alcohol to be of interest to both health professionals and economists. Section 3 presents a conventional summary of the existing demand for alcohol literature and outlines some stylised facts about the demand for beer, wine, and spirits. Section 4 sets out details on the formal meta-analysis framework. The framework is then used to study, interpret, and discuss the elasticity estimate information; with details relating to the fixed effects and random effects approach presented in section 5, and details relating to the meta-regression analysis presented in section 6. Concluding comments are presented in Section 7.

2. Consumption, externalities, and excise taxes

As the World Health Organisation estimates that there are some two billion alcohol consumers, alcohol is clearly a popular good. While most consumers enjoy alcohol in moderation, some consumers do over indulge and heavy alcohol consumption, especially binge drinking, is associated with negative health and social outcomes. The enjoyment alcohol consumption can bring to the consumer, and the potential for negative outcomes have long been documented. For example, the verse of Theognis (c. 650 BC), reproduced in Robinson (1999, p. 419), warns of the dangers of drunkenness, while at the same time praises the virtue of wine. The remainder of this section sets out relevant background information relating to alcohol consumption, taxation, and the view of the health profession on alcohol.

There are several ways of considering alcohol consumption data. One way of presenting information is to consider the conditional or unconditional budget share for each beverage. The conditional budget share of beverage *i* (*i* = beer, wine, sprits), in country *c* denoted w_{ci}, is given by $\left(p_{ci}q_{ci}/M_{cA}\right)$, where p_{ci} is the price of beverage *i* in country *c*, q_{ci} is the quantity of beverage *i* consumed in country *c*, $M_{cA}=\sum_{i=1}^{3} p_{ci}q_{ci}$, and $\sum_{i=1}^{3} w_{ci}=1$. Conditional budget share information is not the only way of presenting information on the relative importance of each beverage to consumers, and nor is it necessarily the most instructive. Another approach that is sometimes more revealing is to consider the level of pure alcohol consumed from each beverage and then develop what might be thought of as conditional ethanol share information. The relative ethanol share of beverage *i* in country *c*, denoted s_{ci}, is given by $\left(a_{ci}q_{ci}/E_c\right)$ where, a_{ci} is the level of alcohol by volume of beverage *i* in country *c*, q_{ci} is the quantity of beverage *i* consumed in country *c*, $E_c=\sum_{i=1}^{3} a_{ci}q_{ci}$, and $\sum_{i=1}^{3} s_{ci}=1$.

For select countries, the left-hand panel of Table 1 presents details on the per capita ethanol consumption associated with beverage *i* in country *c*, in 1996[1]. It informs on the differences between countries with a high level of alcohol consumption such as France -- the per capita level of ethanol consumption for France in 1996 was: beer 2.45 litres, wine 8.91 litres, and spirits 3.01 litres -- and countries with a low level of alcohol consumption such as Norway -- the level of per capita ethanol consumption in Norway in 1996 was: beer 3.27 litres, wine 1.13 litres, and spirits 1.02 litres. The right-hand panel of Table 1 informs on the per capita conditional ethanol share of each beverage. Although the two alcohol consumption measures are correlated, they provide slightly different information. For example, while Norway is in general a low alcohol consumption country, beer, with an ethanol market share of 60 percent, is clearly the most important of the three

[1] As a survey paper that considers elasticity estimates through time, 1996 appeared a reasonable reference year. Current alcohol consumption information can be obtained from the GMID database.

beverages. Similarly, while France is in general a high alcohol consumption country, wine, with an ethanol market share of 62 percent, is noticeably more important than either spirits or beer in terms of a source of ethanol. For the sample of countries considered, the unweighted mean conditional ethanol shares are: beer 48 percent, wine 27 percent, and spirits 25 percent.

Table 1 **Alcohol consumption in 1996 in terms of pure alcohol**

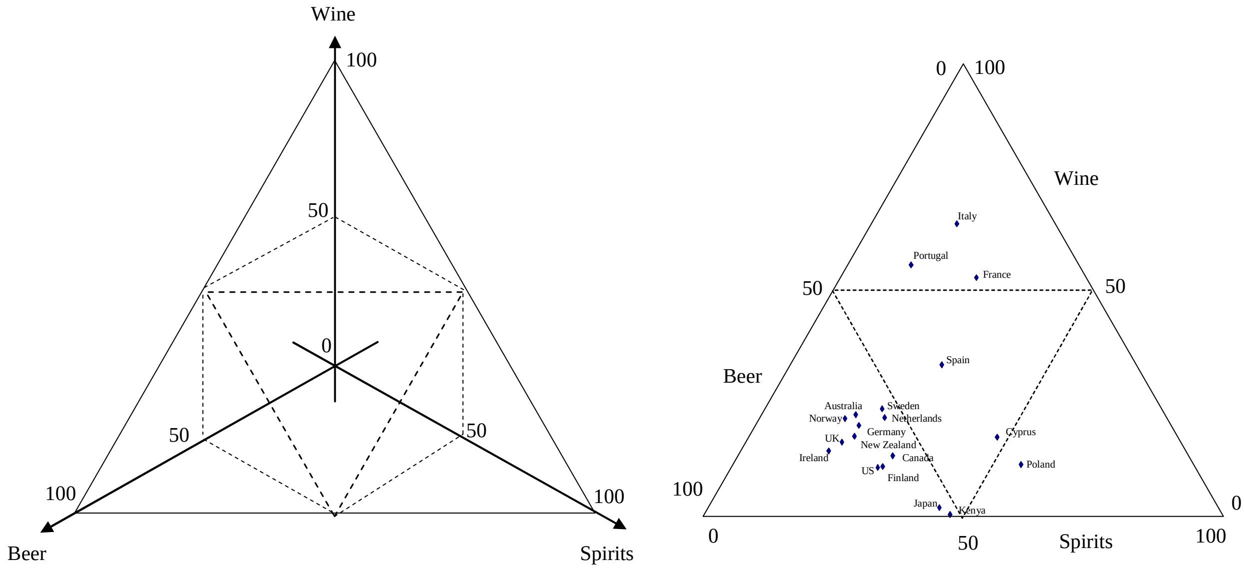
No.	Country	Volume (litres)				Share in Total (percent)			
		Beer	Wine	Spirits	Total	Beer	Wine	Spirits	Total
1.	Australia	6.07	2.78	1.72	10.57	57.43	26.30	16.27	100
2.	Canada	4.23	1.19	2.16	7.58	55.80	15.70	28.50	100
3.	Cyprus	3.40	2.05	4.55	10.00	34.00	20.50	45.50	100
4.	Finland	5.06	1.12	2.40	8.58	58.97	13.05	27.97	100
5.	France	2.45	8.91	3.01	14.37	17.05	62.00	20.95	100
6.	Germany	8.01	3.26	2.50	13.77	58.17	23.67	18.16	100
7.	Ireland	9.32	2.35	2.22	13.89	67.10	16.92	15.98	100
8.	Italy	1.41	7.74	1.06	10.21	13.81	75.81	10.38	100
9.	Japan	3.21	.14	2.62	5.97	53.77	2.35	43.89	100
10.	Kenya	.87	.01	.77	1.65	52.73	.61	46.67	100
11.	Netherlands	5.13	2.51	2.16	9.80	52.35	25.61	22.04	100
12.	New Zealand	6.11	2.59	1.51	10.21	59.84	25.37	14.79	100
13.	Norway	3.27	1.13	1.02	5.42	60.33	20.85	18.82	100
14.	Poland	2.62	1.06	4.24	7.92	33.08	13.38	53.54	100
15.	Portugal	3.75	8.81	.97	13.53	27.72	65.11	7.17	100
16.	Spain	3.86	4.34	2.86	11.06	34.90	39.24	25.86	100
17.	Sweden	3.64	1.97	1.44	7.05	51.63	27.94	20.43	100
18.	U.K.	6.34	1.94	1.72	10.00	63.40	19.40	17.20	100
19.	U.S.	5.36	1.12	2.43	8.91	60.16	12.57	27.27	100
	Mean	4.43	2.90	2.18	9.50	48.01	26.65	25.34	100

Source: Selvanathan and Selvanathan (2005).

When considering the per capita ethanol consumption data in Table 1, the similarities and differences in alcohol consumption between countries are not necessarily immediately clear. One way that the similarities and differences in consumption patterns can be shown is to follow Fogarty (2006) and plot the per capita ethanol market share consumption data within an equilateral triangle. The left-hand plot in Figure 1 shows how the information relating to the conditional ethanol shares on the three beverages is projected into two dimensions. The specific percent of total ethanol ingested attributable to each beverage can be read from the appropriate axis, but here we simply note that points in the bottom left sub-triangle represent points of consumption where more than 50 percent of the total ethanol intake is from beer; points in the top sub-triangle represent points of consumption where more than 50 percent of the total ethanol intake is from wine; points in the bottom right sub-triangle represent points of consumption where more than 50 percent of the total ethanol intake is from spirits; and points in the central sub-triangle represent points where no single beverage accounts for more than 50 percent of the consumer's ethanol intake[2]. From the right-hand plot in Figure 1 it is clear most countries in the sample (68 percent) are beer drinking countries. Only one, Poland, is clearly a spirit drinking country, although perhaps Cyprus could also be considered a spirit drinking country. Italy, France, and Portugal are clearly wine drinking countries, while the Spanish appear to have an equal enthusiasm for all beverage types. It is also notable that the ethanol share for beer, wine, and spirits is quite similar in Anglophone and Nordic countries.

[2] To find the ethanol share for beer associated with any given country take a line drawn parallel to the wine axis from the country to the beer axis. The point of intersection with the beer axis gives the percent of total ethanol consumed attributable to beer. To find wine's ethanol market share, draw a line parallel to the spirits axis from the country to the wine axis. Finally, a line drawn parallel to the beer axis from the country to the spirits axis will give the ethanol share for spirits. By construction the three ethanol shares sum to 100 percent.

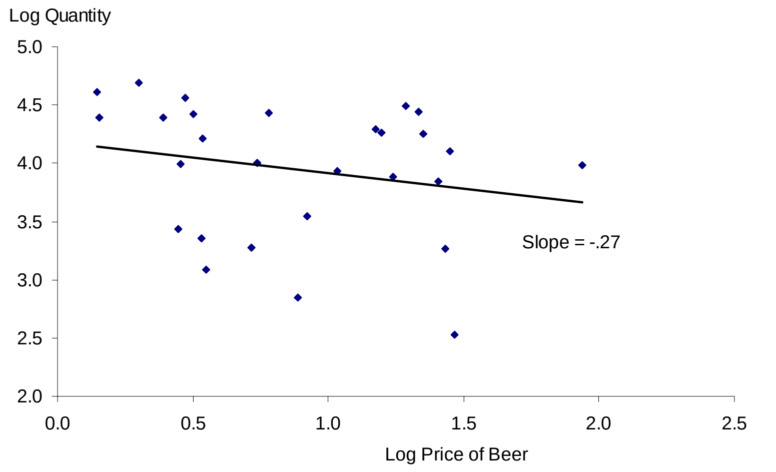
Figure 1 **The geometry of alcohol consumption: select countries**



Data source: Table 1

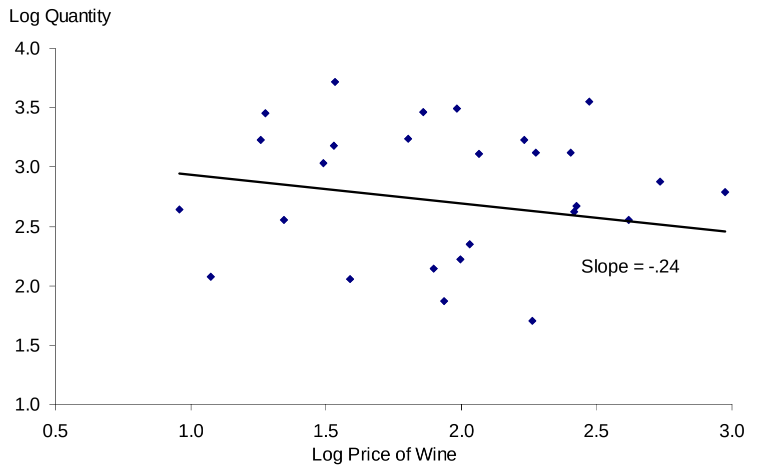
Across countries there is significant variation in both the level of consumption and the price of alcoholic beverages. Stigler and Becker (1977) argued in favour of the proposition that tastes are constant across individuals. Should this proposition be true, then by considering information on alcohol prices and alcohol consumption across countries, it would be possible to gain some insight into whether or not alcohol consumption obeys the law of demand. Price and consumption details relating to off-premise purchases of alcoholic beverage for 28 countries have been plotted in Figure 2 through Figure 4. Specifically, in each figure the log of the (US dollar) price of the alcoholic beverage in question is plotted on the horizontal axis and the log of per capita consumption (at legal drinking age) is plotted on the vertical axis. To provide a general indication of the relationship between price and quantity, a least squares regression line has been fitted to each beverage price-quantity plot. As can be seen, in each case the regression line is downward sloping. Using this approach it seems clear that beer, wine, and spirits obey the law of demand. Further, as the price and quantity information is in log form, the slope coefficient reported in each figure has a possible interpretation as an estimate of the own-price elasticity of demand for each beverage. The plots are meant to provide indicative information only, but using this simple cross-country approach, the implied own-price elasticity estimates are -.27 for beer, -.24 for wine, and -.60 for spirits.

Figure 2 **Cross-country beer price-quantity comparison: 2007**



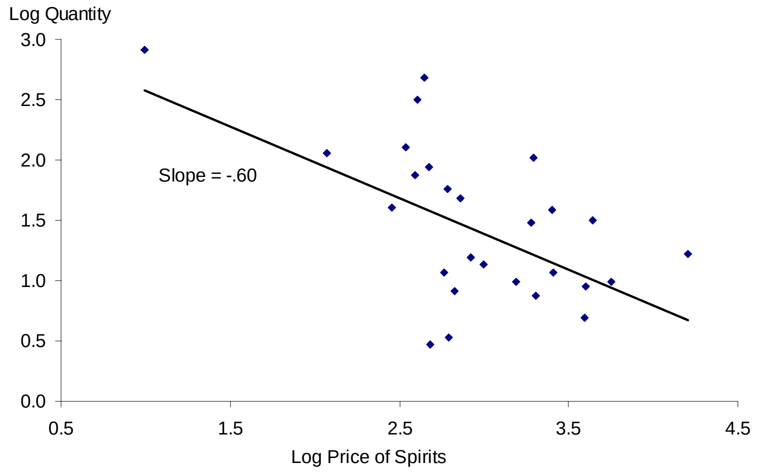
Data source: GMID database.

Figure 3 **Cross-country wine price-quantity comparison: 2007**



Data source: GMID database.

Figure 4 **Cross-country spirit price-quantity comparison: 2007**



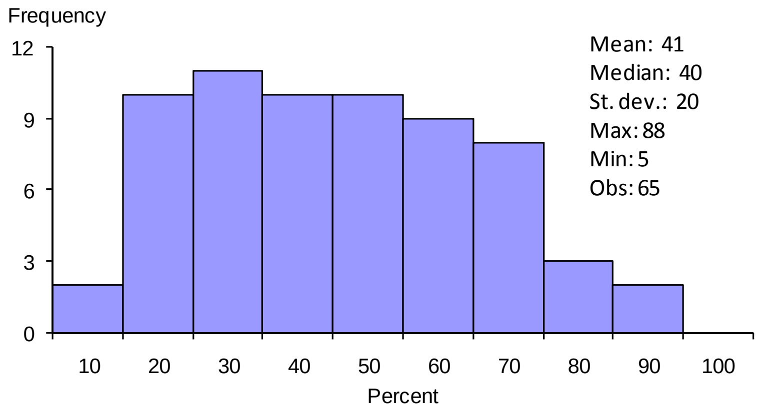
Data source: GMID database.

Despite the positive health effects of moderate alcohol consumption, heavy consumption, or binge drinking, places significant costs on individuals and the wider society. For example, Room et al., (2005, p. 520) report that alcohol is involved in about a quarter of all homicides, and 20 percent of motor vehicle accidents. For further evidence on the continuing role alcohol plays in motor vehicle fatalities see: Skog (2001) on Europe; Quinlan et al., (2005) on the US; Fujita and Shibata (2006) on Japan, and Drummer et al., (2003) on Australia. Total direct harm from alcohol is however not just related to fatalities. As such, it is worth considering an expanded measure of direct harm, such as disability adjusted life years lost. Disability adjusted life years lost is a measure that not only captures information on premature deaths caused by a disease, but also captures information on disease impairment. For example, in terms of disability adjusted life years lost, two years spent suffering a disability with a severity factor of 0.5 is equivalent to one year lost to premature death. In 2000 the WHO estimated that 4.0 percent of all disability adjusted life years lost could be attributed to alcohol (WHO, 2004, pp. 50-1).

More generally, alcohol consumption places externality cost on society through road trauma costs, general health costs, and criminal justice costs; and these costs are significant. See Cnossen (2007, p. 716) for a summary table of reported alcohol externality cost estimates expressed as a percent of GDP, and in per capita terms. For relatively recent estimates of direct and indirect alcohol externality costs see Cabinet (2003) for the UK; Collins and Lapsley (2008) for Australia; and for summary information on reported estimates for studies across various countries WHO (2004, p. 66). Alcohol users also have higher absentee rates from work (Pidd et al., 2006; Norström, 2006) and so calculations of total economic loss attributable to alcohol are substantial.

Excessive alcohol consumption and the existence of externalities has led governments to restrict the sale of alcohol, limit alcohol advertising, and impose substantial taxes on the sale of alcoholic beverages. Taxation levels vary across countries, but it is almost universally the case that in developed economies alcoholic beverages are highly taxed. The tax burden on a good can be considered in several different ways. For example, Selvanathan and Selvanathan (2005, p. 319) provide summary tax information for beer, wine, and spirits across 22 countries where the total tax burden is expressed as a percentage of retail price. Across the countries in the sample the unweighted mean tax burden on beer was 35 percent, standard deviation 13 percent; for wine the mean tax burden was 30 percent, standard deviation 19 percent; and for spirits the mean tax burden was 61 percent, standard deviation 15 percent[3]. The distribution of tax rates across all three beverage types is shown below in Figure 5.

Figure 5 **Alcohol tax rates expressed as percent of retail price**



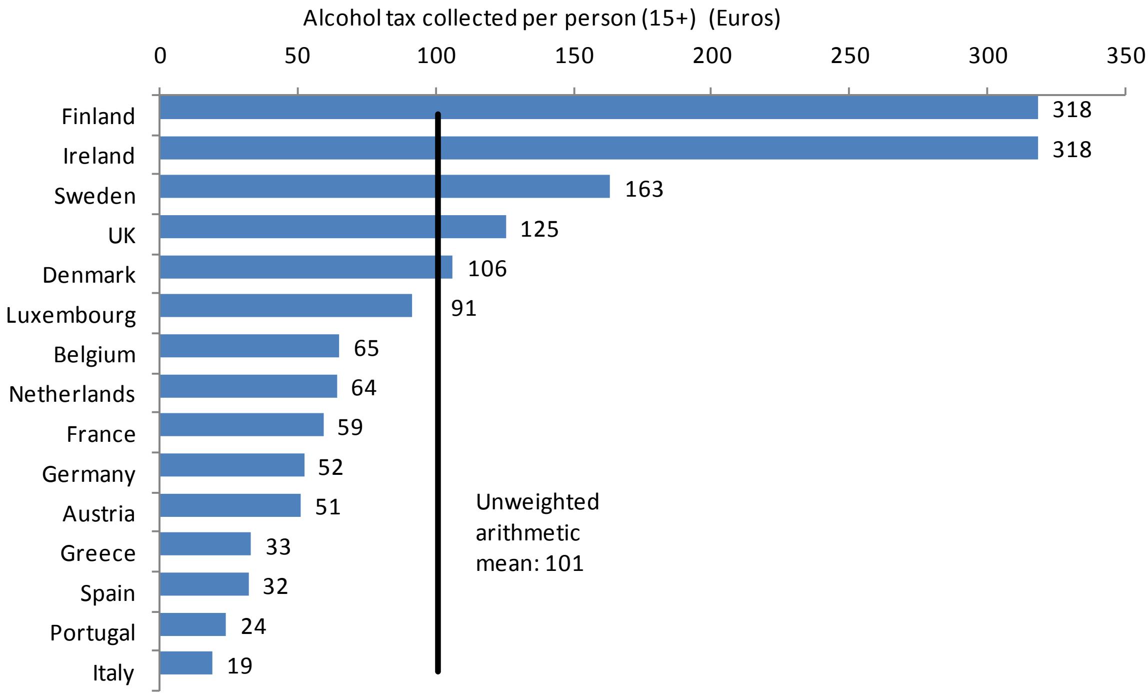
Data source: Selvanathan and Selvanathan (2005).

An alternative way of considering the alcohol tax burden is to consider the revenue generated by alcohol taxes in different counties. Cnossen (2007, p. 706) provides details on alcohol excise taxation revenue in European countries, and for the EU-15, alcohol taxation revenue makes up between 2.5 percent (Ireland) and .2 percent (Italy) of total country tax revenue. By combining information on alcohol tax revenue and population statistics, Cnossen is able to arrive at a measure of the amount paid per person in alcohol excise taxes in each country, which is an interesting statistic. Details on taxes paid are shown in Figure 6. It should however be noted that the amount paid depends both on the tax rate and the level of consumption, so while the residents of Finland

[3] The countries in the sample were: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, and US. There was no Spirit tax information for Japan

and Ireland both pay the highest amount in per capita alcohol excise taxes, in Finland it is because the tax rate is high, and in Ireland it is due to enthusiastic consumption.

Figure 6 **Per capita alcohol tax paid in various European countries**



Data source: Cnossen (2007).

Despite the existence of excise tax rates that are already high, health professionals generally view higher alcohol taxes as appropriate policy. For example, Room et al., (2005, p. 526) reflect the deeply held view of many health professionals when they write "… raising the price of alcoholic beverages is an effective way to reduce rates of alcohol-related problems everywhere." That there are externality costs associated with alcohol consumption is well established. That further increases in alcohol taxes would everywhere be appropriate is far from clear. First, details on tax pass through rates for alcoholic beverages are largely unknown[4]. There is therefore substantial uncertainty regarding the change in alcohol consumption following an increase in alcohol tax. Second, with respect to setting tax rates, public policy officials may be interested in setting tax rates so that they are consistent with the ideas of Ramsey who advocated that: "In taxing commodities

[4] Kenkel (2005) considers pass through rates in Alaska.

which are rivals for demand, like wine, beer and spirits … …the rule to be observed is that the taxes should be such as to leave unaltered the proportions in which they are consumed" (Ramsey 1927, p. 59). Third, the alcoholic beverage industries are important industries and caution should be exercised before an excessive tax burden is placed on them.

3. Demand relationships and literature summary

Fundamentally, the own-price elasticity of a good is determined by the number of substitute products. That this is the case can be seen by considering the implications of demand homogeneity in elasticity form. If η_{ij} is used to denote compensated price elasticities, then for $i = j,\ \eta_{ij}$ represents the compensated own-price elasticity of good *i*, and for $i \neq j,\ \eta_{ij}$ represents the compensated cross-price elasticity of good *i* with respect to good *j*. Demand homogeneity requires $\sum_j \eta_{ij} = 0,$ and by definition, for $i = j,\ \eta_{ij} < 0.$ If, for $i \neq j,\ \eta_{ij}$ is positive, then product *j* is a substitute for product *i*, and if it is negative the product is a complement. The number of substitute products, and the degree to which they are substitutable, is therefore the fundamental determinant of the own-price elasticity of a good.

As alcohol is both mind altering and addictive it is reasonable to suggest alcohol has relatively few substitutes. Estimates of the own-price elasticity of demand for alcoholic beverages are therefore unlikely to be far from zero. Although, as the fundamental determinant of the own-price elasticity is the number of substitute products, estimates will vary depending on how the beverage is defined. Consider beer for example. It could reasonably be argued the most important substitute products for beer are wine and spirits. As there are relatively few substitute products, it is likely the absolute value of the own-price elasticity of beer is quite low. The same is obviously also true for wine and spirits. Now consider a specific brand of beer, or a specific sub-market category of beer, say imported beer. For any given brand of beer, or beer sub-market category, there are many substitute beer products. As such, it is reasonable to expect the absolute value of the own-price elasticity of demand for a specific beer brand or beer sub-market category to be relatively high. Hausman et al., (1994) is a study that provides elasticity estimates for beer as a group and also different beer brands, and the results reported are consistent with expectations. Specifically, the reported own-price elasticity estimates for different beer brands range from -3.8 to -6.2, and the estimated own-price elasticity for beer as a group is -1.3.

As beer, wine, and spirits are all normal goods, if the income elasticity estimates are conditional estimates, the budget share of each good is relatively large, and there is little scope for the conditional income elasticity estimates to vary greatly from unity. However, where the category is finely defined such that the budget share is small, there exists at least the theoretical possibility for income elasticity estimates to vary significantly from unity. To see why this is true consider Engle aggregation in elasticity form. If η_i is used to denote the income elasticity of beverage *i*, then Engle aggregation imposes the requirement that $\sum_i w_i \eta_i$, and only if the number of beverage categories is large, so that it is possible for the budget share of beverage *i* to be small, is it possible for the income elasticity of beverage *i* to be far from unity.

Summary information on each alcohol demand study reviewed is presented in Table 2, and the information is organised first by country, and then by author. Details on the assumptions made in compiling Table 2, along with summary comments on each study are presented in an appendix that is available on request. The oldest approach to estimating price and income elasticities for alcoholic beverages is the utility-free approach, where typically, but not always, a single-equation double-log demand equation is estimated. Some of the earliest examples of the approach that are relevant include Stone (1945) and Prest (1949). The single-equation approach was however superseded by system-wide utility based estimation approaches. The two most commonly used system-wide models appear to have been the Rotterdam model, which as noted in Clements and Theil (1987, p. 25) is associated with the work of Barten (1964) and Theil (1965); and the AIDS model due to Deaton and Muellbauer (1980a). Other system-wide approaches such as the CBS approach and NBR approach are essentially a blend of these two approaches. In the demand for alcohol literature the relationship between different system-wide approaches been set out in several articles, including Nelson and Moran (1995), and Duffy (2001)[5]. A detailed discussion of select approaches to applied demand analysis and the linkages between different approaches can be found in Clements and Selvanathan (1987, pp. 1-72). Worked examples using different estimation approaches can also be found in Deaton and Muellbauer (1980b). The system-wide approach has evolved through time to incorporate additional features and remains a popular estimation approach. Alternative estimation approaches have however also become popular in recent years.

Similar to the demand for cigarettes, alcohol has been seen by researchers as a natural testing ground for the rational addiction hypothesis of Becker and Murphy (1988) that postulates consumption in the past, present, and future are all complements. Framing the demand equation estimated such that it is possible to test for rational addiction has therefore been popular in some more recent papers. Explicit time series approaches that make use of cointegration techniques have also proven to be popular in recent years. Panel data approaches and pure cross-section approaches have not been especially prevalent in the literature, but this is perhaps because of data limitations.

Although much of the detail reported in Table 2 is self explanatory, some brief comments on the link between conditional and unconditional estimates are worthwhile. Consider an increase in the price of beverage *i*, where both real income and the price of all other beverages are held constant so that the relative price of beverage *i* has increased. The conditional demand equation for beverage *i* gives the consumption response where the total expenditure on alcohol is held

[5] As the theoretical variation between different system-wide approaches is minimal, and the differences between estimates obtained using different system-wide approaches slight, for studies reporting estimates from different system-wide models, only one set of estimates are reported in the literature summary. If an author indicted a preference for a particular model specification, the results for the author's preferred model are reported. In the meta-regression analysis all system wide estimates, AIDS, Rotterdam etc., are coded together as a group.

constant, and so by construction the consumption of beverage *i* falls and the consumption of all other alcoholic beverages increases. Any change in the price of a beverage will however have a second effect. A change in the price of an individual beverage will change the relative price of alcohol as a group. In this specific example the relative price of the consumption group alcohol increases, and so in an unconditional setting there is a decrease in the consumption of all alcoholic beverages. For beverage *i* the effect is in the same direction as the conditional effect, and so unconditional own-price elasticity estimates are more responsive to price changes than conditional estimates. The relationship between unconditional and conditional income elasticity estimates depends on the income elasticity for alcoholic beverages as a whole. If the income elasticity for the group alcoholic beverages is greater than unity, unconditional income elasticity estimates are greater than conditional income elasticity estimates. Likewise, if the income elasticity for the group alcoholic beverages is less then unity, unconditional income elasticity estimates are less than conditional income elasticity estimates.

For a given demand equation the theoretical relationships between different Marshallian and Hicksian own-price elasticities are well known. As beer, wine, and spirits are normal goods, the Marshallian own-price elasticity will always be more elastic than the corresponding Hicksian elasticity. However, in addition to Marshallian and Hicksian own-price elasticities, Table 2 also reports details on Frisch own-price elasticities, and the relationship between Frisch own-price elasticity estimates -- where the marginal utility of income is held constant -- and the other elasticity values is not necessarily so well known. As the income elasticity of alcohol as a group is positive, the Frisch own-price elasticity will always be more elastic than the corresponding Hicksian elasticity. However, the relationship between Marshallian and Frisch own-price elasticity estimates depends on both the individual beverage income elasticity and the group income elasticity for alcohol. As such, no clear a priori statements can be made regarding the relationship between

Marshallian and Frisch own-price elasticity estimates. See Clements and Theil (1987, pp. 242-244) for further details on the relationship between different own-price elasticity measures.

Table 2 **Summary elasticity information**

No.	Author(s) and Date	Period	Framework	Demand Model	Own-Price Elasticity				Income Elasticity		
					Type	Beer	Wine	Spirits	Beer	Wine	Spirits
				I. Australia							
1.	Chang et al., (2002)	1975-99	DAIDS	C	M	-.82	-.82	-	1.04	1.25	-
2.	Clements et al., (1997)	1955-85	Rotterdam	C	F	-.40	-.50	-.91	.81	1.00	1.83
			Rotterdam	C	H	-.18	-.42	-.77	-	-	-
3.	Clements and Selvanathan (1991)	1955-86	Rotterdam	C	H	-.15	-.32	-.61	.73	.61	2.51
			Rotterdam	U	H	-.43	-.37	-.83	.73	.61	2.52
4.	Clements and Selvanathan (1987)	1956-77	Working	C	F	-.35	-.37	-1.11	.73	.62	2.50
			Working	C	H	-.12	-.34	-.52	-	-	-
			Working	C	M	-.65	-.42	-.92	-	-	-
5.	Clements & Selvanathan (1988)	1956-77	Rotterdam	C	H	-.09	-.39	-.41	.83	.78	1.97
6.	Clements and Johnson (1983)	1956-77	Rotterdam	C	H	-.09	-.39	-.41	.83	.78	1.97
			Rotterdam	U	H	-.36	-.43	-.74	.80	.75	1.91
7.	Miller and Roberts (1972)	1970-71	Inferred	U	H	-	-1.80	-	-	-	-
8.	Owen (1979)	1955-77	Linear (S)	U	H	-.28	-	-	-	.55	-
			Linear (L)	U	H	-.62	-	-	-	1.23	-
9.	Penm (1988)	1968-84	Rotterdam	C	H	-.45	-	-	.69	-	-
10.	Selvanathan and Selvanathan (2005)	1955-98	Rotterdam	C	H	-.20	-.43	-.64	.79	1.00	1.80
			Linear	C	H	-.65	-.61	-.68	.77	1.06	1.93
11.	Selvanathan and Selvanathan (2004)	1956-99	Rotterdam	C	H	-.16	-.31	-.62	.66	.83	2.47
			Rotterdam	U	H	-.33	-.39	-1.30	.46	.60	1.80
12.	Selvanathan (1991)	1955-85	Rotterdam	C	H	-.15	-.60	-.61	.84	.73	1.94
13.	Taplin and Ryan (1969)	1957-68	Inferred	U	H	-	-3.00	-	-	1.50	-
				II. Canada							
14.	Adrian and Ferguson (1987)	1958-81	Linear (D)	U	H	-.37	-.61	-.05	.23	.70	.89
			Linear (I)	U	H	-.84	-1.27	-.96	1.54	.62	.69
15.	Alley et al., (1992)[1]	Apr. 1981 – Aug. 86	AIDS (D)	U	M	-.15	-.76	-1.76	.06	.27	.26
			AIDS (I)	U	M	-	-.55	-	-	.29	-
			AIDS (U.S.)	U	M	-	-.97	-	-	.11	-
			AIDS (D)	U	H	-.15	-.76	-1.76	-	-	-
			AIDS (I)	U	H	-	-.55	-	-	-	-
			AIDS (U.S.)	U	H	-	-.97	-	-	-	-
16.	Andrikopoulos et al., (1997)[2]	1958-87	DAIDS (D)	C	M	-.48	-.51	-.54	.96	2.22	.08
			DAIDS (I)	C	M	-1.02	-.70	-.34	6.38	6.00	.83
			DAIDS (D)	C	H	-.08	-.39	-.51	-	-	-
			DAIDS (I)	C	H	-1.00	-.35	-.27	-	-	-
17.	Clements et al., (1997)	1955-85	Rotterdam	C	F	-.15	-.60	-.61	.74	1.05	1.25
			Rotterdam	C	H	-.21	-.40	-.47	-	-	-
18.	Heinen and Sims (2000)	1978-88	Time (S)		H	-	-.66	-	-	1.73	-
			Time (S)		H	-	-.79	-	-	2.06	-
19.	Johnson et al., (1992)	1956-83	Time (S)	U	H	-.26	-.88	-.63	.38	.97	.92
			Time (L)	U	H	-.14	-1.17	.37	.27	2.19	1.02

Table 2 **Summary elasticity information**

No.	Author(s) and Date	Period	Framework	Demand Model	Own-Price Elasticity				Income Elasticity		
					Type	Beer	Wine	Spirits	Beer	Wine	Spirits
20.	Johnson and Oksanen (1977)	1956-71	Panel (S)	U	H	-.27	-.67	-1.14	.002	.04	.11
			Panel (L)	U	H	-.33	-1.78	-1.77			.17
21.	Johnson and Oksanen (1974)	1955-71	Linear (S)	U	H	-.22	-.50	-.91	.04	-.008	.23
			Linear (L)	U	H	-.38	-1.60	-1.30	.06	-.02	.40
22.	Lau (1975)	1949-69	Linear	U	H	-.43	-1.88	-1.17	.40	.49	.59
23.	Lariviere et al., (2000)	May 1979 - Apr 87	DAIDS (L)	C	H	-.51	-.87	-.67	.92	1.14	1.11
			DAIDS (L)	C	M	-.61	-.98	-.92	-	-	-
			DAIDS (S)	C	H	-.55	-.78	-.60	-	-	-
			DAIDS (S)	C	M	-.66	-.88	-.83	-	-	-
24.	Quek (1988)	1953-82	Working	C	H	-.28	-.58	-.30	.77	1.12	1.20
			Working	U	H	-.16	-.66	-.66	.44	1.26	.95
25.	Sabuhoro et al., (1996)	1979:5 - 87:4	DAIDS (L)	C	H	-.72	-.99	-1.41	1.61	.26	.13
26.	Selvanathan and Selvanathan (2005)	1953-99	Rotterdam	C	H	-.22	-.48	-.29	.67	1.18	1.32
			Linear	C	H	-.43	-.57	-.49	.64	1.35	1.35
27.	Selvanathan (1991)	1953-82	Rotterdam	C	H	-.26	-.16	-.01	.71	.97	1.29
28.	Yu and Chen (1998)	1955-94	Time series (S)	U	H	-.95	-	-1.15	-	-	-
			Time series (L)	U	H	-1.21	-	-1.54	-	-	-
				III. Cyprus							
29.	Andrikopoulos and Loizides (2000)	1970-92	DAIDS (D)	C	H	-.35	-.24	-.17	1.30	1.03	.65
			DAIDS (I)	C	H	-1.00	-.56	-.72	1.02	.70	1.45
				III. Denmark							
30.	Bentzen et al., (1999)	1960-94	Time Series	U	H	-	-	-1.20	.06	-.02	-.20
31.	Bentzen et al., (1997)	1955-94	Time series (L)	U	H	-.17	-.93	-1.23	1.28	1.15	1.31
			Time series (S)	U	H	-.47	-.29	-.89	.50	.89	.46
32.	Skog and Melberg (2006)	1911-31	Time series (S)	U	H	-	-	-.60	-	-	-
			Time series (L)	U	H	-	-	-.40	-	-	-
				IV. Finland							
33.	Bentzen et al., (1999)	1960-94	Time Series	U	H	-	-	-1.20	.13	.83	.32
			Time Series			-	-	-1.80			
34.	Clements et al., (1997)	1970-83	Rotterdam	C	F	-.61	-1.78	-1.78	.45	1.32	1.32
			Rotterdam	C	H	-.51	-1.46	-1.46	-	-	-
35.	Holm (1995)	1965-87	AIDS	C	H	-.51	-.51	-.91	1.47	.84	.80
36.	Holm and Suoniemi (1992)	1962-87	AIDS	C	H	-.38	-2.31	-.51	-	-	-
37.	Nyberg (1967)	1949-62	_______	-	-	-.49	-.83	-.54	.22	.97	.86
38.	Salo (1990)	1969-86	_______	-	-	-.60	-1.30	-1.00	-	-	-
39.	Selvanathan and Selvanathan (2005)	1969-85	Rotterdam	C	H	-.24	-.78	-.30	.44	1.52	1.29
			Linear	C	H	-.81	-.39	-1.43	.42	1.63	1.24
40.	Selvanathan (1991)	1969-83	Rotterdam	C	H	-.54	-.86	-.73	.40	1.58	1.29
				V. France							
41.	Labys (1976)	1954-71	Linear	U	H	-	-.06	-	-	-	-
42.	Selvanathan and Selvanathan (2005)	1971-95	Rotterdam	C	H	-.06	-.05	-.06	.66	.88	1.23
			Linear	C	H	-.08	-.09	-.14	.65	.85	1.29
				VI. Germany							
43.	Labys (1976)	1954-71	Linear	U	H	-	-.38	-	-	.51	-
				VI. Ireland							
44.	Eakins and Gallagher (2003)	1960-98	DAIDS (S)	U	M	-.53	-.80	-.85	.16	1.86	.86

Table 2 **Summary elasticity information**

No.	Author(s) and Date	Period	Framework	Demand Model	Own-Price Elasticity				Income Elasticity		
					Type	Beer	Wine	Spirits	Beer	Wine	Spirits
			DAIDS (L)	U	M	-.76	-1.59	-.75	1.03	2.33	1.86
45.	Thom (1984)	1969:1-80:4	AIDS	-	-	-.68	-1.60	-1.42	.80	1.23	1.39
46.	Walsh and Walsh (1970)	1953-68	Linear	-	-	-.17	-	-.57	.78	-	1.94
				VII. Italy							
47.	Labys (1976)	1954-71	Linear	U	H	-	-1.00	-	-	.28	-
				VIII. Japan							
48.	Selvanathan and Selvanathan (2005)	1964-02	Rotterdam	C	H	-.12	-.13	-.24	1.28	.63	1.02
			Linear	C	H	-.33	-.06	-.44	1.31	.50	1.26
49.	Selvanathan (1991)	1964-83	Rotterdam	C	H	-.25	.80	-.68	1.43	.29	.47
				IX. Kenya							
50.	Partanen (1991)	1963-85	_______ (S)	-	-	-.33	-	-	-	-	-
			_______ (L)	-	-	-1.00	-	-	-	-	-
				X. Netherlands							
51.	Eecen (1985)	1960-83	_______	-	-	-	-.50	-	-	-	-
				XI. New Zealand							
52.	Clements et al., (1997)	1965-82	Rotterdam	C	F	-.37	-.39	-.64	.84	.88	1.45
			Rotterdam	C	H	-.17	-.34	-.57	-	-	-
53.	Pearce (1986)	1965-82	Rotterdam	C	M	-.15	-.35	-.32	.85	1.14	1.31
54.	Selvanathan and Selvanathan (2005)	1965-82	Rotterdam	C	H	-.18	-.34	-.40	.84	.87	1.45
			Linear	C	H	-.23	-.78	-.43	.81	1.15	1.53
55.	Selvanathan (1991)	1965-82	Rotterdam	C	H	-.12	-.42	-.52	.90	1.13	1.18
56.	Wette et al., (1993)	1983-91	_______	-	-	-1.10	-1.10	-.50	-	-	-
57.	Zhang and Casswell (1999)	1984-96	Time series		H	-1.02	-.72	.05	-	-	-
				XII. Norway							
58.	Bentzen et al., (1999)	1960-94	Time Series	U	H	-	-	-	.36	-.16	.14
59.	Bentzen et al., (1997)	1960-94	Time (S)	U	H	-.39	-.92	-.53	.43	1.05	2.16
60.	Bentzen et al., (1997)	1960-94	Time (L)	U	H	-	-1.06	-.47	-	1.05	2.42
61.	Clements et al. (1997)	1960-86	Rotterdam	C	F	-.03	-.12	-.12	.34	1.48	1.55
			Rotterdam	C	H	-.02	-.10	-.10	-	-	-
62.	Horverak (1979)	1960-74	_______	-	-	-	-	-1.20	-	-	-
63.	Selvanathan and Selvanathan (2005)	1960-96	Rotterdam	C	H	-.04	-.14	-.09	.37	1.23	1.72
			Linear	C	H	-	-.18	-.21	.40	1.38	1.64
64.	Selvanathan (1991)	1960-86	Rotterdam	C	H	-.14	-.07	-.18	.34	1.44	1.56
				XIII. Poland							
65.	Florkowski and McNamara (1992)	1959-85	Lin. Dyn. (S)	U	M	1.28	.82	-.62	-	-	-
				XIV. Portugal							
66.	Labys (1976)	1954-71	Linear	U	H	-	-.68	-	-	.05	-
				XV. Spain							
67.	Angulo et al., (2001)	1990-91	Cross (DH)	C	H	-1.17	-1.04	-1.04	-	-	-
				U	H	-2.44	-1.52	-4.65	-	-	-
68.	Labys (1976)	1954-71	Linear	U	H	-	-.37	-	-	.14	-
				XVI. Sweden							
69.	Bentzen et al., (1999)	1960-94	Time Series	U	H	-	-	-	-.98	-1.10	.38
70.	Bentzen et al., (1997)	1960-94	Time (S)	U	H	-.67	-.40	-.72	1.44	-	.87
71.	Bentzen et al., (1997)	1960-94	Time (L)	U	H	-	-	-1.11	-	-	2.30

Table 2 **Summary elasticity information**

No.	Author(s) and Date	Period	Framework	Demand Model	Own-Price Elasticity				Income Elasticity		
					Type	Beer	Wine	Spirits	Beer	Wine	Spirits
72.	Bryding and Rosen (1969)	1920-51	______	-	-	-1.20	-1.60	-.50	-	-	-
73.	Clements et al. (1997)	1967-84	Rotterdam	C	F	-.30	-.99	-2.18	.21	.69	1.52
			Rotterdam	C	H	-.28	-.88	-1.94	-	-	-
74.	Gruenewald et al., (2006)	1984:1- 94:10	Linear (SUR)	U	H	-1.70	-.59	-.66	.19	-.17	-.16
75.	Huitfeldt and Jorner (1972)	1956-68	______	-	-	-3.00	-.70	-1.20	-	-	-
76.	Malmquist (1948)	1923-39	______	-	-	-	-.71	-.37	-	1.32	.30
77.	Norstrom (2005)	1984:1-04:1	Linear	U	H	-.79	-.57	-.96	-	-	-
78.	Selvanathan and Selvanathan (2005)	1960-99	Rotterdam	C	H	-.45	-.32	-.35	.79	.46	1.35
			Linear	C	H	-.29	-.76	-.84	.81	.40	1.15
79.	Selvanathan (1991)	1960-86	Rotterdam	C	H	-.35	-.87	-.22	.22	.48	1.52
80.	Sundstrom and Ekstrom (1962)	1931-54	______	-	-	-	-1.60	-.30	-	-	-
				XVII. UK							
81.	Baker and McKay (1990)	1970-86	AIDS	U	H	-.88	-1.37	-.94	.89	1.61	.98
82.	Blake and Nied (1997)	1952-91	DAIDS (L)	U	H	-1.27	-.82	-1.31	.81	1.85	1.16
			DAIDS (L)	C	M	-.95	-.93	-1.32	.83	1.50	.91
83.	Clements et al. (1997)	1955-85	Rotterdam	C	F	-.44	-.57	-.72	.82	1.06	1.34
			Rotterdam	C	H	-.24	-.48	-.60	-	-	-
84.	Clements and Selvanathan (1987)	1955-75	Working	C	F	-.25	-.52	-.79	.73	.62	2.50
			Working	C	H	-.19	-.23	-.24	-	-	-
			Working	C	M	-.43	-.48	-.74	-	-	-
85.	Clements & Selvanathan (1988)	1955-75	Rotterdam	C	H	-.21	-.13	-.30	.41	1.93	1.80
86.	Crawford and Tanner (1995)	1992	AIDS	C	M	-.90	-.70	-1.42	-	-	-
		1993	AIDS	C	M	-.67	-1.40	-1.18	-	-	-
87.	Crawford et al., (1999)	1989-92	AIDS	C	M	-.74	-1.85	-.86	-	-	-
		1993-96	AIDS	C	M	-.76	-1.69	-.86	-	-	-
88.	Duffy (1983)	1963Q1-78Q4	Linear (OLS)	U	H	.23	.87	-.79	1.07	2.54	1.61
			Linear (2SLS)	U	H	.20	-1.00	.76	.85	2.22	1.67
89.	Duffy (1987)	1963-83	Rotterdam	C	H	-.27	-.77	-.51	.60	1.70	1.42
			Rotterdam	U	H	-.36	-1.13	-.85	.71	2.18	1.78
90.	Duffy (1995)	1963Q1-88Q4	Rotterdam I	C	H	-.03	-.41	-.83	.80	2.81	2.38
			Rotterdam II	C	H	.01	-.33	-.72	.72	2.87	2.34
91.	Duffy (2001)	1964:1-96:4	AIDS	C	H	-.12	-.67	-.72	.79	1.18	1.34
92.	Duffy (2002)	1963:1-99:4	AIDS (ECM)	C	H	-.39	-.14	-.67	.94	.71	1.38
			AIDS	C	H	-.37	-.22	-.93	.98	.85	1.17
93.	Godfrey (1988)	1956-80	Linear	U	H	-	-.88	-.84	-	2.34	1.53
			Linear	U	H	-.14	-1.23	-1.07	.06	1.54	1.51
94.	Huang (2000)	1970:2-00:1	Time (L)		H	-1.03	-.75	-1.31	.56	1.51	.69
95.	Jones (1989)	1964:1-83:4	AIDS (Habit)	C	M	-.27	-.77	-.95	.31	1.46	1.14
96.	McGuinness (1983)	1956-79	Linear	U	H	-.30	-.17	-.38	.13	1.11	1.54
97.	Prest (1949)	1870-38[3]	Linear	U	H	-.66	-	-.86	.23	-	.74
98.	Moosa and Baxter (2002)	1964:1-95:1	AIDS (KL)	C	H	-3.2	-2.3	-	-1.8	2.3	-
99.	Salisu and Balasubramanyam (1997)	1963:1-92:3	Time (S)	U	H	-.21	-.55	-1.52	.37	.77	.59
			Time (L)	U	H	-.32	-.66	-1.28	.76	1.42	.88
100.	Selvanathan (1988)	1955-85	Working	C	H	-.13	-.37	-.32	.55	1.23	1.82
			Working	U	H	-.20	-.49	-.79	.41	1.74	2.18

Table 2 **Summary elasticity information**

No.	Author(s) and Date	Period	Framework	Demand Model	Own-Price Elasticity				Income Elasticity		
					Type	Beer	Wine	Spirits	Beer	Wine	Spirits
101.	Selvanathan and Selvanathan (2005)	1955-02	Rotterdam	C	H	-.27	-.35	-.56	.88	.67	1.51
			Linear	C	H	-.67	-.41	-.80	.80	.91	1.44
102.	Selvanathan (1991)	1955-85	Rotterdam	C	H	-.13	-.40	-.31	.52	1.31	1.83
103.	Stone and Rowe (1958)	1950-56	Linear (S)	U	H	-.53	-	-	.68	-	-
			Linear (L)	U	H	-.40	-	-	.52	-	-
104.	Stone (1951)	1920-38	Linear	U	H	-.69	-1.17	-.57	-	-	.60
105.	Stone (1945)	1929-41	Linear	U	H	-.73	-	-.72	.14	-	.54
106.	Walsh (1982)	1956-75	Linear	U	H	-.13	-.28	-.47	.13	.51	1.20
107.	Wong (1988)	1920-38	Rotterdam	U	H	-.64	-1.15	-.65	.95	1.59	.96
			Rotterdam	C	H	-.25	-.99	-.51	.94	1.62	.94
				XIX. US							
108.	Baltagi and Goel (1990)	1960-83	Experimental	U	M	-	-	-	-	-	-.63
109.	Baltagi and Griffin (2002)	1959-1994	Panel (S)	U	H	-	-	-.10	-	-	.00
			Panel (L)	U	H	-	-	-1.24	-	-	-
110.	Baltagi and Griffin (1995)	1959-1982	Panel (S)	U	H	-	-	-.20	-	-	.03
			Panel (L)	U	H	-	-	-	-	-	-
111.	Clements and Selvanathan (1987)	1949-82	Working	C	F	-.22	-.23	-.51	.75	.46	1.34
			Working	C	H	-.09	-.22	-.10	-	-	-
			Working	C	M	-.44	-.26	-.71	-	-	-
112.	Clements & Selvanathan (1988)	1949-82	Rotterdam	C	H	-.09	-.05	-.10	.76	.66	1.31
113.	Cook and Tauchen (1982)	1962-77	Panel	U	H	-	-	-1.80	-	-	.43
114.	Comanor and Wilson (1974)	1947-64	______ (S)	-	-	-.56	-.68	-.25	-	-	-
			______ (L)	-	-	-1.39	-.84	-.30	-	-	-
115.	Coulson et al., (2001)	1970Q1-90Q4	Time series (L)	U	H	-.27	-.59	-.34	-.27	.76	.22
116.	Gallet (1999)	1964-66	Linear switch	U	M	-	-	-1.35	-	-	.67
		1978-92	Linear switch	U	M	-	-	-.16	-	-	-.29
117.	Gallet and List (1998)	1964-73	Linear switch	U	H	-1.72	-	-	-.26	-	-
		1983-92	Linear switch		H	.26	-	-	-.83	-	-
118.	Gao et al. (1995)	1987-88	Synthetic	C	H	-.23	-.40	-.25	-.08	5.03	1.21
			Synthetic	U	H	-.22	-.32	-.70	-	-	-
119.	Goel and Morey (2001)	1952-82	Panel (2SLS)	U	H	-	-	-.15	-	-	.88
			Panel (2SLS)	U	H	-	-	-.17			
120.	Hausman et al., (1994)	16 years	Linear	U	H	-1.95	-	-	-	-	-
	Heinen and Pompelli (1989)	1977/78	AIDS (CS)	C	H	-.84	-.50	-.55	1.94	2.66	2.10
121.	Hogarty and Elzinga (1972)	1956-59	Linear (CS)	U	H	-.90	-	-	.43	-	-
122.	Labys (1976)	1954-71	Linear (D)	U	H	-	-.44	-	-	2.34	-
		1954-71	Linear (I)	U	H	-	-1.65	-	-	3.34	-
123.	Lee and Tremblay (1992)	1953-83	Linear (S)	U	H	-.61	-	-	.08	-	-
			Linear (L)	U	H	-.81	-	-	.11	-	-
124.	Levi and Fowler (1995)	1970-91	Linear	U	H		-.16			-.58	
125.	McCornac and Filante (1984)	1970-75	Panel	U	H	-	-	-.88	-	-	1.84
126.	Nelson (2003)	1982-97	Panel	U	H	-.16	-.20	.06	-.06	1.93	.39
127.	Nelson (1999)	1977:3-94:4	Rotterdam	C	H	-.11	-.44	-.10	.77	1.90	1.06
128.	Nelson (1997)	1974:3-90:4	Rotterdam	C	H	-.16	-.53	-.39	.66	.93	1.50
			Rotterdam	U	H	-.27	-.58	-.82	.14	.20	.31
129.	Nelson and Moran (1995)	1964-90	Rotterdam	C	H	-.04	-.08	-.04	.69	.98	1.37

Table 2 **Summary elasticity information**

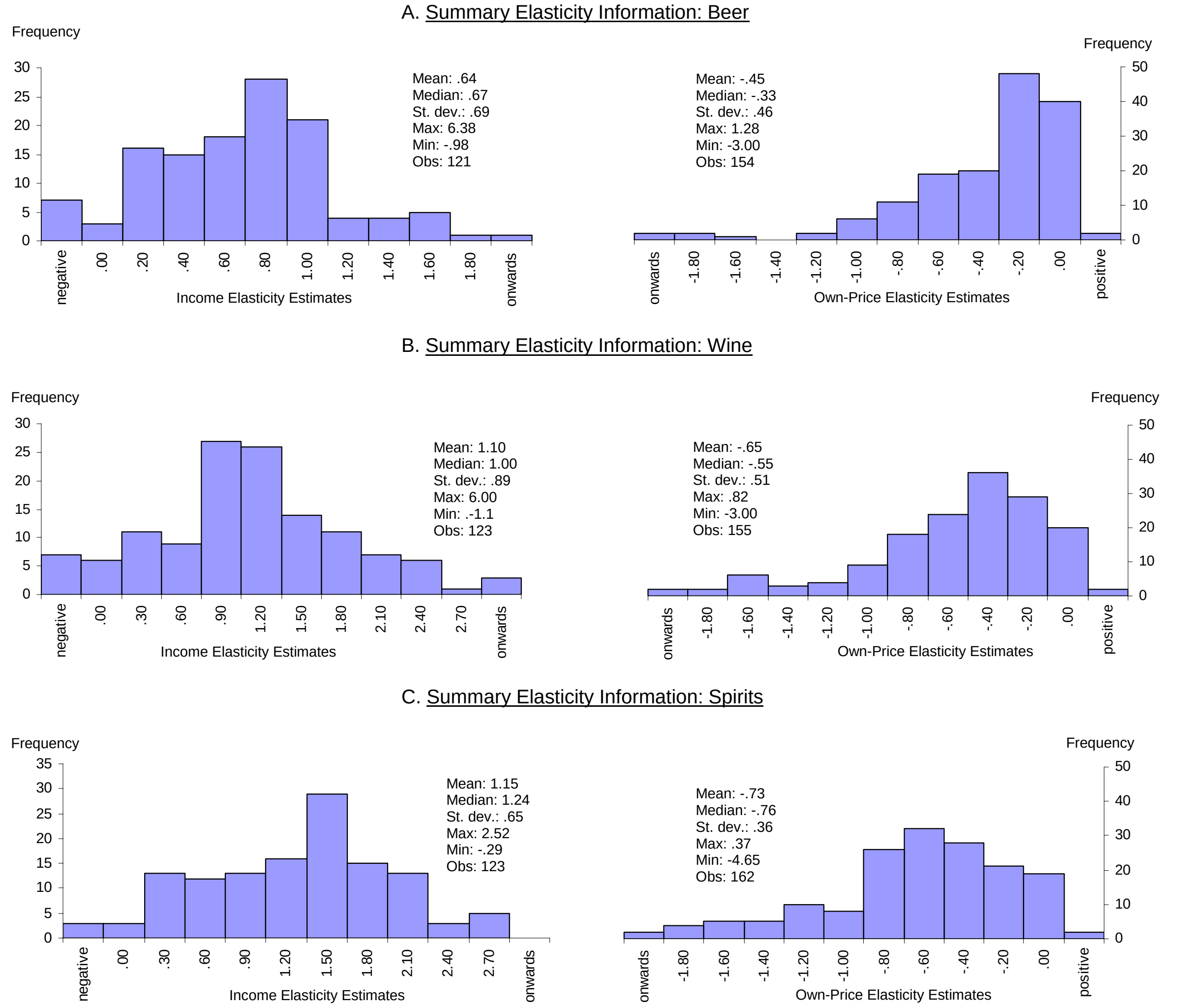
No.	Author(s) and Date	Period	Framework	Demand Model	Own-Price Elasticity				Income Elasticity		
					Type	Beer	Wine	Spirits	Beer	Wine	Spirits
			Rotterdam	C	M	-.37	-.18	-.62	-	-	-
130.	Nelson (1990)	1980	Linear (CS)	U	M	-.56	-1.86	-.89	.48	1.05	1.07
131.	Niskanen (1962)	1934-60[4]	Linear	U	H	-.70	-.98	-1.90	.38	.61	.29
132.	Norman (1975)	1946-70	______	-	-	-.87	-	-	-	-	
133.	Ornstein and Hanssens (1985)	1974-78	Linear	U	H	-	-	-.92	-	-	.44
		1976-78	Linear	U	H	-.13	-	-	-.06	-	-
134.	Selvanathan and Selvanathan (2005)	1949-00	Rotterdam	C	H	-.13	-.27	-.18	.80	1.06	1.24
			Linear	C	H	-.29	-.39	-.26	.81	1.18	1.35
135.	Selvanathan (1991)	1949-82	Rotterdam	C	H	-.11	-.05	-.11	.71	.63	1.36
136.	Simon (1966)	1950-61	Experimental	U	M	-	-	-.79	-	-	-
137.	Smith (1976)	1970	Linear (CS)	U	M	-	-	-1.50	-	-	1.75
138.	Tegene (1990)	1954-79	Time series	U	H	-.71	-1.11	-1.18	.50	.66	1.75
		1980-84	Time series	U	H	-.76	-1.10	-.86	.68	.68	1.81
139.	Trolldal and Ponicki (2005)	1982-99	Panel	U	H	-.24	-.02	-.25	.20	.29	.21
140.	Uri (1986)	1982	Linear (CS)	U	M	-1.07	-.88	-1.21	1.46	2.02	.23
141.	Wang et al., (1996)	1987-88	Synthetic (CS)	C	H	-.35	-.59	-.69	1.01	1.00	.96
			Synthetic (CS)	C	M	-.95	-.83	-.85	-	-	-

Notes: Framework: (I) refers to an imported beverage, (D) refers to a domestically produced beverage, Linear refers to single-equation estimation approaches. Synthetic refers to the average of system-wide estimates, (ECM) denotes Error Correction Mechanism estimate, (CS) is for cross-section study, (K) refers to the Kalman Filter, (S) denotes short run estimate (L) denotes long run estimate.
Demand Model: (C) denotes Conditional setting and (U) denotes Unconditional setting.
Type: (H) denotes Hicksian (Slutsky, Compensated) elasticity, (M) denotes Marshallian (Cournot, Uncompensated) elasticity, and (F) denotes Frisch elasticity.
As the theoretical variation between different system-wide approaches is minimal, and the differences between estimates obtained using different system-wide approaches slight, for studies reporting estimates from different system-wide models, only one set of estimates are reported in the literature summary. If an author indicted a preference for a particular model specification, the results for the author's preferred model are reported. In the meta-regression analysis considered in subsequent sections all system wide estimates, AIDS, Rotterdam etc, are coded together as a group.
[1] Refers to British Columbia only.
[2] Refers to Ontario only.
[3] The years 1915-19 inclusive are excluded from the sample.
[4] The years 1942-46 inclusive are excluded from the sample.

Figure 7 shows frequency plots and summary statistics for the elasticity estimate information listed in Table 2. If we first consider the own-price elasticity information, it is clear there is significant variation in reported estimates. Beer own-price elasticity estimates range from 1.28 to -3.00, with a mean value of -.44 (median -.33), and standard deviation of .46; wine own-price elasticity estimates range from .82 to -3.00, with a mean value of -.65 (median -.55), and standard deviation of .51; and spirits own-price elasticity estimates range from .37 to -4.65, with a mean value of -.73 (median -.76), and standard deviation of .56. Despite the relatively large range of values, 92 percent of the beer own-price elasticity estimates are inelastic, as are 83 percent of the wine own-price elasticity estimates, and 78 percent of the spirits own-price elasticity estimates. So, similar to the initial inference drawn from the rough cross-country price-quantity beverage plots, the actual reported individual country own-price elasticity estimates suggest that the demand for alcoholic beverages is price inelastic.

The income elasticity frequency plots are also interesting. Beer income elasticity estimates range from -.98 to 6.38, with a mean value of .64 (median .67), and standard deviation of .69; wine income elasticity estimates range from -1.10 to 6.00, with a mean value of 1.10 (median 1.00), and standard deviation of .89; and spirits income elasticity estimates range from -.29 to 2.52, with a mean value of 1.15 (median 1.24), and standard deviation of .64. As 89 percent of beer income elasticity estimates are less than unity, it seems reasonable to say that, on average, beer is viewed by consumers as a necessity. Spirits are generally seen as the most luxurious of the three alcoholic beverages, although as only 60 percent of all spirits income elasticity estimates are greater than unity, spirits are clearly not everywhere seen as a luxury. Interestingly, wine income elasticity estimates appear to be approximately evenly distributed either side of unity. So, the frequency plots suggest that beer is a necessity, spirits are on balance a luxury, and wine is a borderline case.

Figure 7 **Elasticity frequency distribution plots**



Such a high level summary of the literature can potentially mask important differences between countries. As such, it is worth summarising the data reported in Table 2 by country. Table 3 provides details of the mean income and price-elasticity estimates for each country identified in Table 2. As the number of estimates for each country varies significantly, and as no distinction is made with respect to what type of elasticity is considered, one must be cautious when interpreting the values in Table 3. Nevertheless, the table highlights some interesting features.

The mean own-price elasticity values in all countries, and across all beverages, are almost all greater than or very close to minus one. The only notable exceptions appear to be the mean own-price elasticity of beer in Spain, and the mean own-price elasticity of wine in both Spain and

Ireland. With respect to the income elasticity information, beer is a necessity almost everywhere, and Cyprus and Japan are the only countries where the mean income elasticity value for beer is greater than unity. The results for wine are mixed. In nine countries wine appears to be a necessity, and in seven countries wine appears to be a luxury. Spirits are a luxury in ten countries, and a necessity in four. So, the country specific results broadly reinforce what was found when considering the data at the aggregate level. Alcoholic beverages are generally price inelastic, beer is generally a necessity, spirits are on balance a luxury, and wine is a mixed case.

Simply aggregating and summarising the data as has been done in this section provides a useful platform for discussing the demand for alcohol. There are however many things a simply summary of the data does not tell us. For example, it does not tell us whether the estimates are changing through time, or whether estimates from linear single-equation models differ systematically from estimates generated using system-wide approaches or time series approaches. Answering such questions is fundamental to ensuring good alcohol public policy development. To more fully understand the data it is therefore important to subject the information contained in Table 2 to structured analysis.

Table 3 **Summary details on the demand for alcohol by country**

No.	Country	Own-Price Elasticity Details									Income Elasticity Details								
		Beer			Wine			Spirits			Beer			Wine			Spirits		
		Est.	Mean	S.D	Est.	Mean	S.D	Est.	Mean	S.D	Est.	Mean	S.D	Est.	Mean	S.D	Est.	Mean	S.D
1.	Australia	19	-.34	.22	18	-.66	.67	15	-.74	.25	14	.77	.13	16	.87	.28	12	2.06	.30
2.	Canada	29	-.45	.31	33	-.80	.39	29	-.78	.55	19	.89	1.41	23	1.13	1.26	20	.74	.46
3.	Cyprus	2	-.68	.46	2	-.40	.23	2	-.45	.39	2	1.16	.20	2	.87	.23	2	1.05	.57
4.	Denmark	2	-.32	.21	2	-.61	.45	5	-.86	.36	3	.61	.62	3	.67	.61	3	.52	.76
5.	Finland	9	-.52	.16	9	-1.14	.63	11	-1.06	.52	7	.50	.44	7	1.24	.35	7	1.02	.38
6.	France	2	-.07	.01	3	-.07	.02	2	-.10	.06	2	.66	.01	2	.87	.02	2	1.26	.04
7.	Germany	-	-	-	1	-.38	-	-	-	-	-	-	-	1	.51	-	-	-	-
8.	Ireland	4	-.54	.26	3	-1.33	.46	4	-.90	.37	4	.69	.37	3	1.81	.55	4	1.51	.50
9.	Italy	-	-	-	1	-1.00	-	-	-	-	-	-	-	1	-	-	-	-	-
10.	Japan	3	-.23	.11	2	-.10	.05	3	-.45	.22	3	1.34	.08	3	.47	.17	3	.92	.41
11.	Kenya	2	-.67	.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12.	Netherlands	-	-	-	1	-.50	-	-	-	-	-	-	-	-	-	-	-	-	-
13.	New Zealand	8	-.42	.40	8	-.56	.28	8	-.42	.21	5	.85	.03	5	1.03	.15	5	1.38	.14
14.	Norway	5	-.12	.16	7	-.37	.43	8	-.36	.38	6	.37	.04	7	1.07	.57	7	1.60	.72
15.	Poland	1	1.28	-	1	.82	-	1	-.62	-	-	-	-	-	-	-	1	1.48	-
16.	Portugal	-	-	-	1	-.68	-	-	-	-	-	-	-	1	.05	-	-	-	-
17.	Spain	2	-1.81	.90	3	-.98	3.00	2	-2.85	2.55	-	-	-	1	.14	-	-	-	-
18.	Sweden	10	-.90	.87	12	-.83	.41	13	-.87	.61	7	.38	.75	7	.30	.76	9	1.03	.76
19.	U.K.	42	-.47	.54	39	-.72	.56	40	-.76	.40	33	.55	.51	30	1.54	.65	32	1.39	.53
20.	U.S.	36	-.52	.49	31	-.55	.45	40	-.60	.51	27	.45	.57	24	1.30	1.20	31	.87	.70

Data source:

4. Meta-analysis framework for considering the demand for alcohol

The simple summary tables and distribution plots presented and discussed above are informative, yet it is possible to consider a more formal approach to data synthesis. To understand the nature of the demand for alcohol it is helpful to know whether or not reported elasticity estimates vary in systematic ways or through time. In particular, it is important to understand whether the choices made by researchers regarding estimation method, etc., impact upon the reported results. Meta-analysis therefore represents an approach that can be used to improve our understanding of the nature of the demand for alcohol.

Some meta-regression studies in the economics literature do not weight estimates by estimate precision. Where estimate precision is not considered the approach taken is to estimate an ordinary least squares regression and then use a general correction for heteroskedasticty such as that proposed by White. Neither Fogarty (2006) or Gallet (2007), two previous meta-studies of the demand for alcohol literature, weight elasticity estimates by estimate precision. As these two meta-studies place equal weight on precise and imprecise estimates they both potentially provide a misleading summary of the alcohol demand literature.

Consideration of multiple estimates from a single study is also a potential issue with some meta-studies in economics. With respect to the two previous alcohol meta studies, Fogarty (2006) generally takes an average across reported values, and while this approach does mean undue weight is not placed on studies that report multiple estimates, such an approach necessarily rules out the possibility of considering the precision of each estimate. Gallet (2007) reports considering 132 studies, and as the income elasticity meta-regression results reported in the paper are based on 1,014 observations and the price elasticity meta-regression results are based on 1,172 observations; multiple estimates must have been taken from at least some studies and so the results of the meta-analysis reported in Gallet (2007) are biased towards studies reporting multiple elasticity values.

The reasoning behind the selection of the meta-analysis explanatory variables in both Fogarty (2006) and Gallet (2007) is also not entirely clear. In Fogarty (2006) consideration is not given to estimation method. In the case of Gallet (2007), while the dependent variable for each of the meta-regressions considered are point estimates, the list of explanatory variables included in each meta-regressions includes variables that relate to the calculation of standard errors not point estimates. Therefore, in addition to failing to weight estimates by estimate precision, both previous meta-studies appear to also suffer to some extent from model specification problems.

The framework described below, and subsequently used in the empirical analysis, has been adapted from Hedges and Olkin (1985), Hedges (1992) and Nelson (2006), where the structure of the section largely follows that presented in Nelson (2006). Let η_{ibc} denote either the own-price or income elasticity estimate reported in study $i\ (i=1,...,N)$ for beverage $b\ (b=1,2,3)$ in country $c(c=1,...,C)$. Let us further assume that for each beverage and country we draw from study *i* a single observation. In the jargon of meta-analysis, the estimate η_{ibc} represents the effect size estimate and this estimate has standard error s_{ibc}, and variance $v_{ibc}=s_{ibc}^2$. The associated population parameter is denoted θ_{ibc}. In the current application the question of interest is whether or not, for a given country and beverage, each study is estimating an identical but unknown population parameter. Specifically, we are interested in knowing whether $\theta_{1bc}=\theta_{2bc}=...=\theta_{nbc}=\boldsymbol{\theta}_{cb}$. That is, we are interested in knowing whether the observed variation in elasticity estimates is due to sampling error only. We may also wish to test this proposition across countries and beverages, but for illustration purpose let us describe the approach for the case where we hold both country and beverage constant.

The fixed effects meta-analysis approach to answering the question of whether the observed variation is due to sampling error only can be outlined as follows. Given the estimates are normally distributed, Hedges and Olkin (1985) define an asymptotically efficient estimator of $\boldsymbol{\theta}_{bc}$ as: $\bar{\eta}_{bc} = \sum_i w_{ibc}\eta_{ibc} \big/ W_{bc}$, where $W_{bc} = \sum_i w_{ibc}$, and $w_{ibc} = 1\big/ v_{ibc}$. The value $\bar{\eta}_{bc}$ is therefore the weighted mean, where the weights are determined as the inverse of the variance of each observation. The variance of $\bar{\eta}_{bc}$ is then $\text{var}\left(\bar{\eta}_{bc}\right) = 1\big/ \sum_i w_{ibc}$. The statistic proposed in Hedges and Olkin (1985) to test for a common population parameter is $Q_{bc} = \sum_i w_{ibc}\left(\eta_{ibc} - \bar{\eta}_{bc}\right)^2$. The test statistic follows a chi-square distribution with N-1 degrees of freedom, and if Q_{bc} is less than the critical value the null that the reported elasticity estimates under consideration share a common population effect size is not rejected. There are several possible interpretations for the case where Q_{bc} is greater than the critical value. It could be that the studies are not estimating a common population parameter, or it could be that the source of the variation may be from factors such as the choice of estimation method, the time period under consideration, etc.

The assumptions that support the fixed effects model are relatively strong and so it is often necessary to consider approaches with less demanding assumptions. The random effects approach is an extension that can be considered when the fixed effects approach has been rejected as inappropriate. In the random effects approach it is hypothesised that the source of observed variation in reported elasticity estimates is in part due to sampling error, and in part caused by variation in the underlying population parameters. In the random effects approach the population values are allowed to vary randomly. In the jargon of meta-analysis the explanation of the approach is generally set out as follows. Let the distribution of true population parameters be drawn from a hyper-population which is normally distributed with mean $\boldsymbol{\theta}'_{bc}$ and variance $\sigma^2_{\theta_{bc}}$, so that the variance of η_{ibc} is no longer v_{ibc} but rather $v'_{ibc} = v_{ibc} + \sigma^2_{\theta_{bc}}$. The random effects approach then proceeds in the same manner as the fixed effects approach, except that the fixed effects weights $w_{ibc} = 1/v_{ibc}$ are replaced by the random effects weights $w'_{ibc} = 1/v'_{ibc}$. Following Hedges (1992), the between study variance method-of-moments estimate of $\sigma^2_{\theta_{bc}}$ is determined by the data. Specifically, the between study variance is found as: $\hat{\sigma}^2_{\theta_{bc}} = Q_{bc} - (N_{bc} - 1)/T$, where $T = \sum_i w_{ibc} - \left(\sum_i w^2_{ibc} / w_{ibc}\right)$ and N_{bc} represents the total number of elasticity observations for beverage *b* in country *c*.

Although the random effects approach has a different motivation, it is worth considering the weights used to estimate $\bar{\eta}_{bc}$. With the fixed effects approach, should any one observation have a small variance it will be given a large weight and it is possible this weight can overwhelm the other estimates. If we consider the range of values we might reasonably expect own-price elasticity estimates for alcoholic beverages to take, it is possible to imagine several estimates will have a reported variance relatively close to zero and so get an extremely large weight. In practical terms the random effects approach reduces the weight to very precise estimates.

An alternate extension to the basic fixed effects approach is to assume that the observed variation in elasticity estimates is caused by sampling error and variations in research methods. The fixed effects meta-regression approach says that observations can be grouped together according to study characteristics. In the case of elasticity estimates the candidates for grouping are likely to be such factors as estimation method, time period, data frequency etc. The fixed effects meta-regression for the own-price elasticity of demand estimates may be written as shown at equation (1):

$$\eta_{ibc} = \alpha + \sum_{j=1} \beta_{jbc} X_{jibc} + u_{ibc}, \tag{1}$$

where the method of estimation is WLS with weights as either the inverse variance or the inverse standard error of the elasticity estimates.

A further extension to the basic approach that can be considered, and an approach that is outlined in Hedges (1992), is a mixed effects meta-regression approach where it is assumed each elasticity estimate, or effect size, is related to the population value as $\eta_{ibc} = \theta_{ibc} + z_{ibc}$, where z_{ibc} is assumed to be normally distributed with zero mean and variance of $\sigma^2_{\theta_{bc}}$. The mixed effects regression is then as shown at equation (2):

$$\eta_{ibc} = \alpha + \sum_{j=1} \beta_{jbc} X_{jibc} + u_{ibc} + z_{ibc}, \tag{2}$$

where the error component is normally distributed with zero mean and variance $\left(v_{ibc} + \sigma^2_{\theta_{bc}}\right)$. In the mixed effects approach the β_{jbc} describe the fixed effects, and the z_{ibz} describe the random effects. The regression weights for the mixed effects model can be based on a variation of either the variance, $w^{m_1}_{ibc} = 1/v_{ibc} + \tilde{\sigma}^2_{\theta_{bc}}$, or a variation on the standard error $w^{m_2}_{ibc} = 1/s_{ibc} + \tilde{\sigma}_{\theta_{bc}}$, where $\tilde{\sigma}^2_{\theta_{bc}}$ is found using the follow method-of-moments estimator suggested in Hedges (1992): $\tilde{\sigma}^2_{\theta_{bc}} = \left[RSS_{bc}/(N_{bc} - J_{bc} - 1)\right] - \left(\sum_i v_{ibc}/N_{bc}\right)$, where RSS_{bc} is the residual sum of squares obtained when equation (1) is estimated with OLS, and J_{bc} is the number of parameters estimated in equation (1).

5. Fixed effects and random effects results

Researchers often report elasticity estimates from multiple model specifications. The framework of analysis requires that only one estimate from each study be considered[6]. The framework further requires that the standard error associated with the estimate be used. It is therefore not possible to simply take the average of the estimates reported in each study. Rather, it is necessary to select an individual estimate from each study. Judgement is therefore required in considering which estimate to use. Where possible the selection of an estimate has been guided by the discussion in each paper. In many cases the standard errors associated with the elasticity

[6] The approach has not always been strictly adhered to as where a single paper provided both a conditional and an unconditional estimate, or both a long-run and short-run estimate both estimates have been considered in the initial testing regime. The issue is further complicated in that authors may have published more than one paper and so the underling data for each paper is not necessarily strictly independent.

estimates were not reported. Depending on the type of model estimated, the particular parameterisation used, and the other information presented, in some cases it was possible to retrieve the implied elasticity estimate standard errors. In many cases it was however not possible to retrieve the standard errors, and so for the meta-analysis these observations are not considered. In the case of the price elasticity information, for testing the fixed effects and random effects models the sample was further restricted to Hicksian estimates only. The small number of Marshallian estimates, along with a dummy variable, are however included in the subsequent meta-regression analysis. Summary details for the fixed effects and random effects model specifications for beer, wine, and spirits are shown in Table 4. The upper panel of the table contains information relating to own-price elasticities and the lower panel contains information relating to income elasticities.

The first row of Table 4 shows the unweighted arithmetic mean of the Hicksian own-price elasticity estimates and the number of observations. If we consider first the beer estimates it can be seen that the unweighted mean Hicksian elasticity estimate was -.42 and that the result is an average taken across 121 estimates. Similarly, for wine the unweighted mean is -.61, (121 observations), and for spirits it is -.69 (125 observations). The second row of the table informs on whether or not restricting the sample to only those estimates with a standard error is likely to matter. Specifically, the second row of the table reports the unweighted arithmetic mean of the sub-sample of observations for which there were standard errors available, or for which it was possible to calculate the standard error. As can be seen, for the case of beer there are 74 Hicksian estimates with standard errors, and the unweighted arithmetic mean for this restricted sub-sample is -.43. For wine there are 73 estimates with a standard error and the unweighted mean of the restricted sub-sample is -.62. For spirits there are 70 estimates with standard errors and the unweighted mean of the restricted sub-sample is -.67. As for all three beverages the unweighted mean own-price elasticity for the sub-sample with standard errors is almost identical to the unrestricted unweighted mean, it is reasonable to conclude that for the price elasticity information restricting the sample to only those observations for which there is a standard error is unlikely to affect the reported information in a substantial manner.

The fixed effects weighted mean own-price elasticity values for each beverage vary noticeably from the unweighted values. Specifically, the fixed effects weighted mean for beer is -.26, for wine it is -.83, and for spirits it is -.38. As can be seen from the fixed effects *Q*-value row of the table the fixed effects null hypothesis is always rejected. Below the fixed effects results the random effects results are reported. For the random effects model, first the estimate of the between-study-variance is reported, and as can be seen, for the own-price elasticity data the estimate of the between-study-variance is .05 for beer, .19 for wine, .07 for spirits. The random effects weighted means are then reported, and are: beer -.36, wine -.57, and spirits -.52. The final row of the own-price elasticity panel of the table gives the random effects *Q*-values, and as can be seen, in all cases the null is rejected.

For the income elasticity estimates, as can be seen from the table, for beer the unweighted mean income elasticity value for the entire sample is .64 (121 obs) and .65 (99 obs) for the sample restricted to observations with a standard error. For wine the unweighted mean income elasticity value for the entire sample is 1.11 (123 obs) and for the sample restricted to observations with a standard error the value is 1.12 (98 obs). For spirits the unweighted mean income elasticity value for the sample restricted to only those observations with a standard error is 1.14 (98 obs) and for the entire sample it is 1.15 (123 obs). As was the case for the own-price elasticity information, restricting the income elasticity meta-analysis to only those values for which there is a standard error does not make a material difference to the unweighted mean values.

The beer income elasticity fixed effect weighted mean is .99, and the wine income elasticity fixed effect weighted mean is 1.0. However, in the case of spirits something strange appears to have happened. While the unweighted mean income elasticity value for spirits is close to unity, the fixed effect weighted mean is .01. The result arises because there is one study that reports an income elasticity value for spirits of .0002, with standard error .0006, and so this one estimate completely overwhelms all other estimates. As can be seen from the fixed effects *Q*-value row of the table, the fixed effects null hypothesis is always rejected. For the random effects model, again first the estimate of the between-study-variance is reported, and as can be seen, the estimates of the between-study-variance for the income elasticity data are, beer .18, wine .44, and spirits .52. Next the random effects weighted means are reported, and for the income elasticity data the values are: beer .61, wine 1.08, and spirits 1.12. The final rows of each panel of the table give the random effects *Q*-values, and again, in all cases the null is rejected.

An obvious possible source of variation in the estimates relates to country effects. As such, before progressing to a meta-regression analysis the fixed effects and random effects models were tested for select individual countries. The number of estimates reported for Australia, Canada, UK, and USA were sufficient to test the fixed effects and random effects hypothesis at the individual country level. For both the income elasticity information and the own-price elasticity information, in each individual country, and for each beverage, the fixed effects null hypothesis and the random effects null hypothesis were always rejected. As such, it would seem the meta-regression approach is worth considering.

Table 4 **Fixed effects and random effects testing**

Details	Beer		Wine		Spirits	
	Value	Obs	Value	Obs	Value	Obs
Own-Price Elasticity Details						
Unweighted mean entire sample	-.42	121	-.61	121	-.69	125
Unweighted mean restricted sample	-.43	74	-.62	73	-.67	70
Fixed effects weighted mean	-.26	74	-.83	73	-.38	70
Fixed effects Q-value	629.0	Reject	1506	Reject	1025	Reject
Random effects between study variance	.0489	-	.1930	-	.0666	-
Random effects weighted mean	-.36	74	-.57	73	-.52	70
Random effects Q-value	117.81	Reject	51.96	Reject	112.1	Reject
Income Elasticity Details						
Unweighted mean entire sample	.64	121	1.11	123	1.15	123
Unweighted mean restricted sample	.65	99	1.12	98	1.14	98
Fixed effects weighted mean	.99	99	1.01	98	.01	98
Fixed effects Q-value	4233	Reject	5341	Reject	28768	Reject
Random effects between study variance	.1787	-	.4436	-	.5152	-
Random effects weighted mean	.61	99	1.08	73	1.12	70
Random effects Q-value	82.45	Reject	135.9	Reject	66.47	Reject

6. Meta-regression results

As a practical matter the estimation approach was as follows. First, an ordinary least squares regression was run to check for outliers and to provide baseline data for later comparisons. In the case of the own-price elasticity information and the income elasticity information three outliers were detected and these observations were deleted from the sample. A fixed effects regression was then estimated for both the income and own-price elasticity data using both the inverse variance and the inverse standard error as weighting structures. If either weighting structure appeared, on empirical grounds, to be appropriate, then the fixed effects meta-regression was deemed an appropriate specification. If neither fixed effects weighting structures appeared appropriate, regressions were then estimated using the two mixed effects weighting structures described above, where empirical criteria were used to select between the two mixed effects weighting structures discussed.

Non-country specific own-price elasticity results

In Table 5 the first column reports the OLS point estimates -- excluding the country dummy variable point estimates -- obtained when equation (1) was estimated for the own-price elasticity data. As the OLS regression failed a heteroskedasticty test the second column reports the associated standard errors obtained after running White's general correction for heteroskedacticity. The third column of Table 5 reports the point estimates obtained from the WLS regression where the inverse variance[7] was used as the weighting structure, and the fourth column reports the associated standard errors[8]. The fifth column of the table indicates whether or not the respective OLS point estimates with White's standard errors are equal to the WLS point estimates. Specifically, the column reports the result of a Wald-test regarding whether or not it is possible to reject the null hypothesis that the WLS point estimate is equal to the corresponding OLS point estimate. The level of confidence regarding the rejection of the null is indicated by an asterisk. A single asterisk indicates that the null is rejected at the 95 percent level. When reading the own-price elasticity information in Table 5 it should be noted that the base elasticity type is Hicksian, the base estimation method is single-equation OLS, and the base response time is the short-run.

[7] In this instance based on a Ramsey test the inverse variance performed better than the inverse standard error as a weighting structure.

[8] Although both sets of WLS estimates still fail a heteroskedasticty test, and there is nothing restricting the use of White's general correction following the use of WLS, application of White's general correction generates less than convincing results.

Table 5 **Non-country specific meta-regression results**

Detail	Own-Price Elasticity Meta-regression					Income Elasticity Meta-regression				
	OLS (Whites)		WLS (Variance)		Point est. test	OLS (Whites)		WLS (Mixed)		Point est. test
	Est.	SE	Est.	SE		Est.	SE	Est.	SE	
Intercept	-22.66	(269.7)	-402.68	(112.5)	*	-871.57	(435.3)	-664.25	(360.6)	-
Marshallian	-.39	(.13)	-.24	(.01)	*	-	-	-	-	-
Dynamic	.09	(.09)	-.11	(.03)	*	-.07	(.17)	-.20	(.14)	-
Unconditional	-.10	(.09)	-.08	(.06)	-	-.39	(.10)	-.42	(.09)	-
Time Series	.02	(.13)	.50	(.10)	*	.07	(.17)	.29	(.17)	-
Cross-Section	.07	(.24)	.28	(.71)	-	.46	(.28)	.53	(.29)	-
Panel	.46	(.18)	.53	(.08)	*	-.05	(.23)	-.06	(.17)	-
Linear 2SLS	.25	(.14)	.35	(.08)	-	.12	(.23)	.18	(.17)	-
SURE (utility free model)	.75	(.40)	.96	(.16)	-	.24	(.69)	-.02	(.47)	-
System-wide	.38	(.14)	.38	(.09)	-	.00	(.07)	.00	(.08)	-
Long-run	.05	(.14)	.14	(.07)	-	.16	(.20)	.18	(.17)	-
Imported beverage	-.52	(.10)	-.33	(.17)	-	.34	(.40)	.22	(.20)	-
Quarterly	.01	(.08)	-.02	(.05)	-	-.16	(.14)	-.24	(.11)	-
Monthly	-.90	(.25)	-.82	(.10)	-	-.46	(.61)	-.40	(.33)	-
Daily	-.15	(.12)	-.45	(.05)	*	.04	(.21)	-.06	(.24)	-
Sample date	.02	(.28)	.41	(.11)	*	.89	(.45)	.68	(.37)	-
Sample date squared x 1,000	.00	(.07)	-.11	(.03)	*	-.23	(.12)	-.17	(.09)	-
Level of consumption	-.03	(.04)	-.03	(.01)	-	-.29	(.11)	-.25	(.16)	-
Country Dummies										
Adj. R-squared	.37		-			.40		-		
White's F-stat. [p-val.]	.00		.00			.01		.00		
Ramsey F-stat. [p-val.]	.08		.61			.92		.35		
F-statistic	3.74		1886.00			5.13		5.13		
N,K										

The first aspect of the non-country dummy specific results worth discussing relates to the difference between the OLS estimates and WLS estimates. For the own-price elasticity meta-regression the decision regarding whether or not to weight each estimate by the precision of the estimate has major implications. As can be seen from the fifth column of the table the null hypothesis that the respective fixed effects WLS point estimate is equal to the OLS point estimate is rejected for eight explanatory variables. Further, in several cases the difference between the two point estimates is such that it is of practical importance. Consider, for example, the information contained in the time series row of the table. The base estimation approach in the meta-regression is single-equation OLS. If the meta-regression on the own-price elasticity data is estimated using OLS with a general heteroskedacticty correction, the conclusion drawn would be that, controlling for other factors, single-equation OLS methods and time series approaches give estimates that are not statistically different. However, the WLS results indicate that time series approaches and single-equation OLS approaches give statistically different elasticity estimates. Further, as the difference between the two estimates is about .50, the difference is also of practical importance. As the two previous meta-studies considering the demand for alcohol did not weighted elasticity estimates by estimate precision, the result is an important finding. Consideration is now given over to a discussion of the actual WLS regression results.

As alcoholic beverages are normal goods, the Slutsky equation says Marshallian own-price elasticity estimates are more elastic than Hicksian elasticity estimates. As the meta-regression results indicate that on average Marshallian estimates are about .25 more elastic than Hicksian estimates the results are consistent with theory. Information about the approximate difference between Hicksian and Marshallian estimates for alcoholic beverages is potentially useful information for policy makers. Academic economists are generally interested in pure price effects, and so almost always report Hicksian price elasticity estimates. Policy makers on the other hand may be more interested in uncompensated own-price effects. The meta-regression results provide policy makers with the means to make an approximate conversion from the Hicksian estimates that are generally reported to Marshallian estimates without needing recourse to the Slutsky equation, and this is potentially very helpful for those concerned with policy matters.

The dynamic dummy variable picks up estimates from approaches that allow for either a standard myopic addiction specification or a rational addiction specification and the estimated coefficient suggests that such approaches generally result is own-price elasticity estimates that are slightly more elastic than approaches that do not explicitly consider addiction. Although a difference of approximately .10 is not necessarily of practical importance when considering elasticity estimates, the difference is statistically significant. The meta-regression results perhaps suggests that for alcohol, while explicitly allowing for addiction issues may be a modelling consideration, from a practical point of view regarding the own-price elasticity estimates generated, it makes little difference whether or not the model explicitly allows for addiction.

As outlined previously, theory suggests that unconditional own-price elasticity estimates should be more responsive to price changes than conditional own-price elasticity estimates. Although the meta-regression results suggest unconditional estimates are more price responsive than conditional estimates, the difference is not statistically different. Again the importance of this finding relates to issues faced by policy makers. For system-wide approaches to modelling the demand for alcohol the most natural form for reporting elasticity information is as conditional estimates. A policy maker that wanted information on the demand for alcoholic beverages may be unsure of how to interpret conditional own-price elasticity estimates. The meta-regression results suggest that as a practical matter policy makers can pool information on conditional and unconditional estimates without any loss of generality. This is an important practical finding.

While it is important to understand whether single-equation OLS approaches and say time series approaches give different estimates -- which is information that can be read directly from Table 5 -- it is just as important to understand whether system-wide approaches and time series approaches give statistically different estimates. The relationship between the different estimation approaches has been summarised in Table 6. In the table the symbol × denotes a pair-wise comparison between estimation approaches where it is possible to reject the null hypothesis of equality between estimation approach effects. The certainty with which the hypothesis can be rejected is indicated by an asterisk; a single asterisk indicates a confidence level of 95 percent; a double asterisk indicates a confidence level of 90 percent. The symbol √ denotes cases for which it is not possible to reject the null hypothesis that the estimation approaches give different estimates.

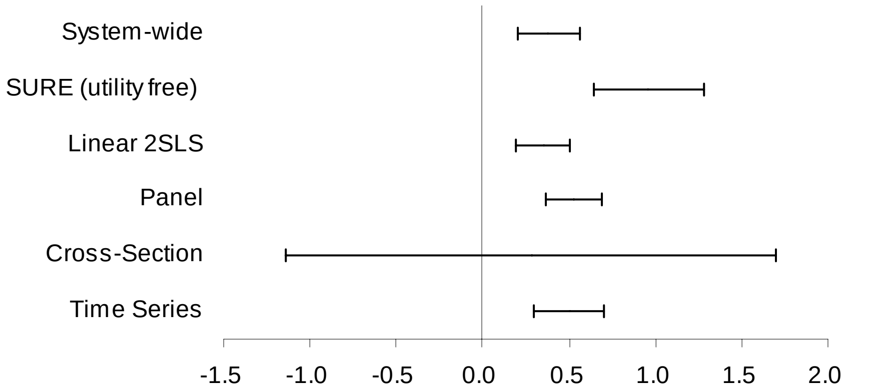
As the overall trend in the literature has largely been an evolution from single-equation OLS approaches to system-wide approaches, to time series approaches, it is the relationships between these three approaches that are perhaps of most interest to the policy maker. By reading down the single-equation OLS column of Table 6 it can be seen that the own-price elasticity estimates obtained using single-equation OLS approaches are statistically different to those obtained using all other approaches, except for the cross-section approach. By reading across the system-wide row it can be seen that times series approaches and system-wide approaches result in, other things constant, estimates that are not statistically different. So, single-equation OLS type approaches to estimating demand relationships give statistically different results to system-wide type approaches and time series approaches, but system-wide approaches and time series approaches do not appear to generate estimates that differ systematically. This is important knowledge for those concerned with policy. It suggests more recent information on the demand for alcoholic beverages generated from either a system-wide approach or a time series approach can be safely pooled, but that older information from single-equation OLS type approaches should not be pooled. Specifically, OLS approaches appear to generate own-price elasticity estimates that are more elastic than the more recent and sophisticated system-wide and time series estimation approaches.

Table 6 **Estimation approach comparison**

	Single equation OLS	Time Series	Cross-Section	Panel	Linear 2SLS	SURE (utility free)	System-wide
Single equation OLS	-						
Time Series	×*	-					
Cross-Section	√	√	-				
Panel	×*	√	√	-			
Linear 2SLS	×*	√	√	×*	-		
SURE-utility free	×*	×*	√	×*	×*	-	
System-wide	×*	√	√	×**	√	×*	-

For completeness the two-standard error bounds for each estimation approach, relative to single-equation OLS estimates, are shown in Figure 8. In the figure the significant overlap between the approach effects confidence interval for system-wide effects and time series effects can be clearly seen. The lack of precision regarding the cross-section approach effect can also be seen in the figure. As an illustration of the use of such information it can be noted that in 2003 the UK Treasury changed their modelling approach. Prior to 2003 the UK Treasury obtained estimates of the demand for alcoholic beverages using a system-wide approach but in 2003 changed to a time series approach. The meta-regression results suggest that policy makers should feel relaxed about the decision to change the modelling approach from a system-wide approach to a pure time series approach as such a change it is unlikely to have had a fundamental impact on the estimates.

Figure 8 **Estimation approach effect relative to single-equation OLS: Own-price elasticity**



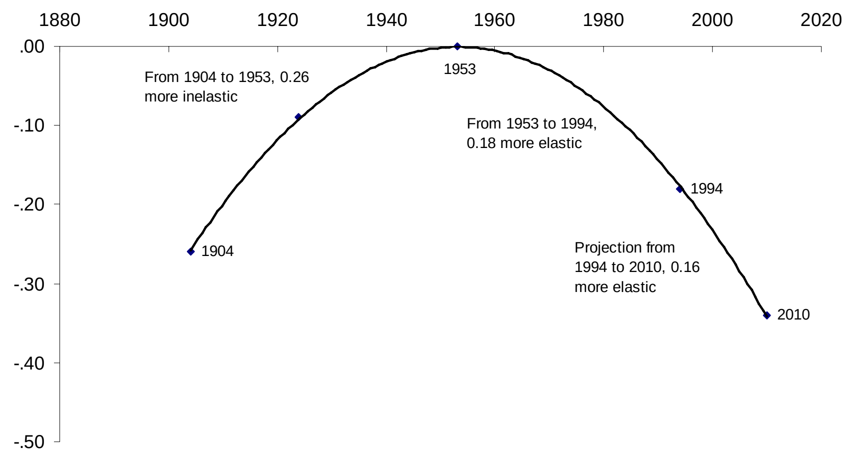
The estimated long-run own-price elasticity effect, while not significant at the 95 percent confident level is significant at the 90 percent confidence level. The demand for imported beverages appears to be significantly more elastic than the demand for domestic beverages. Such information about differences in demand for domestic beverages versus imported beverages may be helpful for international beverage companies and retail operations as they consider their pricing policies. For example, the findings suggest that when retail alcohol outlets engage in product discounting they should possibly focus on discounting imported products rather than domestic products, as this will stimulate the largest demand response.

Regarding data frequency, the base data frequency is annual, and the results suggest that other things constant, models that use quarterly data generate own-price elasticity estimates that are not statistically different to those generated using annual data. Results generated from models where the data frequency is higher than this, such as monthly or daily, do however generate results that are statistically different to the results obtained when using annual or quarterly data. Specifically, the results generated using relatively high frequency data are significantly more elastic than the results generated using annual or quarterly data, and this result is worth considering further.

When using high frequency data the results indicate that demand is significantly more elastic than when low frequency data is used. This necessarily implies that when high frequency data is used, beer, wine, and spirits are seen as better substitutes than when low frequency data is used. One possible explanation for such a result could be as follows. Let us consider the case of a consumer that generally drinks wine, but from time-to-time also enjoys both beer and spirits, and let us assume that the local liquor store has a special on beer this week. The consumer, seeing the special price for beer purchases some beer. However, rather than drinking the beer immediately, the consumer takes the opportunity to build up a small inventory of beer and continues to consume their standard mix of mostly wine plus some spirits and the occasional beer. With data collected at the frequency of one month or less, much of the sales turnover is likely to be driven by the particular specials running in the store that month. Consumers see the special and take advantage of this special to accrue inventories but do not in fact change their actual consumption patterns. When data is collected over a longer period, say a quarter or annually, the effects of the various specials will have washed out. With such an interpretation the own-price elasticity estimates obtained using relatively high frequency data capture both the consumer response to a price change and inventory behaviour. If this interpretation is correct, for studies of alcohol demand, high frequency data is a less appropriate measure than quarterly or annual data. The inventory behaviour theory is an interpretation that also has implications for alcoholic beverage retailers and the promotion strategies they pursue. It is also an area that would be worth further direct investigation.

The possibility of a time trend in the own-price elasticity estimates was considered, and as there was no a priori regarding the nature of the possible trend various options were tested. The appropriate specification for the own-price elasticity data appears to be a quadratic time trend. In general the results in the various papers reviewed are evaluated at sample means, so while the earliest publication date in the sample is 1945 and the most recent publication date in the sample is 2006, the earliest evaluation date is 1904, and the latest 1994. Before considering the implications of the time trend estimates it is worth noting that for the OLS specification there was no implied time trend. This again highlights the importance of weighting the estimates by the reported estimate precision. For the WLS specification the implied turning point is a maximum, and the actual implied turning point year is 1953. Specifically, the results suggest that between 1904 and 1953 the own-price elasticity of demand for alcoholic beverages became increasingly inelastic, and then from 1953 to 1994 became increasingly elastic. By evaluating the implied time trend impact in 1904, 1953, and 1994, it is possible to obtain some insight in to the size of the effect. Specifically, the meta-regression results suggest that between 1904 and 1953 the alcohol own-price elasticity estimates, on average, became more inelastic by about .26, and between 1953 and 1994 became less inelastic by about .18. A simple projection into the future of the implied time trend effect gives a possible indication of future developments, and while any such projection must be treated with caution, it does provide some context to the discussion. Projecting forward from 1994 to 2010 suggests the possibility that the demand for alcoholic beverages could become more elastic by about .16. The implied effect through time is shown in Figure 9 below, where for illustrative purposes the effect in 1953 has been set to zero.

Figure 9 **Implied own-price elasticity partial time trend effect**



The implied time trend has implications for alcoholic beverage suppliers. For firms with market power the optimal product mark-up is inversely related to the absolute value of the product's own-price elasticity. The trend towards less inelastic own-price elasticity estimates since the mid-1950s is suggestive of falling profit margins for the industry and this should be of concern to alcoholic beverage suppliers. On the other hand this trend should be welcomed by drinkers. It is notable that there has been substantial consolidation in the beer, wine, and spirits industries in recent decades. Should the trend to more elastic demand for alcoholic beverages continue, it is reasonable to expect industry consolidation to continue.

More generally, the trend suggests that since the mid-1950s either the number of products that are seen by consumers as suitable substitutes for alcoholic beverages has increased, or the suitability of existing products as substitutes has increased. It is somewhat speculative to consider what any new substitute products might be, although given the mind altering properties of alcohol, the substitute products are possibly other mind altering substances such as marijuana, ecstasy, and other so called soft drugs. The real price of illicit drugs has certainly fallen dramatically in the past 30 years (Basov et al., 2001, p. 16) and the use of amphetamine type products, including ecstasy, has increased dramatically (UNOECD, 2003). Regarding the substitutability of alcoholic products, at least for the case of beer and wine, there is evidence for a convergence in the relative market share across countries (Aizenman and Brooks, 2008), which could be interpreted as evidence consumers see at least beer and wine as increasingly substitutable.

The level of consumption variable took account of the level of pure alcohol consumption (measured in litres) of each beverage in each country in the mid 1990s. As the measure is of pure alcohol the numbers are generally quite low, for example the average value across all countries and all beverages was 2.1 litres. The results suggest that the higher the level of consumption the more elastic the own-price elasticity estimate. Although the effect is statistically significant, within the context of considering own-price elasticity values where the critical value is minus one, the implied effect is relatively modest.

Income elasticity non-country specific results

The structure of the income elasticity meta-regression panel of Table 5 is the same as for the own-price elasticity information. Although, as both fixed effect weighting structures performed poorly, the information in the WLS columns is based on the case where the inverse variance mixed effect weighting structure is used. As can be seen by considering the information in the last row of Table 5, the OLS point estimates are not statistically different to the WLS estimates. This does not however imply there are no important differences between the two sets of results. For example, the OLS results suggest that income elasticity estimates from studies using quarterly data do not differ from those obtained from studies using annual data, while the WLS results suggest that income elasticity estimates obtained using quarterly data are systematically lower than those obtained using annual data. Further, as the estimated difference is about .25, the difference is important in a practical sense as well as a statistical sense. Again it is clear that the inferences drawn from meta-analysis where estimates are weighted by precision are different to those obtained when estimates are not weighted.

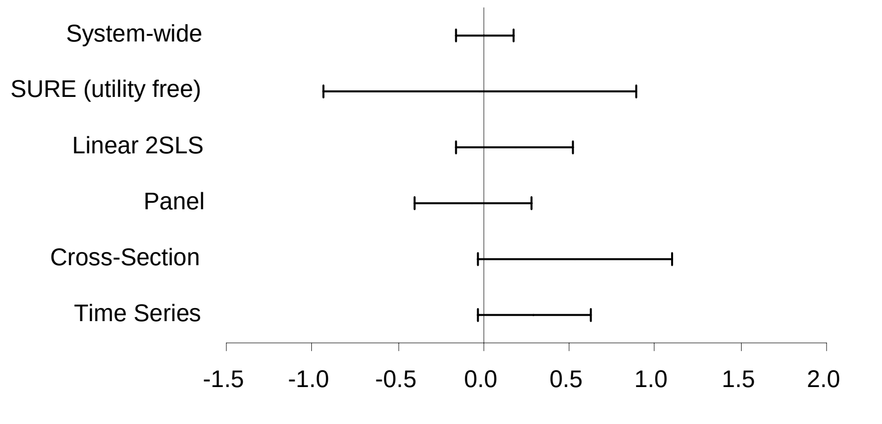
Unsurprisingly, whether or not the model considers the issue of addiction does not impact income elasticity estimates. Unconditional income elasticity estimates do however appear to be different to conditional income elasticity estimates. As explained above, the relationship between unconditional and conditional income elasticity estimates depends on the income elasticity for alcoholic beverages as a whole. If the income elasticity for the group alcoholic beverages is greater than unity, unconditional income elasticity estimates are greater than conditional income elasticity estimates. Likewise, if the income elasticity for the group alcoholic beverages is less then unity, unconditional income elasticity estimates are less than conditional income elasticity estimates. As the meta-regression results suggest that unconditional income elasticity estimates are about .40 less than conditional income elasticity estimates the meta-analysis suggest that alcohol as a group should be considered a necessity.

Regarding modelling approach, at the 95 per cent confidence level it is only income elasticity estimates from panel data studies and income elasticity estimates from cross-section studies that appear to differ in systematic ways. At the 90 percent confidence level cross-section estimates are also different to system-wide estimates and single-equation OLS estimates; and time series estimates are also different to single-equation OLS estimates. Again it may be thought of as comforting to policy makers that it makes little difference whether a system-wide approach is chosen or a time series approach is chosen. A summary of the various pair-wise comparisons that can be made is shown in Table 7, and Figure 10 shows the two standard error bands, where single-equation OLS is the base.

Table 7 **Estimation approach comparison: Income elasticity meta-regression**

	Single equation OLS	Time Series	Cross-Section	Panel	Linear 2SLS	SURE (utility free)	System-wide
Single equation OLS	-						
Time Series	×**	-					
Cross-Section	×**	√	-				
Panel	√	√	×*	-			
Linear 2SLS	√	√	√	√	-		
SURE-utility free	√	√	√	√	√	-	
System-wide	√	√	×**	√	√	√	-

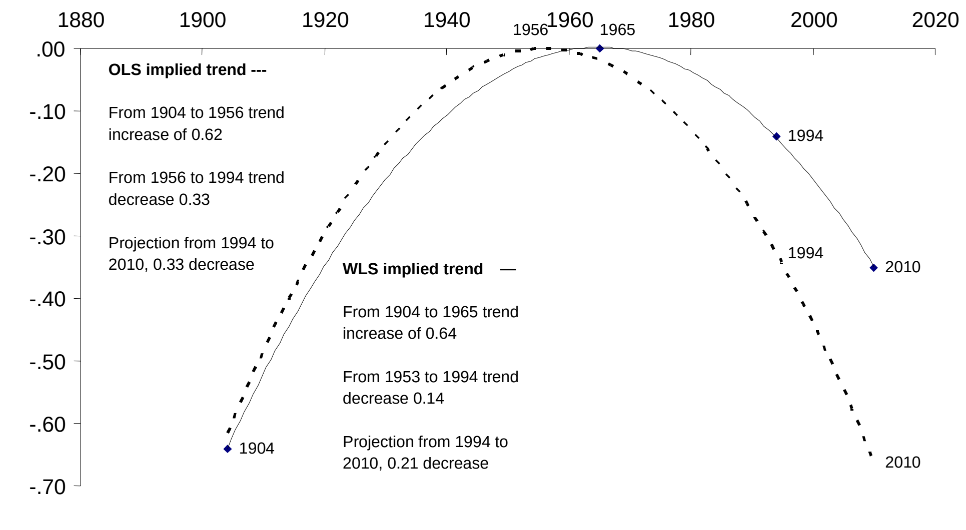
Figure 10 **Estimation approach effect relative to single-equation OLS: Income elasticity**



Although the imported beverage dummy variable point estimate suggests that imported beverages are seen as more luxurious than domestic beverages, the difference is not statistically significant. Regarding data frequency, models using quarterly data appear to give estimates that are systematically different to estimates that are obtained from all other data frequencies. This is an interesting empirical finding, and given the estimated size of the effect, -.24, a potentially important piece of information for policy makers.

Both the WLS estimates and the OLS estimates suggest a statistically significant time trend in the income elasticity information. From the values reported in Table 5 it is not immediately clear how significant in practical terms the implied time trend is, or how the implied trend differs between the OLS estimates and the WLS estimates. The implied turning point for the OLS estimates is 1956 and the implied turning point for the WLS estimates is 1965, and for both cases these years represent the point in time when alcoholic beverages were seen as most luxurious. For ease of comparison Figure 11 plots the implied partial effect of the time variable for both the OLS estimates and the WLS estimates, where the effects have been rebased such that the maximum effect is set to zero. In the figure the solid line represents the implied effect for the WLS estimates and the dashed line the effect for the OLS estimates.

Figure 11 **Implied partial income elasticity time trend**



Rather than focus on the question of whether or not alcoholic beverages are a luxury or a necessity, it is worth considering whether or not the implied trend is intuitively reasonable. To answer this question it is helpful to note the relationship between the income elasticity of a good and the marginal share of a good. Holding prices constant, the budget-share weighted income elasticity can be related to the marginal share, denoted, α_i, as $w_i\eta_i = \frac{p_i q_i}{M}\frac{\partial q_i / q_i}{\partial M / M} = p_i \frac{\partial q_i}{\partial M} = \frac{\partial (p_i q_i)}{\partial M} = \alpha_i$. As with budget shares, marginal shares are constrained to sum to unity, but unlike budget shares which must be positive, the marginal share of a good will be negative when the good is an inferior good. From the above it can be seen that the income elasticity of a good can be found as the marginal share divided by the budget share.

When investigating family expenditure patterns, Working (1943) included all beverages in the food expenditure group, and noting that "the proportion of total expenditure that is devoted to food tends to decrease exactly in arithmetic progression as total expenditure increases in geometric progression" proposed the following formal relationship to approximate the relationship between income and expenditure on food: $F/T = a - b\log T$, where F represents expenditure on food and T total expenditure. Generalising Working's model we have $w_i = a_i + b_i \log M$, where $b_i > 0$ denotes a luxury and $b_i < 0$ denotes a necessity. By multiplying both sides of the relationship proposed by Working by income we have $p_i q = M(a_i + b_i \log M)$, and $\partial(p_i q_i)/\partial M = a_i + b_i \log M + b_i = \alpha_i$. As $\eta_i = \alpha_i / w_i$ under Working's model the income elasticity is defined as $\eta_i = 1 + b_i / w_i$, and regardless of whether the good is a luxury or a necessity, as income grows the income elasticity falls. Given the elasticity estimate trend since the mid-1960s appears consistent with at least one model of consumer behaviour, it is reasonable to suggest that the trend in the observed income elasticity estimates is not unreasonable[9].

Country effects

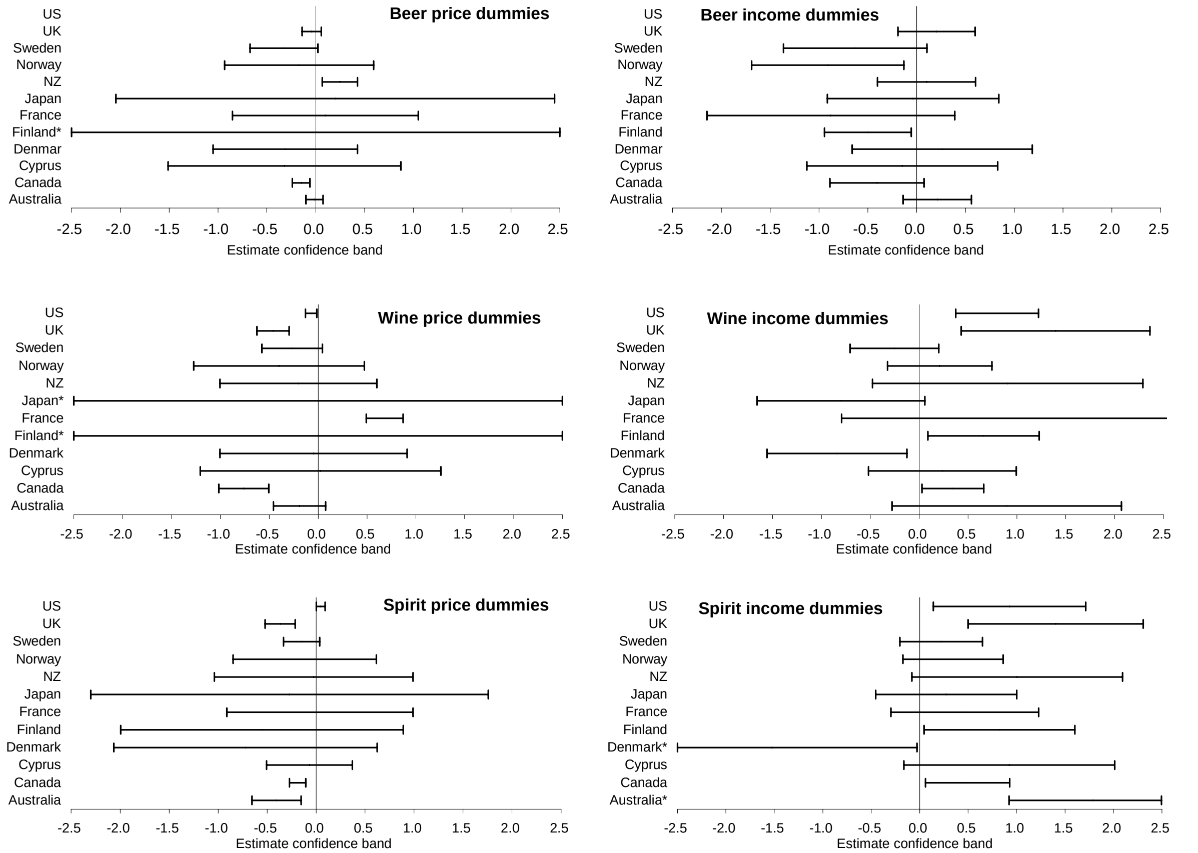
In considering the country dummy variable information the most interesting question relates to testing the infamous proposition of Stigler and Becker (1977) that tastes are constant.

[9] As issue with Working's model, and other models such as the AIDS model, is that for very large changes in income the budget share is not bounded by [0,1].

Selvanathan and Selvanathan (2007) estimate a Rotterdam demand system for beer, wine, and spirits for ten countries and test the validity of pooling across the ten countries by means of a likelihood ratio test. Across the ten countries the pooled model is rejected in favour of the individual country models, and the authors conclude that the alcohol data does not support the Stigler and Becker hypothesis of constant tastes (Selvanathan and Selvanathan 2007, p. 205). Although, as pooling across sub-samples of countries, sub-samples of beverages, and potential issues with outlier countries are not investigated, the conclusions presented in the paper cannot be thought of as definitive.

The meta-regression results provide an excellent opportunity to explore the Stigler and Becker hypothesis as it applies to alcohol consumption in greater detail. Figure 12 below plots the two standard error band for each of the country dummy variables, and can be seen by simply eyeballing the plots, for both the own-price elasticity dummy variables and the income elasticity dummy variables, pair-wise tests for equality of country specific effects will generally not be rejected. Reviewing the own-price elasticity information it can be seen that the country effects for both Japan and Finland are not estimated with any degree of precision, and that of all the estimated country own-price elasticity effects, the only case that looks noticeably different is the case of wine in France. Regarding the income elasticity effects, there is substantial overlap in the confidence interval for most estimates, although wine in the US looks as if it might be different to most other estimates, as do spirits in Denmark.

Figure 12 **Summary country dummy variable effects and confidence bands**



Note: * indicates the value has been truncated at 2.5. Beer in the US is the base.

To present the complete results for pair-wise testing of equality of country effects would represent an overwhelming amount of detail. As such just the summary results of testing are shown in Table 8. The left-hand panel of Table 8 contains details relating to the own-price elasticity country effects and the right-hand panel of Table 8 contains details relating to the income elasticity country effects.

For the own-price elasticity estimates, at the 95 percent confidence level, the null hypothesis of equal mean country effects is rejected eight times out of 66 pair-wise comparisons for beer, and all rejections involve a pair-wise comparison to either New Zealand or Canada. For wine there are a total of 12 rejections and in all but one pair-wise comparison (UK and US) the pair-wise comparison involves either Canada or France. In the case of France, the null of equal mean country effects for wine is rejected in the majority of cases. For the price elasticity data, across all three beverages, wine in France is the only case where the null is rejected in the majority of cases. There are five rejections of the null for spirits, and although the rejection rates are never high, the two countries that feature most prominently in the rejections are the UK and the US.

The null of equal income elasticity effects is rejected six times for beer, and all of the rejections involve a pair-wise comparison to either Norway or Finland. Interestingly, the null of equal effects for the pair-wise comparison of Norway and Finland is not rejected. There are 19 rejections for wine, and for Demark the null hypothesis of equal country effects for wine is rejected in a majority of cases. For spirits there are six rejections of the null, and all involve a pair-wise comparison to either UK or US.

As can be seen from the table, relaxing the level of confidence to 90 percent generally made little difference to the results of the pair-wise testing. The exception to this relates to the wine income elasticity information where the number of pair-wise rejections rose from 19 to 30. At the 90 percent confidence level the null for is rejected in a majority of cases for Denmark, Japan, Sweden, and UK.

Table 8 **Summary number of rejections for pair-wise comparisons of equal country effects**

Confidence level	Price Elasticity Effects				Income Elasticity Effects			
	Beer	Wine	Spirits	Total	Beer	Wine	Spirits	Total
95 percent No.	8	12	5	25	6	19	6	31
90 percent No.	10	13	7	30	14	30	8	52

When considering relatively disaggregated data it is too much to expect that the Stigler and Becker hypothesis would hold exactly. The evidence above does however suggest that the Stigler and Becker hypothesis is not a bad starting assumption. There will be cases where demand for a good is different to that generally observed, such as the demand for wine in France, but these appear to be the exception rather than the rule. On balance, the results of the pair-wise testing can be said to provide evidence that at a minimum does not contradict the assumption of constant tastes across alcoholic beverages. The case of wine, and in particular whether it is a luxury or a necessity, may represent an exception to this general statement, and is an area worth further investigation.

7. Summary and conclusions

Alcohol is a widely consumed and enjoyed good. However, excessive alcohol consumption can result in costs accruing to society via the health and legal systems. As such, alcohol policy is an area of active concern for government and public policy makers throughout the world. To assist with making sense of the many divergent published own-price and income elasticity estimates this paper has presented a meta-analysis of the demand for alcoholic beverage literature. Unlike previous attempts to summarise the literature the study considered the precision of each estimate, and as the reported regression results demonstrated, this makes an important difference when it comes to meta-analysis.

For the own-price elasticity estimates the meta-regression information suggests that single-equation OLS estimates are different to estimates from other estimation approaches. System-wide estimation approaches and pure time series approaches, on the other hand, give estimates that are not statistically different. This finding is reassuring as it suggests if you ask the same question using different but relatively sophisticated estimation approaches, you will get the same answer. Models that allow for addiction arrive at statistically different own-price elasticity estimates, but the difference is not so great to be of practical importance. The demand for imported beverages was found to be more elastic than the demand for domestic beverages. As a practical matter for policy makers, it seems possible to pool conditional and unconditional own-price elasticity estimates. Regarding data frequency, estimates from models where the frequency is relatively high give more elastic estimates, and it was hypothesised that this result might be due to inventory behaviour by consumers. An underlying time trend was found, and it suggests that since 1953 there has been a gradual drift towards more elastic own-price elasticity estimates.

Possible reasons for the trend might include an increase in the use and availability of substitute products such as soft drugs; and an increasing tendency for consumers to see beer and wine as substitutable.

For the income elasticity estimates some evidence was found to support the idea that alcohol as a commodity group was more likely to be a necessity than a luxury, and that unconditional and conditional estimates should not be pooled. Models that allow for addition do not appear to generate income elasticity estimates that are different to models that do not. As with the price elasticity information, estimates from system-wide models and time series models are not statistically different. Although, unlike the case for the price elasticity estimates, OLS single-equation estimates are not statistically different to system-wide estimates, and are different to time series estimates only at the 90 percent confidence level. A time trend was found, and it appears that the income elasticity for alcoholic beverages has been falling since the mid-1960s. A falling income elasticity, with rising incomes, was noted as consistent with Working's observations regarding household food and beverage consumption.

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* Results for these studies are reported but it was not possible to obtain a copy of these papers.