Ithaca 2018 Abstract Submission

Title
UNDERSTANDING ALCOHOL CONSUMPTION ACROSS COUNTRIES

I want to submit an abstract for:
Conference Presentation

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Keywords
Economic determinants of the consumption of beer, wine and spirits

Research Question
How similar are tastes across countries regarding alcohol?

Methods
Data analytic; contingency table; econometrics of demand systems

Results
Drinkers respond to prices in the way predicted by microeconomic theory.
There are both differences and similarities in tastes across countries.

Abstract
The table below (see pdf) shows the 2005 pattern of alcohol and food consumption in 110 countries, which account for about 88% of the world's GDP and 80% of population. On average, consumers in countries in the bottom quartile of the income distribution (the fourth) devote something approaching one-half of all expenditures to food, while this falls to about 11% for those in the richest countries, in accordance with Engel's law. The share for alcohol also drops for the same income change, but much slower, so drinking rises relative to food consumption as income increases. For the fourth quartile countries, on average, alcohol expenditure is about 5% of food expenditure; this rises to about 15% for the top-quartile countries.
The within-alcohol consumption pattern also changes noticeably with income. As shown in the bottom several rows of the table (see pdf), all three beverages increase with income; however, beer grows more slowly than the other two, pointing to a lower income elasticity.

Table -- Alcohol and Food Consumption,
110 Countries in 2005 (see pdf)

This paper uses these data to analyse in detail international drinking patterns. The data, from the International Consumption Program, have the attraction of wide coverage and consistency across countries, as well as substantial differences in incomes and prices. Do drinkers respond to prices signals in the usual way by economising on beverages with higher prices and vice versa? Is currency denomination irrelevant, or are drinkers subject to money illusion? Are the substitution effects of price changes symmetric? More fundamentally, can drinking patterns of such a diverse group of consumers be adequately accounted for by a single, utility-maximising demand model? Is the marginal utility of each beverage independent of the consumption of the other two, as is the case under preference independence? Or is the nature of utility-interactions more complex? What are the implication of this for price elasticities?
We address these questions with four approaches:

1. Exploratory data analysis. We start with elementary price-quantity scatter plots for each beverage. This provides a "feel" for the data, the identification of outlying countries and preliminary measures of price sensitivity. We also employ Divisia index numbers to summarise prices and quantities, as well as their correlation -- below is a histogram of the correlations for the 110 countries (see pdf). As can be seen, a substantial majority are negative, which is encouraging.

Divisia Price-Quantity Correlation Coefficients (see pdf)

2. A contingency table. Using a nonparametric approach, we cross-classify consumption and prices for each of the three beverages. The table below (see pdf) reveals support for the law of demand that higher prices lead to reduced consumption and vice versa.

The Covariation of Quantities and Prices (see pdf)

3. A demand system. We use a system of demand equations for beer, wine and spirits. As there is no unique way of ordering countries, a "levels version" of a differential system is used that is similar to the Rotterdam model of Theil and Barten. The system is used to test the hypotheses of homogeneity (the absence of money illusion) and symmetry of the substitution effects. Both tests are passed with flying colours. We also test for the stability of coefficients across countries, which sheds some light on the question of the similarity of tastes. The system also provides estimated income and price elasticities, which we tabulate for each country.
We then classify countries according to the beverage intensively consumed and ask, is a separate demand system required for each type of country, or can all countries be pooled together? For example, are wine-intensive countries (such as France) more or less the same as the beer drinkers (the US) insofar as their alcohol consumption is concerned? This analysis sheds further light on the question of the cross-country similarity of tastes, the similarity of drinking patterns once differences in incomes and prices are accounted for.
The classification of countries by beverage intensity is based on the share of alcohol spending allocated to each beverage. The three shares can be plotted on an equilateral triangle as is illustrated for the US in the left panel of the figure below (see pdf). Here, more than 50% of alcohol expenditure is on beer, so the US is classified as a beer-intensive country. The right-hand panel plots the shares for 110 countries and shows the percentage of countries intensive in each beverage, as well as the percentage with diversified drinking patterns (intensive in none of the three beverages).

Intensity of Drinking Patterns (see pdf)

4. Australian comparison. The final approach compares cross-country alcohol consumption with that over time in Australia (where the econometrics of drinking has been long studied). Is there anything special about Australian drinkers or are they just duplicates of their global counterparts? In other words, do the two sources of data lead to more or less the same estimates of income and price sensitivity of consumption? This provides a third reading on the similarity of tastes.

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UNDERSTANDING ALCOHOL CONSUMPTION ACROSS COUNTRIES

by

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February 2018

Abstract

The table below shows the 2005 pattern of alcohol and food consumption in 110 countries, which account for about 88% of the world's GDP and 80% of population. On average, consumers in countries in the bottom quartile of the income distribution (the fourth) devote something approaching one-half of all expenditures to food, while this falls to about 11% for those in the richest countries, in accordance with Engel's law. The share for alcohol also drops for the same income change, but much slower, so drinking rises relative to food consumption as income increases. For the fourth quartile countries, on average, alcohol expenditure is about 5% of food expenditure; this rises to about 15% for the top-quartile countries.

The within-alcohol consumption pattern also changes noticeably with income. As shown in the bottom several rows of the table, all three beverages increase with income; however, beer grows more slowly than the other two, pointing to a lower income elasticity.

Alcohol and Food Consumption,
110 Countries in 2005

Item	Income Quartile			
	First	Second	Third	Fourth
(1)	(2)	(3)	(4)	(5)
Budget Shares (×100)				
Food share	10.9	22.6	35.9	45.5
Alcohol share	1.5	2.5	2.0	2.3
Alcohol : food ratio	15.3	12.0	6.0	5.2
Per Capita Consumption ($US)				
Beer	109.0	79.6	29.4	6.8
Wine	106.7	33.9	8.5	2.3
Spirits	59.4	35.2	9.1	1.8
Income per capita (US = 100)	66.8	28.9	12.2	3.7

Notes: The budget share is the proportion of total consumption expenditure devoted to the good. Per capita consumption of good i in country c is $p_{ic}q_{ic}/p_{ic}$, where $p_{ic}q_{ic}$ is per capita expenditure and p_{ic} is the PPP price. Income is real total consumption at PPP prices.

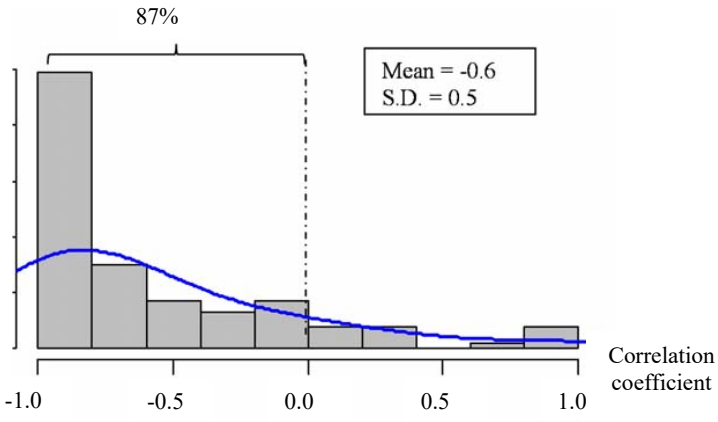
Source: World Bank, 2005 International Comparison Program Data for Researchers. Washington, DC: World Bank, unpublished, 2008.

This paper uses these data to analyse in detail international drinking patterns. The data, from the International Consumption Program, have the attraction of wide coverage and consistency across countries, as well as substantial differences in incomes and prices. Do drinkers respond to prices signals in the usual way by economising on beverages with higher prices and vice versa? Is currency denomination irrelevant, or are drinkers subject to money illusion? Are the substitution effects of price changes symmetric? More fundamentally, can drinking patterns of such a diverse group of consumers be adequately accounted for by a single, utility-maximising demand model? Is the marginal utility of each beverage independent of the consumption of the other two, as is the case under preference independence? Or is the nature of utility-interactions more complex? What are the implication of this for price elasticities?

We address these questions with four approaches:

1. **Exploratory data analysis**. We start with elementary price-quantity scatter plots for each beverage. This provides a "feel" for the data, the identification of outlying countries and preliminary measures of price sensitivity. We also employ Divisia index numbers to summarise prices and quantities, as well as their correlation -- below is a histogram of the correlations for the 110 countries. As can be seen, a substantial majority are negative, which is encouraging.

Divisia Price-Quantity Correlation Coefficients



2. **A contingency table**. Using a nonparametric approach, we cross-classify consumption and prices for each of the three beverages. The table below reveals support for the law of demand that higher prices lead to reduced consumption and vice versa.

The Covariation of Quantities and Prices

Quantity relative to average	Price relative to average			Quantity relative to average	Price relative to average		
	Above	Below	Total		Above	Below	Total
	A. Beer				**B. Wine**		
Above	6 (5)	75 (68)	81 (73)	Above	10 (9)	21 (19)	31 (28)
Below	6 (5)	23 (22)	29 (27)	Below	60 (55)	19 (17)	79 (72)
Total	12 (10)	98 (90)	110 (100)	Total	70 (64)	40 (36)	110 (100)
Measure of association	ϕ = -0.19			Measure of association	ϕ = -0.41		
	C. Spirits				**D. Total**		
Above	12 (11)	11 (10)	23 (21)	Above	28 (8)	107 (32)	135 (40)
Below	77 (70)	10 (9)	87 (79)	Below	143 (44)	52 (16)	195 (60)
Total	89 (81)	21 (19)	110 (100)	Total	171 (52)	159 (48)	330 (100)
Measure of association	ϕ = -0.34			Measure of association	ϕ = -0.52		

Notes:

i. The first entry in each cell is the number of countries, while the figure in parenthesis is the percentage of all 110 countries.

ii. The measure of association ϕ lies in the range [-1, 1]. If the 2×2 contingency table is denoted by $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $\phi = (ad - bc)/\sqrt{(a+b)(a+c)(c+d)(b+d)}$. When quantities and prices are independent, $a = c$ and $b = d$, $ad = bc$ and $\phi = 0$. The statistic to test $H_o: \phi = 0$ is $C \cdot \hat{\phi}^2 \sim \chi^2$, where C is number of countries and $\hat{\phi}$ is the observed value. For beer, $\hat{\phi} = -0.19$ and so the statistic is $110 \times (-0.19)^2 = 3.97$, which is greater than the critical value of $\chi^2(1) = 3.84$. The null is thus rejected. The same conclusion holds for the other three panels.

3. A demand system. We use a system of demand equations for beer, wine and spirits. As there is no unique way of ordering countries, a "levels version" of a differential system is used that is similar to the Rotterdam model of Theil and Barten. The system is used to test the hypotheses of homogeneity (the absence of money illusion) and symmetry of the substitution effects. Both tests are passed with flying colours. We also test for the stability of coefficients across countries, which sheds some light on the question of the similarity of tastes. The system also provides estimated income and price elasticities, which we tabulate for each country.

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Intensity of Drinking Patterns