Does minimum pricing reduce alcohol consumption?

The experience of a Canadian province

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Abstract:

Aims: Minimum alcohol prices in British Columbia have been adjusted intermittently over the past 20 years. The present study estimates impacts of these adjustments on alcohol consumption.

Design: Time series and longitudinal models of aggregate alcohol consumption with price and other economic data as independent variables.

Setting: British Columbia (BC), Canada.

Measurements: Data on alcohol prices and sales for different beverages were provided by the BC Liquor Distribution Branch for 1989 to 2010. Data on household income were sourced from Statistics Canada.

Findings: Longitudinal estimates suggest that a 10% increase in the minimum price of an alcoholic beverage reduced its consumption relative to other beverages by 16.1% ($P<0.001$). Time series estimates indicate that a 10% increase in minimum prices reduced consumption of spirits and liqueurs by 6.8% ($P=0.004$), wine by 8.9% ($P=0.033$), alcoholic sodas and ciders by 13.9% ($P=0.067$), beer by 1.5% ($P=0.043$) and all alcoholic drinks by 3.4 % ($P=0.007$).

Conclusions: Increases in minimum prices of alcoholic beverages can substantially reduce alcohol consumption.

Does minimum pricing reduce alcohol consumption?

A Canadian case study

Introduction

Alcohol has been causally implicated in over 60 diagnostic categories of disease, illness and injury,[1] including a variety of cancers, cardiovascular illnesses and traumatic conditions. This paper presents a Canadian case study of the effectiveness of setting minimum prices to reduce per capita alcohol consumption. We find that increases in minimum prices are associated with substantial decreases in consumption.

There is good evidence from individual studies that hazardous drinkers tend to seek out the cheapest forms of alcohol[2,3] and from meta-analyses that overall alcohol price increases are a potent strategy to reduce both consumption[4,5] and related harms[6,7]. The effectiveness of overall price increases, however, can be blunted if drinkers are able to choose cheaper, lower quality products to compensate[8]. There has been much recent public debate in the UK and Australia as to whether minimum alcohol prices should be legislated as a public health measure[9,10] but no empirical evaluations of the effects of such policies have been published. Canada is one of a handful of countries to have implemented minimum alcohol price policies. The present paper is the first report of a research program designed to evaluate the public health and safety impacts of this policy using data on alcohol consumption from a jurisdiction which implements minimum alcohol prices.

Reviews of the effectiveness of alternative alcohol prevention strategies and policies have regularly rated the scientific support for increasing the price of alcohol through taxation as being of the highest level[11-14] though governments are often reluctant to use alcohol taxes for public

health purposes. A comprehensive meta-analysis of 1,003 price elasticity estimates from 112 studies including data spanning two centuries and many countries found a significant negative relationship between alcohol tax/price and drinking[4]. On average, the study estimated that a 10% increase in the retail price of alcohol reduced consumption by 4·4%. Other studies have suggested disproportionate effects on alcohol related problems from changes to alcohol prices, for example, larger impacts on rates of liver disease than would be expected given the percentage change in price[6], suggesting that problem drinkers respond relatively more to changes in price than other drinkers. Other evidence shows that increases in alcohol taxes have lead to reductions in serious harms including alcohol-related mortality[15,16], liver cirrhosis[12], road trauma[12], youth suicide[17] and alcohol dependence[18]. A recent meta-analysis estimated that a doubling of the rate of US excise taxes on alcohol[7] would result in an estimated 35% fewer alcohol-related deaths overall, 11% fewer traffic crash deaths, 6% fewer sexually transmitted diseases and a 2% reduction in violence.

Minimum pricing in conjunction with conventional taxation may more effectively reduce alcohol-related harm than conventional taxation alone. Minimum pricing promises the twin advantages of greater effectiveness for health purposes and greater public acceptability. There is strong evidence that hazardous and problem drinkers seek out the most inexpensive alcohol so as to maximise ethanol intake per dollar spent. Meier et al[2] estimated that price increases among cheaper products would especially impact consumption levels of hazardous drinkers in the UK. Gruenewald et al[8] also modeled the impacts on consumption of raising prices of relatively cheap versus relatively expensive drinks showing that the former had the greatest effect on overall consumption. In the US, Kerr and Greenfield[3] found a significant preference among heavier drinkers for lower-priced drinks. Their analysis of the 2000 US National Alcohol Survey found that

the top 10% of drinkers by volume spent $0·79 per standard drink compared to $4·75 for the bottom 50% of drinkers.

These studies suggest that mandating minimum prices of alcoholic drinks targets hazardous drinkers with reasonable specificity and is likely to be an effective strategy for improving public health outcomes. Table 1 illustrates the practical application of these policies across three Canadian government monopolies in the provinces of British Columbia, Ontario and Saskatchewan. Saskatchewan has consistently higher minimum prices per standard drink across beverage types than the other two following substantial increases in April 2010. British Columbia, on the other hand, has relatively low minimum prices for some beverage categories (especially high alcohol content wine varieties) and has only periodically increased these at different rates for different beverages (see both Figure 1 and online supplementary material, Table S1). The present study exploited this natural experiment to assess the size and significance of impacts on both beverage specific and total per capita alcohol consumption as a function of fluctuations in minimum price.

Insert Table 1 and Figure 1 about here

Methods

Research design

An observational study was conducted involving analysis of official BC government data on quarterly alcohol sales, quarterly alcohol prices and both quarterly and annual economic indicators over a 20 year period. We take advantage of substantial variation in the number and timing of minimum price increases for different alcoholic beverages over the study period. Our empirical strategy exploited these natural experiments in order to generate estimates of causal effects of minimum pricing on consumption patterns. Household income and estimates of mean

drink prices were incorporated in statistical models to reduce confounding. As a preliminary step we also tested to what extent a change in government set minimum prices affected overall drink prices so as to ensure the mandated changes had the potential to affect sales.

Research questions and statistical methods.

We first addressed the question of whether minimum price policies in BC are effectively implemented at the retail level. We examined the proportion of spirits selling for less than $31·66 immediately before and after the May 2, 2010 increase in the minimum price of spirits from $30·66 to $31·66. Data were unavailable to test the size and significance of earlier changes to minimum prices, whether for spirits or other alcoholic beverages.

Two distinct approaches were used to test whether minimum price policies had significant effects on alcohol consumption. First, we examined how substantial variation in the level and timing of minimum prices between the main alcoholic beverages impacted alcohol consumption using longitudinal models. These models take the form

$$y_{it} = X_{it}\beta + \theta_i + \phi(t) + u_{it},$$

where y_{it} is log per capita purchases of alcohol type i in time period t expressed in units of ethanol, θ_i are fixed effects for alcohol types, u_{it} is a noise term, X_{it} is a vector of covariates including a constant, log statutory minimum price, log dollars per litre of ethanol, and log per capita household income, and β is a vector of unknown parameters. The notation $\phi(t)$ denotes controls for seasonality and trends. We estimate two specifications of the model varying the time control: (i) a model with season dummies and a linear time trend, and (ii) a two-way fixed effects model in which we include a complete set of 83 quarter dummies, thereby nonparametrically removing all common trends in minimum prices and the other variables. In this second model,

neither the season dummies nor household income are included as a covariates since they are perfectly colinear with the quarter dummies[19].

We included the measure of mean dollars per litre of ethanol (an approximation to 'mean price) to remove the effects of other unmeasured influences on alcohol consumption which may be correlated with changes in minimum price. However, changes across the full price spectrum may mediate the effects of minimum price leading to underestimation of minimum price effects. Since both approaches are problematic, we estimated all models including and not including mean dollars per litre of ethanol. We found that our models were not qualitatively affected by whether this variable was included.

Our two-way fixed-effects minimum price model identified the effect of changes to minimum prices on consumption by comparing relative changes in minimum prices with relative changes in consumption within time periods. For example, if the minimum price of beer rises by proportionately more in some quarter than the price of spirits, the effect of minimum prices is inferred from the resulting relative changes in consumption of beer and spirits. Other types of alcohol act as "control groups" in these models. In the time series models, minimum price effects are inferred from deviations around trend over time independent of changes in price and consumption of other beverages.

To assess whether the temporal and cross-sectional variation in our data lead us to similar estimates, we also ran a battery of independent time series models[20] for each type of alcoholic beverage. In these models we regressed consumption of each type of alcoholic beverage on minimum price, mean dollars per litre of ethanol, a quadratic trend, dummies for season (annual quarter) and household income. These models can be expressed as:

$$y_{it} = X_{it}\beta_i + \phi_i(t) + u_{it},$$

where the models are expressed separately by alcohol beverage type i, y_t is consumption type i in time period t, X_t is a vector of covariates described above, u_{it} is an error term and the time and season controls $\phi_i(t)$ take the form of quadratic second time and sets of season dummies.

Both the longitudinal and time series models estimate the effect on an increase in the minimum price of one alcohol type on its own consumption, for example, the effect of a 10% increase in the minimum price of beer on consumption of beer. If consumers respond to such an increase in the price of one type of alcohol by substituting a now relatively cheaper type, our estimates overstate the effect of a change in a minimum price on total alcohol consumption. This effect is particularly problematic in panel models, in which substitution will manifest as upward bias in own-price elasticities. To address this issue, we also estimated the overall effect of a weighted average of minimum prices of all alcoholic beverages on total consumption of alcohol, where the weights are whole-sample proportions of litres of ethanol sold.

Our estimation strategy is to use ordinary least squares (OLS) to estimate coefficients and correct for nonspherical disturbances by employing robust covariance matrix estimators.

Since our data comprise aggregate time series, strong serial dependence may be an issue, and we first estimated Phillips-Perron unit root tests, which demonstrated that our data reject the null hypothesis that they are not trend-stationary. However, we confirmed substantial serial correlation in the residuals. Following modern practice in applied econometrics (see for example, Angrist and Pischke[21]), we therefore estimated models in levels rather than first differences and in all models use heteroskedasticity and autocorrelation consistent covariance matrix estimators, allowing for two-quarter arbitrary serial correlation, to estimate confidence intervals and to conduct other inference[22].

As noted, in all models natural log transformations were conducted on the dependent variable of per capita consumption and, when relevant, independent variables of minimum price, family income and mean dollars per litre of ethanol. The reported coefficients can then be interpreted as elasticities, that is, they can be interpreted as the percentage change in consumption of an alcoholic beverage resulting from a one-percent increase in minimum price, in mean dollars per litre or in household income. All models were estimated using Stata 11.0 statistical software.

Data and data sources

Alcohol price data

The BC Liquor Distribution Branch (BC LDB) sets prices each month across approximately 200 government liquor stores in the province. The 600-plus privately-owned liquor stores in BC purchase alcoholic products from the BC LDB at fixed prices presently set at 16% below government liquor store prices. Private liquor stores began to be introduced in BC in the late 1990s[23]. As a consequence, government liquor store prices have a close relationship to those in private liquor stores, though they tend to be approximately 10 to 15% higher on average in the private stores[24]. All government set prices (including sales taxes) for products sold in government liquor stores were obtained for the month immediately preceding (April 2010) and the month immediately following (May 2010) the last increase in the minimum price of spirits.

Minimum retail prices (inclusive of sales taxes) of alcoholic beverages and the date of all changes to these for government liquor stores in BC over years were provided by the BC LDB along with the dates that changes were implemented. Different minimum prices were also set for packaged and draft beers and ciders over the entire study period. However, the minimum prices for draft beer and cider are in effect wholesale minimum prices and cannot be assumed to be passed on in every case to the consumer or otherwise be equivalent to the retail prices for

packaged beverages. As a consequence only data on packaged beverages were used in the analysis presented here.

Prior to April 1993, minimum beer prices were not set in the same way as other products. At this time the BC Liquor Distribution Branch also set minimum "markups" over and above wholesale prices at which the products were obtained from manufacturers. Legal records from the Canadian International Trade Tribunal from this time indicate that the minimum price of a "six-pack" of cheap beer increased from $5·20 in June 1991 to $6·40 in April 1993 in two substantial steps, firstly in July 1991 and secondly in April 1992 (see: http://www•citt-tcce.gc.ca/doc/english/Dumping/Reviews/Orders_Reasons/rr94001e.pdf). Estimates of minimum price per Canadian standard drink at each time period were calculated accordingly to complete the series for beer and then adjusted by CPI.

An overall minimum price for all packaged alcoholic beverages was calculated for each quarter of the 20 year period using an average of all individual minimum prices weighted by individual market share of each beverage (in terms of litres of ethanol). All quarterly minimum prices of each of the main beverage varieties and for all alcoholic beverages were adjusted by the quarterly BC consumer price index (CPI)[25]. Between the years of 1989 and 1993 government set minimum prices differed according to container size with bulk discounts effectively provided for higher volume varieties of spirits and wines (see online supplement Tables S1 and S2). Composite estimates of minimum price were calculated for each of these combined beverage categories using average minimum prices weighted by the estimated market share of small and large varieties using data on the numbers of each type of product available for sale in BC. For example, 95% of wines were sold in containers of less than 1·5 L and an overall minimum price was calculated accordingly.

Alcohol sales data

The BC LDB also provided quarterly provincial sales for beer, cider, alcoholic sodas ("coolers"), liqueurs, spirits and wine from 1 April 1989 to 31 March 2010 both the volume of beverages sold each quarter in litres of beverage and their total retail dollar value were provided (see: http://www.bcliquorstores.com/quarterly-market-review). The mean value of all alcohol sales expressed in dollars per litre of beverage was calculated for each annual quarter from the BC LDB data by dividing total sales revenue by litres of *beverage* sold. These prices were converted to mean dollars per litre of *ethanol* by assuming the following typical alcohol contents of each beverage type: spirits 40%, liqueurs 20%, wines 12·53%, coolers and ciders 6·77%, 5·04% by volume. These were calculated from more detailed alcohol sales data available for the years 2003 onwards.

Population data.

Population data on July 1 for the years 1989 to 2009 were obtained from official government sources (http://www.bcstats.gov.bc.ca/data/pop/popstart.asp) based on successive Canadian Censuses.

Per capita aged 15 plus alcohol consumption

Quarterly per capita alcohol consumption was estimated by dividing alcohol sales with estimates of the population aged 15 years and older for each time period.

Covariates

Several covariates which potentially confounded the effects of minimum price increase of beverages on alcohol consumption were included in the analysis: family income, mean dollars per litre of each type of alcohol, year and season. Data on annual family income were obtained

from Statistics Canada[26]. Mean dollars per litre of beverage were calculated for each annual quarter from the BC LDB data by dividing total sales revenue by litres of *beverage* sold.

Family income and mean dollars per litre were CPI adjusted for use in the analyses by multiplying values for each annual and quarter by (100/quarterly CPI).

Further technical details of methods and data sources are provided as supplementary online materials.

Results

Descriptive statistics for alcohol sales and price variables adjusted by CPI

Across the 20 year study period most alcohol was consumed in the form of beer, followed by spirits and wine, with relatively small proportions consumed in the form of liqueurs, coolers and ciders (see Table 2). The great majority of beer sales were in the form of packaged beer as opposed to draft beer typically sold in bars and restaurants. Minimum prices varied substantially, as reflected by the ranges noted in parentheses.

Insert Table 2 here

Number of products affected by most recent minimum price increase

Prior to the most recent change in minimum price, 28·5% of spirits products were priced below $31·65 and subsequently increased statistically significantly on average by $1·07 per litre thereafter (SE= 0·036, P<0·0001). Products in the higher value categories up to $35·00 also had statistically significant price increases and a statistically significant overall average increase of $0·50 per litre was observed (SE= 0·117, P<0·0001).

Insert Table 3 here

Effects of minimum price increases on consumption

The longitudinal models (Table 4) suggest that a 10% increase in the minimum price of any given alcoholic product reduced its consumption by between 14·6% (Model 1) and 16.1% (Model 2) (P<0·001 in both cases). These estimates are both statistically and economically significant as well as robust to different methods of controlling for unobserved influences over time. We also estimated the models in first differences and did not find statistically significant effects for any of the covariates. A differenced model can identify short-term immediate effects whereas the fixed effects model we employed identified changes over longer time periods before and after changes in minimum price.

Insert Table 4 here

A quadratic function for the effects of time was found to be the best fit in the time series models presented in Table 5. The model for total consumption indicates that a 10% increase in mean minimum price reduced total consumption of packaged beverages by 3·4 % (p<0·001). Beverage-specific 10% increases in minimum prices reduced consumption of spirits by 6·8 % (p<0.01), wine by 8·9 % (p=0.03), and beer by 1·5% (p=0.04). A 10% increase in the minimum price of alcoholic sodas and packaged cider decreased their consumption substantially by 13·9 %, though statistical significance was marginal (p=0·065). The results of the time series models using a linear time trend (unreported) were qualitatively similar, whereas the models with no control for time produced substantially stronger and more statistically significant relationships.

Insert Table 5 here

Discussion

Formal empirical evaluations of the impact of minimum liquor pricing on consumption have not been previously published, despite the strong *a priori* grounds for expecting this to be an effective policy for promoting public health and safety[2,3,8]. Our results suggest that minimum

pricing at the levels implemented over our sampling period in British Columbia effectively reduced both beverage-specific and aggregate consumption: The estimates indicate that a 10% increase in the minimum price of a given type of beverage reduced consumption of that type by about 16.1% relative to all other beverages, and a simultaneous 10% increase in the minimum prices of all types reduced total consumption by 3.4% ($p<0.01$ in both cases). The first estimate may overestimate minimum price effects because it incorporates compensatory increases in consumption of all other beverages. The estimate of the effect of across-the-board changes in minimum prices on total consumption will be biased to the extent that the extra structure we imposed on the model is unrealistic.

Both estimates may be conservative given that in this natural policy experiment minimum prices for some products – beers, ciders, and coolers in particular - were maintained at the relatively low level of less than one dollar per standard Canadian drink; only spirits and liqueur minimum prices were maintained at a level consistent with increases in the cost of living which may have encouraged a pattern of substitution. The effect of an increase in minimum prices may be larger in magnitude if minimum prices are set at higher levels and impact more consumers, or smaller if minimum prices are set at lower levels than those we observe in our sample.

Some limitations of the study need to be acknowledged. First, our measure of "mean dollars per litre" as a proxy for mean price was a measure of the prices paid on average by consumers and was not an independent measure of how the price of a fixed basket of goods changed over the study period, so price changes may in part reflect quality changes rather than changes in the prices of given products. Further, even putting quality changes aside, variation in demand may have caused some of the observed variation in our measure of "mean price" and hence there will be some residual confounding. Second, we only have data on prices of packaged, legally sold

alcohol, so our estimates maybe too large in magnitude to the extent that consumers substitute on-premise or black market alcohol when minimum prices increase. However, the packaged, legally sold alcohol forms the great bulk of all alcohol consumed in the province, so there is unlikely to be significant substitution to the more expensive. Finally, the estimate in our time series model for total alcohol consumption requires us, due to data limitations, to assume that total consumption depends on a weighted average of minimum prices, and to the extent that that assumption is false our estimate may be misleading.

These results are usefully considered alongside evidence that hazardous drinkers spend less per unit of alcohol than do light to moderate drinkers[3] and that drinkers compensate for price increases by shifting to cheaper drinks[8]. Our results show that the incremental increases to minimum prices of specific beverages between 1989 and 2010 caused economically and statistically significant decreases in consumption of those beverages. Substantially larger beverage-specific reductions in consumption (at least 13%) were estimated from the cross-sectional panel models for 10% increases in minimum price of a single beverage but effects of these on total alcohol consumption would be offset by consumers switching to other beverages whose price did not increase

These findings are consistent with recent calls from public health authorities to establish and maintain minimum alcohol prices. The Provincial Health Officer of British Columbia has recommended the setting a minimum price of CA$1·50 per standard drink (17·05 mL ethanol in Canada) to be adjusted annually with inflation for alcohol sold liquor stores[27], a minimum close to that now implemented in Saskatchewan for most beverage types and double some current minimum prices in BC. Elsewhere, the Chief Medical Officer for England recently recommended a £0·50 minimum price per unit of alcohol[28].

This is the first empirical evaluation of the impact of minimum pricing as a public health measure designed to limit consumption. Further studies will be conducted to assess impacts on health outcomes such as alcohol-related hospitalizations and deaths using data from various Canadian jurisdictions. In the meantime, the present findings contribute to the case for using minimum pricing as a strategy intended to reduce the burden of injury, illness and death associated with alcohol consumption.

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Co-Authors contributions
Each co-author made a substantive contribution to the paper. Tim Stockwell is Principal Investigator and Christopher Auld a Co-investigator on Canadian Institutes for Health Research grant #102627 "Does minimum pricing reduce the burden of injury and illness attributable to alcohol?". Both are equally responsible for the content of this paper. Jinhui Zhao created the main dataset from which key analyses were conducted, ran extensive preliminary analyses and contributed to the overall design of the study. Gina Martin prepared an additional dataset and conducted the analysis of the number of spirit based products whose price increased after a recent change in minimum prices. Christopher Auld was responsible for conducting the main analyses presented in the paper. Tim Stockwell conceived the research plan, wrote first drafts of the paper and contributed to decisions about data manipulation and analysis at each step.

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Table 1: A comparison between effective minimum prices for the cheapest products in Canadian dollars per standard drink (=17·05mL ethanol) in British Columbia, Ontario and Saskatchewan

Beverage	% Alcohol Content	BC Official Minimum*	Ontario Minimum Price*	Saskatchewan Minimum Price*
Fortified wine	22%	$0·56	$0·81	$1·04
Coolers/Cider	7%	$0·73	$1·00	$1·25
Beer	8%	$0·75	$1·00	$1·49
Wine	12%	$1·02	$1·00	$1·41
Spirits (Tequila)	40%	$1·35	$1·43	$1·31
Spirits (Rum)	75·4%	$0·72	$0·76	$1·04

Note: * Calculated for a 22% fortified wine, 7% cooler, 8% beer, 12% wine, 40% tequila and 75·4% rum being the cheapest products in each beverage category in BC.

Table 2: Mean and range of values for British Columbia age 15+ per capita alcohol consumption and prices for study period after adjustment by Consumer Price Index (2002=100) for annual quarters, April 1989 to March 2010

Measure	Spirits & liqueurs	Packaged Beers	Draft Beers	Wines	Coolers & Packaged Ciders	Draft Ciders	Total
Per capita consumption in L of beverage	1·63 L (1·15-2·70)	16·49 L (11·80-22·90)	4·31 L (2·76-6·31)	3·10 L (2·12-4·68)	1·25 L (0·52-2·32)	0·01 L (0·002-0·04)	26·81 L (20·19-35·76)
Per capita consumption in L of ethanol	0·61 L (0·44-1·01)	0·83 L (0·60-1·15)	0·22 L (0·14-0·32)	0·39 L (0·27-0·59)	0·09 L (0·04-0·16)	0·001 L (0·00-0·002)	2·14 L (1·57-2·83)
Minimum prices in $/standard drink †	1·13 (1·07-1·20)	1·06 (0·95-1·16)	n/a	0·99 (0·86-1·11)	0·78 (0·66-0·89)	n/a	1·05 (0·97-1·15)
Mean prices in $/standard drink †	1·40 (1·30-1·59)	1·32 (0·97-1·46)	n/a	1·74 (1·36-2·07)	1·29 (0·95-1·39)	n/a	1·43 (1·25-1·58)

Note: † one Canadian standard drink = 17·05 ml or 13·45g ethanol.

Table 3: Changes to the prices of spirits in different value categories after an advertised increase of minimum price from $30·66 to $31·66* on May 2, 2010

Price/ Litre of Spirits	% Products Before (n=488)	% Products After (n=492)	Mean price Increase ($) (n=485)	Standard Error of Mean	p-value
≤ $30·64	0·0	0·0	0·00		
$30·65 - 31·64*	28·5	0·0	1·09	0·036	<0·001
$31·65 - 32·64	6·0	29·3	0·83	0·126	<0·001
$32·65 - 35·00	9·6	13·0	0·29	0·140	·046
$35·01 - 50·00	17·0	18·9	-0·09	0·122	·480
$50·01 - 100·00	20·9	20·5	0·42	0·236	·076
≥ $100·01	18·0	18·3	0·24	0·573	·682
Total	**100·0**	**100**	**0·50**	**0·117**	**<0·001**

* A small number of products listed retailed at $30·65 prior to the increase and also $31·65 immediately after the increase i.e. 1 cent below the announced minimum price which is assumed to be due to rounding.

Table 4: Longitudinal model estimates of the effects of a 1% increase in minimum price, mean dollars per litre and household income on age 15+ per capita alcohol consumption in BC, 1989-2010†

Covariates	Model 1				Model 2			
	β	95% C.I.		P	β	95% C.I.		P
Minimum price	**-1.46**	-1.80	-1.12	0·000	**-1·61**	-2.07	-1.15	0.000
Mean $ per litre	0.04	0.22	0.37	0.713	0.13	-0.12	0.39	0.30
Household income	0.62	0.42	0.83	0.000				

† All estimates are log-log models and coefficient estimates can be interpreted as elasticities. Model 1 includes a linear time trend, household income, mean alcohol price, and seasonal effects. Model 2 includes a full set of quarterly fixed effects and mean alcohol price. Confidence intervals and p-values are robust to arbitrary heteroskedasticity and autocorrelation.

Table 5. Time series estimates of the effects of 1% increases in minimum price, mean dollars per litre and household income on age 15+ per capita consumption of different alcoholic beverages in BC, 1989-2010†

	β	95% C.I.		P
Dependent variable: volume of spirits				
Minimum price	**-0·68**	-1·45	-0·22	0·004
Mean $ per litre	-0·63	-0·92	-0·34	<0·001
Household income	0·05	-0·15	0·25	0·615
Dependent variable: volume of packaged beer				
Minimum price	**-0·15**	-0·30	-0·00	0·043
Mean $ per litre	-0·35	-0·55	-0·15	0·001
Household income	-0·35	-0·48	-0·21	<0·001
Dependent variable: volume of wine				
Minimum price	**-0·89**	-1·70	-0·08	0·033
Mean $ per litre	-0·37	-0·70	-0·04	0·026
Household income	-0·21	-0·44	0·02	0·072
Dependent variable: volume of packaged alcoholic sodas and cider				
Minimum price	**-1·39**	-2·88	0·10	0·067
Mean $ per litre	-0·15	-0·41	0·11	0·255
Household income	2·09	1·64	2·54	<0·001
Dependent variable: volume of all packaged alcoholic beverages				
Minimum price	**-0·34**	-0·80	-0·14	0·007
Mean $ per litre	-0·12	-0·32	0·08	0·241
Household income	-0·12	-0·28	0·04	0·139

† All estimates are log-log models and coefficient estimates can be interpreted as elasticities. All models include seasonal effects and quadratic time trends. Confidence intervals and p-values are robust to arbitrary heteroskedasticity and serial correlation.

Figure 1: Quarterly minimum prices of spirits, beer, wines and coolers in CPI adjusted Canadian dollarsper standard drink (CPI in year 2000; 1 standard drink equal to 17.05 mL) for British Columbia, 1989-2010