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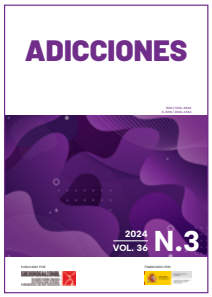

ORIGINAL

Substitution of higher-strength beers with zero-alcohol beers: Interrupted time series analyses of Spanish household purchase data, 2017-2022

Sustitución de cervezas de mayor graduación alcohólica por cervezas sin alcohol: Análisis de series temporales interrumpidas de datos de compra de los hogares españoles, 2017-2022

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Abstract

In its action plan (2022-2030) to reduce the harmful use of alcohol, WHO calls on economic operators to "substitute, whenever possible, higher-alcohol products with no-alcohol and lower-alcohol products in their overall product portfolios, with the goal of decreasing the overall levels of alcohol consumption in populations and consumer groups". This paper investigates substitution within beer brands at the level of the consumer, based on Spanish household purchase data using interrupted time series analysis. For households (n = 1791, 9.1% of all households) that newly bought at least one of eleven branded zero-alcohol beers (responsible for over three-quarters of all zero-alcohol beer purchased), the associated purchases of all grams of alcohol after the first purchase of zero-alcohol beer were reduced by 5.5%, largely due to substituting every one litre of higher strength beer (ABV > 3.5%) with 0.75 litres of same-branded zero-alcohol beer (ABV = 0.0%). For households (n = 337, 1.8% of all households) that had never previously purchased a same-branded higher-strength beer, but newly purchasing a same-branded zero-alcohol beer, the associated purchases of all grams of alcohol after the first purchase of zero-alcohol beer were reduced by 14%; this reduction was largely due to such households' decreasing their associated purchases of wines and spirits. Thus, at the level of the consumer, based on Spanish household purchase data of branded zero-alcohol beers, the evidence behind WHO's call for substitution appears to be substantiated.

Keywords: zero-alcohol beer, substitution, household purchases, ARIMA modelling

Resumen

En su plan de acción (2022-2030) para reducir el uso nocivo del alcohol, la OMS pide a los operadores económicos que «sustituyan, siempre que sea posible, los productos con alto contenido de alcohol por productos sin alcohol y con bajo contenido alcohólico, con el objetivo de disminuir los niveles generales de consumo de alcohol en las poblaciones y los grupos de consumidores». Este articulo investiga la sustitución dentro de las marcas de cerveza a nivel del consumidor, a partir de los datos de compra de los hogares españoles mediante análisis de series temporales interrumpidas. Para los hogares (n = 1791, 9,1% de todos los hogares) que compraron recientemente al menos una de las once cervezas 0,0% (responsables de más de tres cuartas partes de toda la cerveza sin alcohol comprada), las compras asociadas de todos los gramos de alcohol después de la primera compra de la cerveza 0,0% se redujeron en un 5,5%, en gran parte debido a la sustitución de cada litro de cerveza con graduación alcohólica > 3,5% con 0,75 litros de cerveza 0,0% de la misma marca. Para los hogares (n = 337, 1,8% de todos los hogares) que nunca antes habían comprado una cerveza de mayor graduación de la misma marca, pero que compraron recientemente una cerveza 0,0% de la misma marca, las compras asociadas de todos los gramos de alcohol después de la primera compra de la cerveza 0,0% se redujeron en un 14%; esta reducción se debió en gran parte a que los hogares disminuyeron sus compras asociadas de vinos y licores. Así, a nivel del consumidor, en base a los datos de compra de cervezas 0,0% por parte de los hogares españoles, parece estar fundamentada la evidencia detrás del llamamiento de la OMS a la sustitución.

Palabras clave: cerveza sin alcohol, sustitución, compras del hogar, modelado ARIMA

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The risk of damaged health and the likelihood of early death is greater the higher the level of alcohol consumption from a nadir of five grams of alcohol per day (GBD 2020 Alcohol Collaborators, 2022). To reduce the risk, consumers need to drink less alcohol. WHO, in its action plan (2022–2030) to reduce the harmful use of alcohol, further to the "continued enforcement of high-impact cost-effective policy options included in its SAFER technical package" (World Health Organization, 2019), called on 'economic operators' to "substitute, whenever possible, higher-alcohol products with no-alcohol and lower-alcohol products in their overall product portfolios, with the goal of decreasing the overall levels of alcohol consumption in populations and consumer groups." (World Health Organization, 2022).

To have an impact on people's drinking, WHO's call to economic operators needs to follow through to substitution at the level of the consumer (Anderson, Kokole, Jané Llopis, Burton & Lachenmeier, 2022a; Anderson, Kokole & LLopis, 2021; Rehm, Lachenmeier, Jané Llopis & Imtiaz, 2016). WHO's call is premised on the likelihood that economic operators will enact substitution within brands (Anderson, Jané Llopis & Rehm, 2020). Elsewhere, based on British household purchase data, we have demonstrated that consumers do substitute higher-strength alcohol beers with newly introduced lower-strength beers within brands (Anderson, Llopis, O'Donnell, Manthey & Rehm, 2020). The downside of the British analysis is, though, that it is based on just one jurisdiction - Great Britain. In this paper, we examine substitution within beer brands based on analyses of Spanish household purchase data for the period 2nd quarter 2017 to end of 1st quarter 2022. Since substitution of higher-strength beers with zero-alcohol beers (ABV = 0.0%) (alcohol by volume [ABV]) could have a greater impact in reducing consumptions of grams of alcohol than substitution with no-alcohol beers (ABV ≤ 1.0%), we examine potential substitution with zero-alcohol beers.

Since the 1970s, there have been large decreases in per capita levels of alcohol consumption in Spain, largely due to decreases in wine and spirits consumption and increases in beer consumption, such that Spain is now predominantly a beer-drinking country (Llamosas-Falcón, Manthey & Rehm, 2022). There are a range of factors that might explain the decreases and shifts in consumption, including beer becoming relatively cheaper than wine, cultural shifts with decreased drinking at lunch time, and government policies regulating purchase age, advertising, and licensing premises to sell alcohol (Matrai et al. 2014; Llamosas-Falcón et al., 2022). Over the last ten years, consumption has remained relatively stable (Llamosas-Falcón et al., 2022). In Spain (Anderson & Kokole, 2022), as a proportion of all beer purchases, purchases of zero-alcohol beers (ABV = 0.0%) are nearly six-fold higher than in Great Britain (Anderson, O'Donnell, Jané Llopis & Kaner, 2022b). This paper considers the extent to which households that newly purchase zero-alcohol beers decrease their purchases of same-branded higher-strength beers, and the extent to which this might vary by sociodemographic attributes of the households. We also consider for households that had never previously purchased a same-branded higher-strength beer, the extent to which new purchases of the same-branded zero-alcohol beer led to subsequent purchases of the same-branded higher-strength beers and how this impacted the overall numbers of grams of alcohol purchased. Our data source is restricted to purchase data, and thus we can only analyse changes in purchases, rather than the mechanisms that lead to changes in purchases. We cannot assess the extent to which changes in purchases were driven by consumer demand or by marketing strategies of the alcohol producers.

The two specific hypotheses to be tested are:

1. For households that had previously purchased same-branded higher-strength beers, new purchases of zero-alcohol beers are associated with reduced purchases of all grams of alcohol; and,
2. For households that had not previously purchased same-branded higher-strength beers, new purchases of zero-alcohol beers are not associated with increases in purchases of all grams of alcohol. This hypothesis considers the extent to which producers of a given brand might use zero-alcohol beers as products to induce consumers to buy subsequently their higher-strength products.

Methods

Study design

We use interrupted time series analyses to investigate the potential impact of new purchases of zero-alcohol beers on changes in purchases of grams of all alcohol over time.

Data source

Our data source is Kantar Worldpanel's (KWP) household shopping panel. KWP comprises approximately 12,000 Spanish households at any one time, recruited via stratified sampling, with targets set for province, household size, and age of main shopper, with the panel being representative of households in Spain as a whole. Households provide demographic information when joining the panel, followed by annual updates and quality checks. Using barcode scanners, households record all alcohol purchases brought into the home from all store types, including Internet shopping.

We analysed raw KWP data on take-home purchasing of alcohol products in Spain for the time-period second quarter of 2017 to end of first quarter of 2022. For each individual purchase, the provided data included the type and volume

of the purchase, the brand, and the alcohol by volume (ABV). The provided data categorized each purchase as either a beer, a wine, a sparkling wine, or a spirits-based product. The volume purchased was combined with ABV to calculate grams of alcohol purchased. Households were grouped by age of main shopper, social grade, Autonomous Community, and level of alcohol purchases supplement Table 1, supplement pages 1-2.

Our inclusion criteria were a branded zero-alcohol beer (ABV = 0.0%) with at least 1,000 separate purchases across all households and the five-year time period, and that had a same-branded higher-strength beer; this resulted in eleven zero-alcohol beers. We summed volumes and grams of purchased alcohol across all the eleven beers, treating them for the analyses as though they were one product. We prepared data by, first, for any day that a household bought alcohol, summing the amount of alcohol purchased in both volume and grams, divided by the number of adults in the household. Then, for each day of the time-period (second quarter of 2017 to end of first quarter of 2022), we calculated the mean volume and grams of purchases across all households for all products and for beers separated into: zero-alcohol (ABV = 0.0%); non-zero low-alcohol beers (ABV > 0.0% and ≤ 3.5%); and all other beers (ABV > 3.5%).

We made two separate classifications of households that had made any purchase of any one of the branded beers:

i. Into those that made the first purchase of one of the branded zero-alcohol beers after a period of at least 12 months (and, for sensitivity analyses, both six and 18 months) since the first purchase of one of the same-branded higher-strength beers (ABV > 3.5%), defined as newly purchasing (NP) households, and all other households, defined as non-newly purchasing (N-NP) households;
ii. For households that had made the first purchase of one of the branded zero-alcohol beers after a period of at least six months since the first purchase of any alcohol product, into those that had not bought a same-branded higher-strength beer (ABV > 3.5%) prior to the first purchase of the same-branded zero-alcohol beer ([-ve > 3.5%]|[+ve 0.0%] households) and those that had bought a same-branded higher-strength beer prior to the first purchase of the same-branded zero-alcohol beer ([+ve > 3.5%]|[+ve 0.0%] households).

We adjusted the study days as follows: for each household, we set the first day of the new purchase of a zero-alcohol branded beer as day 0, numbering all other days as minus days before the purchase and plus days after the purchase.

Statistical analyses

We used generalized linear models to estimate the odds ratio of being a newly purchasing household compared with other households by the socio-demographic attributes of the households. We present the odds ratios with 95% confidence intervals. For details, see supplement page 3.

Hypothesis 1: For households that had previously purchased same-branded higher-strength beers, new purchases of zero-alcohol beers are associated with reduced purchases of all grams of alcohol

Our primary dependent variable was grams of all alcohol purchased per adult per household per day of purchase, averaged per adjusted study day.

Our secondary dependent variables were:

- Volume of purchases (millilitres) of the zero-alcohol branded beer (ABV = 0.0%);
- Volume of purchases (millilitres) of the low-alcohol branded beer (ABV > 0.0% and ≤ 1.0%);
- Volume of purchases (millilitres) of the higher-strength branded beer (ABV > 3.5%);
- Grams of alcohol within all of the same-branded beers;
- Volume of purchases (millilitres) of all other higher-strength beer (ABV > 3.5%);
- Volume of purchases (millilitres) of wines with an ABV > 8.5%;
- Volume of purchases (millilitres) of spirits with an ABV > 38%.

Using a generalized linear model, we undertook before-the event and after-the event analyses to assess the associated impact of the event, the first day of purchase of a zero-alcohol beer that defines a newly purchasing household. The event was dummy-coded as 0 for all days prior to the event and 1 for all days from the event forwards. We repeated the before- and after-analysis investigating the interaction between the grouped level of alcohol consumption of the household prior to the event and the event (noting that such interaction analysis is not possible with interrupted time series analyses). For details, see supplement pages 4-5.

We also used interrupted time series analyses to assess the associated impact of the event. As sensitivity analyses, we repeated the model, setting, for each household, the period between the first purchase of the same-branded higher-strength beer and the same-branded zero-alcohol beer as either six months or 18 months (as opposed to 12 months for the main analyses). We report unstandardized coefficients and 95% confidence intervals. For details, see supplement pages 5-6.

Hypothesis 2: For households that had not previously purchased same-branded higher-strength beers, new purchases of zero-alcohol beers are not associated with increases in purchases of all grams of alcohol.

Our primary dependent variable was grams of all alcohol purchased per adult per household per day of purchase, averaged per adjusted study day.

Our secondary dependent variables were:

- Volume of purchases (millilitres) of the zero-alcohol branded beer (ABV = 0.0%);
- Volume of purchases (millilitres) of the higher-strength branded beer (ABV > 3.5%);
- Volume of purchases (millilitres) of all other higher-strength beer (ABV > 3.5%);
- Volume of purchases (millilitres) of wines with an ABV > 8.5%;
- Volume of purchases (millilitres) of spirits with an ABV > 38%.

As for hypothesis 1, we used a generalized linear model to undertake before-the event and after-the event analyses to assess the changes in volume of purchases of both the zero-alcohol and higher-strength branded beers following the first purchase of the zero-alcohol branded beer.

As for hypothesis 1, we used interrupted time series analyses to assess the associated impact of the event (the first purchase of the zero-alcohol beer) on purchases of all grams of alcohol. The event was dummy-coded as 0 for all days prior to the event and 1 for all days from the event forwards. We subsequently noted from plots that there were slopes in purchases over time before and after the event. Therefore, we created two dummy-coded slope variables: the study days for the slope before the event were dummy-coded as 0 for all days from the event forwards; and for the study days for the slope after the event were dummy-coded as 0 for all days prior to the event.

All analyses were performed with SPSSv27 (IBM Corp 2020).

Results

Households and purchases

We analysed data from 18,954 Spanish households with 1.29 million separate alcohol purchases between the beginning of the second quarter of 2017 to the end of the first quarter of 2022. Out of the volume of all zero-alcohol beers purchased, 105.0 ml (95% CI = 103.4 to 106.7) (per adult per household per day of purchase per study day, averaged over all study days and all households), 79.5ml (95% CI = 78.0 to 80.9), 75.5%, was from one of the eleven included branded beers.

Hypothesis 1: At the household level, new purchases of zero-alcohol beers are associated with decreased purchases of same-branded higher-strength beers, resulting in reduced purchases of all grams of alcohol

Out of the 18,954 households, 17,283 (91.2%) had made at least one purchase of beer, 15,797 (83.3%) had made at least one purchase of one of the branded beers and 6,911 (36.5%) had made at least one purchase of one of the branded zero-alcohol beers, 1,719 of which (9.1% of all households) had made the first purchase of the zero-alcohol beer at least one year after the first purchase of the same-branded beer with an ABV > 3.5% (the included newly purchasing households for the analysis). Compared with other households that had purchased a zero-alcohol branded beer, the newly purchasing households were more likely to be heavier purchasers of alcohol, tended to be older, but did not differ by social grade, and had no consistent pattern by autonomous community in which the household was located, supplement Table 2, supplement page 7.

Of the 1,719 newly purchasing households, 1,547 (90%) bought only one type out of the eleven zero-alcohol brands; of these 1,547 households, 1,238 (80%) bought the same brand of zero-alcohol beer as the previous purchases of the higher-strength branded beer (ABV > 3.5%). Of the 1,719 newly purchasing households included in the analyses, Figure 1 plots on the left vertical axis the volumes of purchases (ml per adult per household per day of purchase, averaged for each adjusted day across all households) for branded zero-alcohol beer and for same-branded beer with an ABV > 3.5%. On the right vertical axis, Figure 1 plots grams of alcohol purchased (grams per adult per household per day of purchase, averaged for each adjusted day across all households) for all grams of alcohol and for all grams of alcohol within the branded beers. It is important to remember that not all 1,719 households are represented in the averages for all the adjusted study days. At the left of the horizontal axis, the large negative adjusted study days include households that had the largest time interval between the first purchase of the same-branded higher-strength beers (ABV > 3.5%) and the first purchase of the branded zero-alcohol beers; whereas, at the right of the horizontal axis, the large positive adjusted study days include households that had the shortest time interval between the first purchase of the same-branded higher-strength beers (ABV > 3.5%) and the first purchase of the branded zero-alcohol beers. Visual inspection of the plots illustrates an initial decrease in the volume of purchases of the zero-alcohol beer, followed by a stable trend over time, mirrored by opposite changes in the volume of purchased higher-strength beers, and purchased grams of alcohol.

Table 1 displays the coefficients for the changes in the dependent variables associated with the event for both the before- and after- analyses and the interrupted time series analysis. The coefficients are similar for both sets of analyses. Using the coefficients from the interrupted time series analyses, for the primary outcome, the event was associated with a reduction in purchases of 5.5 grams (95% CI = 3.9 to 7.0) of alcohol (per adult per household per day of purchase averaged across each adjusted study

day), a 5.5% reduction. That the event, with subsequent purchases of zero-alcohol beer of 98ml (95% CI = 96 to 101) was associated with reductions at the household level in volumes of purchases of same-branded higher-strength beer (-73 ml, 95% CI = -90 to -56), an 11% reduction, is consistent with substitution. Since the first day of new purchases of zero-alcohol beer, every one litre of higher-strength beer (ABV > 3.5%) was substituted with 0.745 litres (95% CI = 0.736 to 0.753) of same-branded zero-alcohol beer (ABV = 0.0%), this ratio increasing over time, regression coefficient per 100 days, 0.022 (95% CI = 0.019 to 0.024), supplement Figure 3, page 8.

That the associated reductions in purchases of grams of all alcohol might be due to the reductions in purchases of the higher-strength branded beer (ABV > 3.5%), is suggested by that, when including the purchase volumes of higher-strength branded beer as an independent variable in the model for the associated changes in purchases of grams of all alcohol as dependent variable, the coefficient for the associated changes in purchases of grams of alcohol dropped to 1.9 grams, with relatively wide 95% confidence intervals, 0.12 to 3.70.

The sensitivity analyses, with the time intervals between the first purchase of the same-branded higher-strength beer and the same-branded zero-alcohol beer as either six months or 18 months (as opposed to 12 months for the main analyses) found very similar results, supplement Table 3, supplement page 9, with the exception that the associated reductions in purchases of the volume of same-branded higher-strength beers and reductions in purchases of grams of alcohol in all branded beers seemed larger the longer the time interval.

When analysing by groups of the amount of alcohol normally purchased prior to the first purchase of the newly-purchased zero-alcohol beer, the normal heavier buyers of alcohol had greater reductions in the volume of purchases of same-branded higher-strength beer and greater reductions in purchases of alcohol than lighter buyers of alcohol, supplement Table 4 supplement page 10, confirmed by the interaction analysis, supplement Table 5, supplement page 10, where the highest purchasing group reduced their purchase of grams of alcohol by 11.2 grams (95% CI = 8.4 to 14.0) more than the lowest purchasing group.

Figure 1

Left vertical axis plots the volumes of purchases (ml per adult per household per day of purchase, averaged for each adjusted day across all households) for branded zero-alcohol beer (ABV = 0.0%) and for same-branded beer with an ABV > 3.5%. Right vertical axis plots grams of alcohol purchased (grams per adult per household per day of purchase, averaged for each adjusted day across all households) for all grams of alcohol and for all grams of alcohol within the branded beers. Dots: daily data points, predicted values from ARIMA models. Black vertical line: Day of first purchase of newly purchased zero-alcohol branded beer

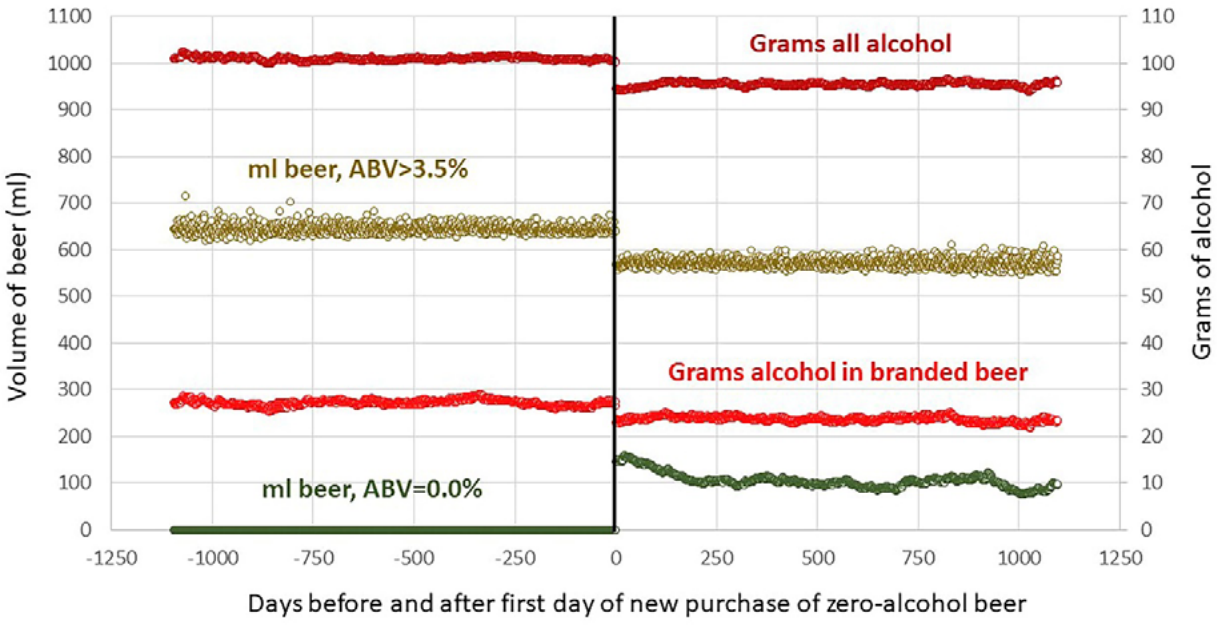

Table 1
Coefficients (95% confidence intervals) for the changes in the dependent variables associated with the event for both the before- and after- analyses and the interrupted time series analysis

Dependent variables	Before and after analyses		Interrupted time series analyses
	Intercept	Event	
Branded zero-alcohol beer (ml)	0.0	97.81 (93.74 to 101.88)	98.22 (95.64 to 100.86)
Branded low-alcohol beer (ABV > 0.0 and ≤ 3.5%) (ml)	101.79 (97.72 to 105.86)	-8.86 (-14.61 to -3.10)	-8.81 (-14.98 to -2.63)
Branded higher-strength beer (ABV > 3.5%) (ml)	645.31 (633.78 to 656.84)	-73.28 (-89.59 to -56.98)	-73.31 (-90.39 to -56.22)
Grams of alcohol in all branded beers	27.17 (26.73 to 27.62)	-3.46 (-4.09 to -2.83)	-3.48 (-4.57 to -2.39)
Grams of alcohol in all products	100.92 (100.00 to 101.84)	-5.43 (-6.73 to -4.12)	-5.45 (-7.01 to -3.88)
Other non-branded beer (ABV > 3.5%) (ml)	434.41 (425.00 to 443.81)	-24.67 (-37.98 to -11.37)	-24.67 (-37.97 to -11.38)
Wine (ABV > 9.5%) (ml)	361.01 (360.55 to 361.47)	1.33 (.68 to 1.98)	-1.14 (-2.12 to -.15)
Spirits (ABV > 35%) (ml)	27.95 (27.85 to 28.04)	1.89 (1.76 to 2.02)	Non-significant

Hypothesis 2: For households that had not previously purchased same-branded higher-strength beers, new purchases of zero-alcohol beers are not associated with increases in purchases of all grams of alcohol.

Out of the 6,911 households that had made at least one purchase of one of the branded zero-alcohol beers, 3,458, 50% (18.2% of all households) made their first purchase of a branded zero-alcohol beer at least six months after their first purchase of any alcohol product, of which 337 (9.7%) had never previously purchased a same-branded higher-strength beer ([-ve > 3.5%]|[+ve 0.0%] households), and 3,121 (93.3%) had previously purchased a same-branded higher-strength beer ([+ve > 3.5%]|[+ve 0.0%] households). Figure 2, which plots purchases over time, shows that [-ve > 3.5%]|[+ve 0.0%] households purchased slightly greater volumes of zero-alcohol beer (134.4 ml, 95% CI = 132.8 to 135.9) than [+ve > 3.5%]|[+ve 0.0%] households (105.6 ml, 95% CI = 104.6 to 106.5), difference = 28.8ml (95% CI = 27.0 to 30.7). For same-branded higher-strength beer, [-ve > 3.5%]|[+ve 0.0%] households subsequently made purchases, but much less in volume over the same time period (181.9 ml, 95% CI = 178.3 to 185.5) than [+ve > 3.5%]|[+ve 0.0%] households (555.8 ml, 95% CI = 554.3 to 557.3), difference = 373.9 ml (95% CI = 370.0 to 377.8). Over the whole time since the first purchase of zero-alcohol beer, for every one litre of zero-alcohol beer (ABV = 0.0%) purchased, 1.22 litres (95% CI = 1.18 to 1.25) of higher-strength beer (ABV > 3.5%) were purchased, the ratio increased during the first year, and thereafter remained relatively stable for the next two years (the length of time of analysis) at 1.61 (95% CI = 1.58 to 1.64), decreasing slightly over time during the final two years, per every 100 days over the two years, coefficient = -0.012 (95% CI = -0.017 to -0.0074), supplement Figure 4, supplement page 11.

For grams of all alcohol, [-ve > 3.5%]|[+ve 0.0%] households showed a trend of increasing purchases prior to their first purchase of zero-alcohol beer, with this trend reversing after their first purchase, Table 2. Overall, subsequent to the first purchase of the zero-alcohol beer, [-ve > 3.5%]|[+ve 0.0%] households reduced their associated purchases of grams of all alcohol by a greater amount than [+ve > 3.5%]|[+ve 0.0%] households, difference, 6.63 grams (95% CI = 6.05 to 7.20), Table 2. This could be due the fact that whilst [-ve > 3.5%]|[+ve 0.0%] households increased their associated purchases of other beer by a greater amount than [+ve > 3.5%]|[+ve 0.0%] households, difference, 79.5 ml (78.7 to 80.3), they decreased their associated purchases by a greater amount of both wine, difference, 68.7 ml (63.6 to 73.8) and spirits, difference, 14.9 ml (13.9 to 15.8) than [+ve > 3.5%]|[+ve 0.0%] households, Table 2.

That this might be the case is suggested by, that, when including the purchase volumes of other beer, spirits and wines as independent variables in the model for the associated changes in purchases of grams of all alcohol as dependent variable, the coefficient for the associated changes in purchases of grams of alcohol was no longer significant and excluded from the model for [-ve > 3.5%] | [+ve 0.0%] households.

Discussion

Main findings

We analysed data from Spain, since this is one of the European countries with the highest proportion of beer purchases that are zero- and no-alcohol (Kokole, Jané

Llopis & Anderson 2021). We studied eleven zero-alcohol beers that had same-branded higher-strength beers, and that were responsible in volume terms, for 75.5% of all purchased zero-alcohol beer over the time period, second quarter of 2017 to end of first quarter of 2022.

For our first hypothesis (for households that had previously purchased same-branded higher-strength beers, new purchases of zero-alcohol beers are associated with reduced purchases of all grams of alcohol), we analysed the purchasing behaviour of 1,719 households (9.1% of all households in the data set) that had made a first purchase of the branded zero-alcohol beer (ABV = 0.0%) at least one year after the first purchase of the same-branded beer with an ABV > 3.5%, calling such households newly purchasing households of zero-alcohol beer. Eighty percent of newly purchasing households bought the same brand of zero-alcohol beer as the brand of the higher-strength beer that they had previously bought.

The first hypothesis is confirmed. New purchases of zero-alcohol beers were associated with reduced purchases of all grams of alcohol by, on average, 5.5%. The volume of associated new purchases of same-branded zero-alcohol

Figure 2

Left vertical axis plots the volumes of purchases (ml per adult per household per day of purchase, averaged for each adjusted day across all households) for branded zero-alcohol beer (ABV = 0.0%) and for same-branded beer with an ABV > 3.5%. Right vertical axis plots grams of alcohol purchased (grams per adult per household per day of purchase, averaged for each adjusted day across all households) for all grams of alcohol. Separate plots for [-ve > 3.5%]|[+ve 0.0%] and [+ve > 3.5%]|[+ve 0.0%] households. Dots: daily data points, predicted values from ARIMA models. Black vertical line: Day of first purchase of newly purchased zero-alcohol branded beer

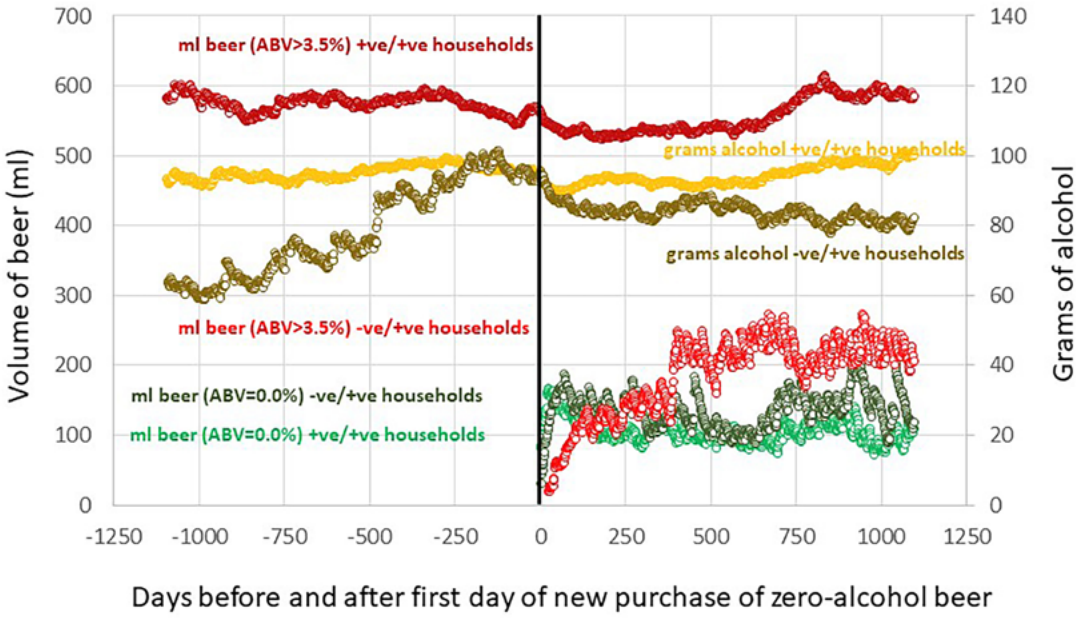

Table 2

Coefficients (95% confidence intervals) for the changes in the dependent variables associated with the event for the interrupted time series analysis

	Grams all alcohol		Volume other beer (ml)		Volume spirits (ml)		Volume wine (ml)	
	[-ve>3.5%]|[+ve0.0%] households	[+ve>3.5%]|[+ve0.0%] households	[-ve>3.5%]|[+ve0.0%] households	[+ve>3.5%]|[+ve0.0%] households	[-ve>3.5%]|[+ve0.0%] households	[+ve>3.5%]|[+ve0.0%] households	[-ve>3.5%]|[+ve0.0%] households	[+ve>3.5%]|[+ve0.0%] households
Intercept	101.0 (100.6 to 101.4)	97.3 (97.2 to 97.5)	371.449 (371.449 to 371.449)	427.202 (426.653 to 427.751)	35.508 (34.817 to 36.198)	27.485 (27.314 to 27.656)	543.760 (540.162 to 547.358)	376.335 (375.382 to 377.288)
Slope prior to event	.041 (.039 to .042)	.0039 (.0036 to .004)	Non-significant	.025 (.024 to .026)	.004 (.003 to .006)	Non-significant	.281 (.275 to .288)	.047 (.046 to .049)
Event	-14.2 (-14.7 to -13.6)	-7.3 (-7.5 to -7.1)	54.015 (54.015 to 54.015)	-25.451 (-26.228 to -24.674)	-11.810 (-12.769 to -10.852)	3.044 (2.803 to 3.286)	-103.362 (-108.372 to -98.351)	-34.667 (-36.016 to -33.318)
Slope after event	-.0053 (-.0059 to -.005)	.0077 (.0074 to .008)	Non-significant	.014 (.013 to .015)	Non-significant	.001 (.001 to .001)	-.095 (-.100 to -.089)	.003 (.001 to .004)

beer (98 ml) was matched with reductions in purchases of regular strength beer (ABV > 3.5%) of 73 ml, a substitution ratio of 74.5% that increased slightly over three years (the length of time of follow-up analysis). Households that bought the most alcohol to begin with showed evidence of greater substitution. That, together with newly purchasing households being heavier purchasers of alcohol in general could be interpreted that such households were purchasing zero-alcohol beers in an attempt to reduce their alcohol purchases, and thus alcohol consumption.

For our second hypothesis (for households that had not previously purchased same-branded higher-strength beers, new purchases of zero-alcohol beers are not associated with increases in purchases of all grams of alcohol), we analysed the purchasing behaviour of 3,458 households (18.2% of all households in the data set) that had made at least one purchase of one of the branded zero-alcohol beers at least six months after their first purchase of any alcohol product, dividing them into 337 households that had never previously purchased a same-branded higher-strength beer ([-ve > 3.5%]|[+ve 0.0%] households), and 3,121 that had previously purchased a same-branded higher-strength beer ([+ve > 3.5%]|[+ve 0.0%] households).

With respect to no increases in purchases of all grams of alcohol, the second hypothesis is confirmed. There were no associated increases in purchases of grams of alcohol; rather, for [-ve > 3.5%]|[+ve 0.0%] households, new purchases of zero-alcohol beers were associated with reduced purchases of all grams of alcohol by, on average, 14%, larger than the 7.5% associated reduction for [+ve > 3.5%]|[+ve 0.0%] households. Whilst [-ve > 3.5%]|[+ve 0.0%] households followed their new purchases of zero-alcohol beer with associated increased purchases of both same-branded higher-strength beer and other beers (with such purchases being, respectively, about one-third and one-sixth of the equivalent volumes purchased by [+ve > 3.5%]|[+ve 0.0%] households), their associated purchases of the volumes of both wine and spirits were reduced. The associated 14% reductions in purchases of all grams of alcohol were fully explained by the associated reduced purchases of wines and spirits. Thus, it seems that households that had not previously purchased a higher-strength branded beer that went on to newly buy a same-branded zero-alcohol beer were shifting their purchases from higher-strength alcohol products (wines and spirits) to lower strength alcohol products (beer), with new beer purchases split roughly two-fifths zero-alcohol beer and three-fifths higher-strength beer, with the proportion of zero-alcohol beer increasing slightly over time during the second two years of follow-up. This shift at the level of household purchases is consistent with what has occurred throughout Spain as a whole over the last 50 years, where there have been large decreases in per capita levels of alcohol consumption, largely due to shifts from wine and spirits consumption to beer consumption (Llamosas-Falcón et al., 2022).

What is already known on this topic

The only other similar studies that we are aware of are our own studies of British household purchase data with over four million alcohol purchases from 64,280 households for the years 2015-2018, that is a data set some 3.4 times larger than the Spanish set (Jané Llopis, O'Donnell, Kaner & Anderson, 2022). The study investigated the extent to which the launch of six new zero (ABV = 0.0%) and low-alcohol (ABV > 0.0% and ≤ 3.5%) beers affected the volume of purchases of higher-strength beers (ABV > 3.5%). British households that had previously bought same-branded regular-strength beers and that went on to buy newly-introduced same-branded no- and low-alcohol beers subsequently reduced purchases of the regular-strength beers by 48.5 ml per adult per household per day for days in which a purchase was made, a 22.5% reduction, matched by new purchases of 34.6 ml of the new no- and low- alcohol beers, with such changes stable over at least two years follow-up (the length of time available for analyses). Looking at all households that had not previously bought one of the higher-strength branded beers, those households that went on to buy one of the newly introduced same-branded zero or low alcohol beers did subsequently buy same-branded higher-strength beer, but by only half as much as those households that had not gone on to buy one of the newly introduced zero or low alcohol beers.

What this study adds

A strength of the study is that we include a large number of alcohol purchases from a large number of households, with large numbers of data points before and after the examined event, with scanned barcode data providing objective data. Examining household purchases in Spain, with a very different drinking culture than that of Great Britain, found evidence for substitution at the ratio of 75% and reduced purchases of grams of alcohol. The associated reductions in purchased grams of alcohol were greater the higher the initial level of overall alcohol purchases. Households that had not previously bought a branded higher-strength beer and subsequently bought a branded zero-alcohol beer had overall associated reductions in purchases of grams of alcohol due to shifting associated purchases from wines and spirits to beer; these households did go on to buy the same-branded higher-strength beer, but to a lesser extent (about one third the volume) than households that had previously bought a branded higher-strength beer.

Limitations of the study

A main limitation of the study is that we are only able to assess changes in household alcohol purchases from shops and supermarkets, and exclude alcohol consumed from cafés, bars and restaurants. Further, we only examine purchases and not actual levels of alcohol consumption for the time periods studied. Adults in a household may not

have an equal share of the alcohol purchased, and not all adults in a household may be drinkers. The data also have limitations, with alcohol purchases tending to be under-reported in these types of datasets (Leicester, 2012).

Conclusions

Within brands of beer, household purchases, in both Spain and Great Britain, seem to confirm WHO's intended model of change when WHO called on economic operators to "substitute, whenever possible, higher-alcohol products with no-alcohol and lower-alcohol products in their overall product portfolios, with the goal of decreasing the overall levels of alcohol consumption in populations and consumer groups". The examined data found both substitution and decreased purchases of grams of alcohol overall. There needs to be expanded research across different jurisdictions to monitor the impact of potential substitution on consumer behaviour and public health, including what facilitates substitution and any potential unintended consequences of substitution. Substitution is an addition to, and not a replacement of, the elements in WHO's SAFER initiative that need to be implemented to reduce the harmful use of alcohol,[3] without interference from alcohol producers.[3,6]

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Contributors

PA conceptualised the paper, undertook the analyses and prepared the draft of the paper. DK refined the various versions of the full paper and approved the final manuscript for submission. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. All authors had access to the data used for analyses, and all authors verified the raw data sets received from Kantar Worldpanel and are the guarantors for the data used for the analyses.

Conflict of interests

P.A. and D.K. received funds from the European Health and Digital Executive Agency under a service contract.

Ethical approval

Not required.

Data sharing

No additional data available. Kantar Worldpanel data cannot be shared due to licensing restrictions.

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Supplement

Supplement Table 1
Divisions of households by socio-demographic characteristics (N = 18,954 households)

Group	GDP per capita (€)	Categories	Number of households within each group	Distribution within each group (%)
Age of the main shopper (years)		18-34	3668	19.4
		35-49	7690	40.6
		50-64	5634	29.7
		65+	1962	10.4
Social grade[a]		Medium-High and High	3397	17.9
		Medium-Medium	6375	33.6
		Medium-Low	5081	26.8
		Low	4101	21.6
Groups of weekly purchases of alcohol (grams) prior to 1st purchase of zero-alcohol beer		≤12	3879	20.5
		>12-≤25	5601	29.6
		>25-≤49	4845	25.6
		> 49	4629	24.4
Autonomous Community	19,107	Andalusia	3319	17.5
	28,151	Aragon	547	2.9
	22,789	Asturias	444	2.3
	27,682	Balearic Islands	416	2.2
	33,223	Basque Country	788	4.2
	20,892	Canary Islands	838	4.4
	23,757	Cantabria	234	1.2
	24,031	Castile and León	1277	6.7
	20,363	Castilla- La Mancha	824	4.3
	30,426	Catalonia	3036	16.0
	35,041	Community of Madrid	2783	14.7
	18,769	Extremadura	467	2.5
	23,183	Galicia	1083	5.7
	27,225	La Rioja	136	.7
	21,269	Murcia	552	2.9
	31,389	Navarre	214	1.1
	22,426	Valencian Community	1996	10.5

[a] Based on 20 variables, using Multiple Correspondences Analysis (MCA), households were factored into one of four groups as follows:

Low Grade

Head of family:
Owners of agriculture, livestock and fisheries
Employees in agriculture, livestock and fisheries
No studies
Other: students, retired, etc.

Equipment:
No internet
No computer
No mobile phone
No car
No microwave
No vacuum cleaner
No dishwasher
No stereo
1 TV

Medium-Low Grade

Head of family:
Lower levels of employment
Primary school

Equipment:
No dishwasher
1 Bathroom
1 car
1 TV set
No pay TV
No electric toothbrush
No housekeeper

Medium-Medium Grade

Head of family:
Mid management
Office employees
Industry and commerce employees
Secondary school

Equipment:
Robotic Vacuum cleaner
Dishwasher
Stereo
2+ cars
2+ TV sets
2+ bathrooms
Electric toothbrush

Medium-High and High Grade

Head of family:
High management
Mid management
Self-employed
University

Equipment:
Housekeeper
Secondary residence
3+ TV sets
2+ cars

Odds ratios for being a newly purchasing household

We estimated the odds ratios for the 1,719 households that had made the first purchase of the zero-alcohol beer at least one year after the first purchase of the same branded beer with an ABV > 3.5%, compared to the 5,192 households that had made the first purchase of the zero-alcohol beer less than one year after the first purchase of the same branded beer with an ABV > 3.5%. Households were dummy coded 0 for less than one year and 1 for one year or more for the time gap, the dependent variable (new). The independent variables were dummy coded 'yes' or 'no' for each of categories of the groups of age (age), social grade (grade), autonomous community (AC), and groups of weekly purchases of alcohol (grams) prior to 1st purchase of zero-alcohol beer (gmgroup). The SPSS syntax was:

```
GENLIN new (REFERENCE=first) BY age grade AC gmgroup (ORDER=ASCENDING)
  /MODEL age grade AC gmgroup INTERCEPT=YES
 DISTRIBUTION=BINOMIAL LINK=LOGIT
  /CRITERIA METHOD=FISHER(1) SCALE=1 COVB=MODEL MAXITERATIONS=100 MAXSTEPHALVING=5
    PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012 ANALYSISTYPE=3(WALD) CILEVEL=95 CITYPE=WALD
    LIKELIHOOD=FULL
  /EMMEANS TABLES=age SCALE=ORIGINAL
  /EMMEANS TABLES=grade SCALE=ORIGINAL
    /EMMEANS TABLES=gmgroup SCALE=ORIGINAL
  /EMMEANS TABLES=AC SCALE=ORIGINAL
  /MISSING CLASSMISSING=EXCLUDE
  /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION (EXPONENTIATED).
```

Interrupted Time Series Analyses

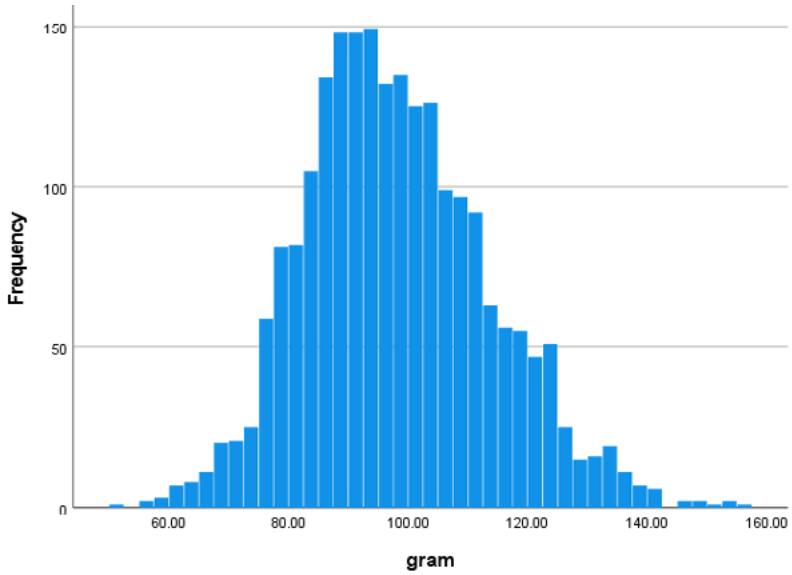
The primary outcome dependent variable is:
- Grams of all purchased alcohol, per adult per household per day of purchase.

The secondary outcome dependent variables are:
- Volume of purchases (millilitres) of the zero-alcohol branded beer (ABV = 0.0%);
- Volume of purchases (millilitres) of the low-alcohol branded beer (ABV > 0.0% and ≤ 1.0%);
- Volume of purchases (millilitres) of the higher-strength branded beer (ABV > 3.5%);
- Grams of alcohol within all of the same-branded beers;
- Volume of purchases (millilitres) of all other higher-strength beer (ABV > 3.5%);
- Volume of purchases (millilitres) of wines with an ABV > 8.5%;
- Volume of purchases (millilitres) of spirits with an ABV > 38%.

The independent variable is:
The study days were adjusted as follows: for each household, we set the first day of the new purchase of a zero-alcohol branded beer as day 0, numbering all other days as minus days before the purchase and plus days after the purchase. The event, the adjusted first day of purchase was dummy coded as zero prior to the event and as 1 form the event forwards.

Distribution of primary outcome
The primary outcome, grams of all purchased alcohol, per adult per household per day of purchase across all adjusted study days was normally distributed, Supplement Figure 1.

Supplement Figure 1
Distribution of primary outcome, grams of all purchased alcohol, per adult per household per day of purchase across all adjusted study days



Before and after analysis

We undertook before and after analyses, using the following SPSS syntax:

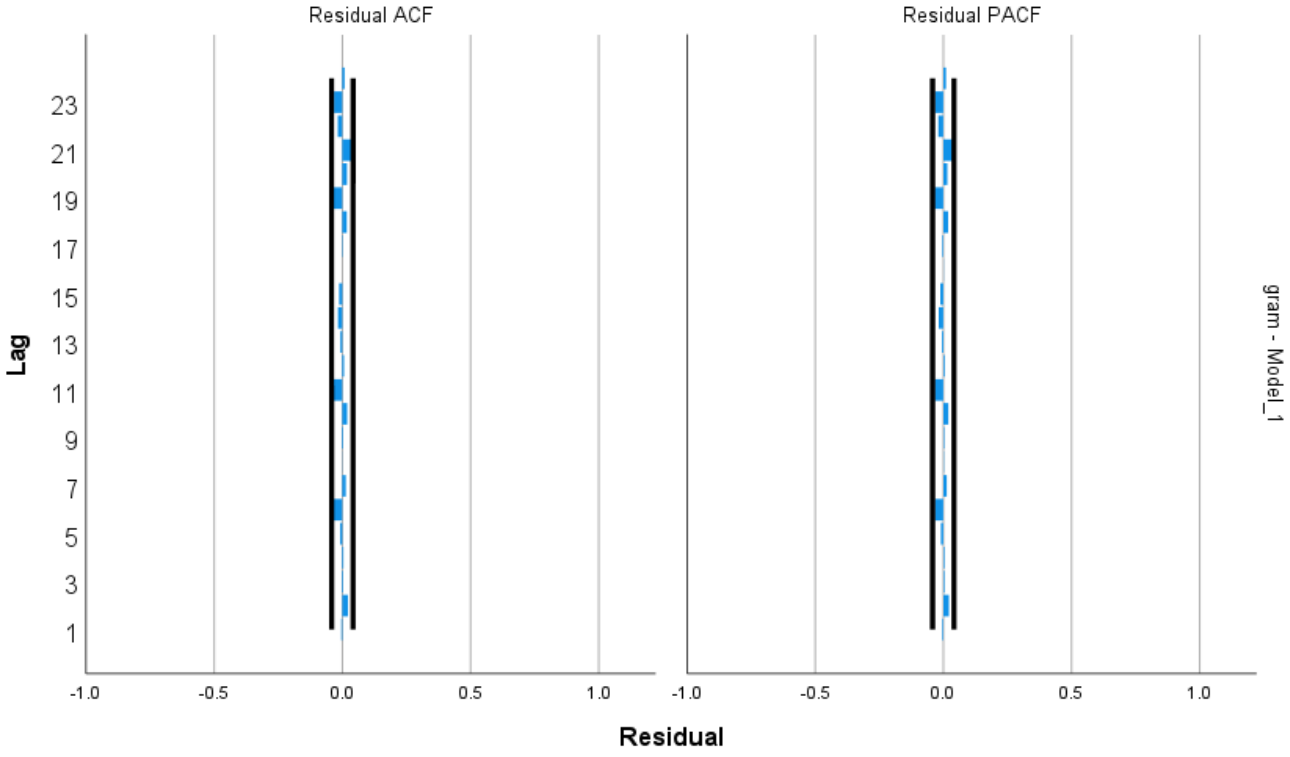
```
GENLIN gram WITH event
  /MODEL event INTERCEPT=YES
 DISTRIBUTION=NORMAL LINK=IDENTITY
  /CRITERIA SCALE=MLE COVB=MODEL PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012 ANALYSISTYPE=3(WALD)
    CILEVEL=95 CITYPE=WALD LIKELIHOOD=FULL
  /MISSING CLASSMISSING=EXCLUDE
  /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION.
```

Interrupted time series analyses

We used a time series modeler function to estimate best fitting non-seasonal and seasonal ARIMA models that: a) specify degrees of differencing and/or a square root or natural log transformation to ensure a stationary series; and, b) specify autoregressive and moving average orders. This eliminated the need to identify an appropriate ARIMA model through trial and error: (ftp://public.dhe.ibm.com/software/analytics/spss/documentation/statistics/26.0/en/client/Manuals/IBM_SPSS_Forecasting.pdf.),with the ARIMA terms (1,0,1) (0,0,0) and residual ACF and PACF plots in Supplement Figure 2. The Ljung-Box Q(18) statistic was non-significant (p = 0.90).

Supplement Figure 2

Residual ACF and PACF of time series for grams of all purchased alcohol per adult per household per day of purchase



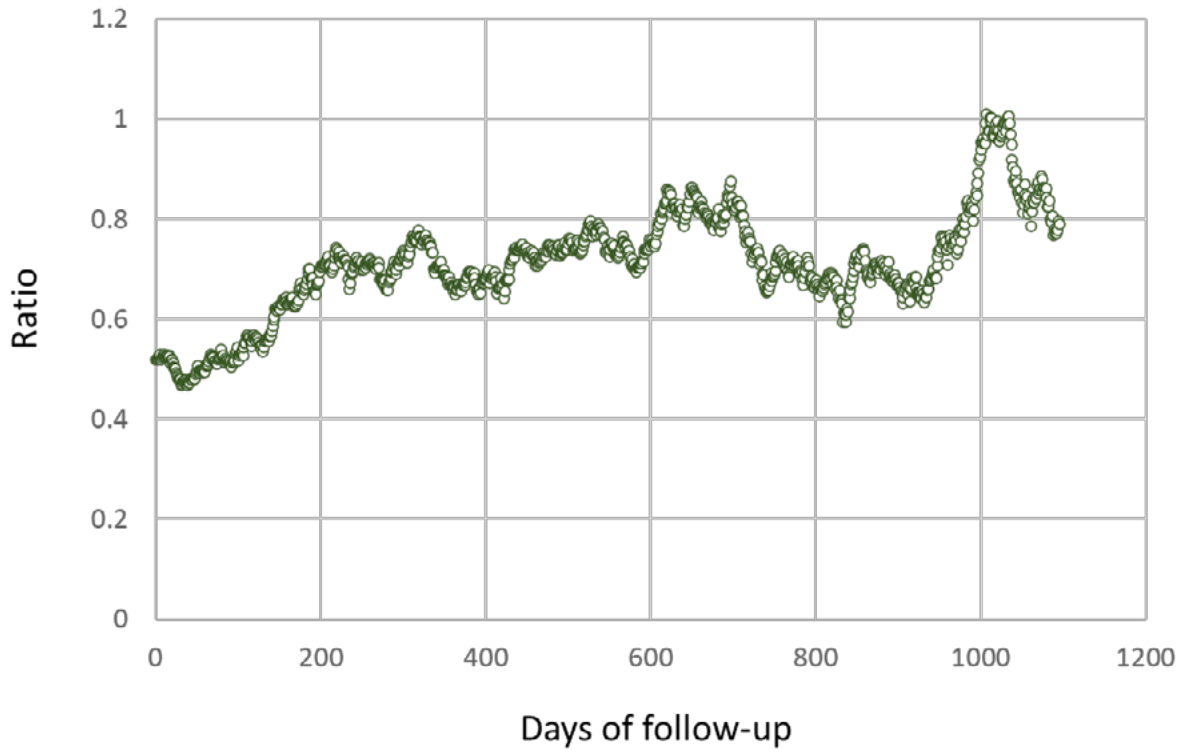
The SPSS syntax was:

```
TSMODEL
  /MODELSUMMARY  PRINT=[MODELFIT]
  /MODELSTATISTICS  DISPLAY=YES MODELFIT=[ SRSQUARE]
  /MODELDETAILS  PRINT=[ PARAMETERS]  PLOT=[ RESIDACF RESIDPACF]
  /SERIESPLOT OBSERVED FIT
  /OUTPUTFILTER DISPLAY=ALLMODELS
  /AUXILIARY  CILEVEL=95 MAXACFLAGS=24
  /MISSING USERMISSING=EXCLUDE
  /MODEL DEPENDENT=gram INDEPENDENT=event [E]
    PREFIX='Model'
  /EXPERTMODELER TYPE=[ARIMA EXSMOOTH]
  /AUTOOUTLIER  DETECT=OFF.
```

Supplement Table 2
Proportion of households making at least one new purchase of zero-alcohol beer (ABV = 0.0%) defined by day of first purchase of branded zero-alcohol beer more than 12 months after day of first purchase of same branded higher strength beer (ABV > 3.5%); odds ratios of newly buying zero-alcohol beer compared with other households that were not new purchasers of same branded zero-alcohol beer

	Proportion (95% confidence interval)	Odds ratio (95% confidence interval)
Groups of weekly purchases of alcohol (grams) prior to 1st purchase of zero-alcohol beer		
≤7	0.143 (0.124 to 0.164)	0.40 (0.33 to 0.49)
>7-≤21	0.239 (0.218 to 0.262)	0.76 (0.65 to 0.89)
>21-≤56	0.295 (0.270 to 0.321)	1.01 (0.87 to 1.18)
>56	0.292 (0.263 to 0.324)	1.00 (. to .)
Age of main household shopper		
18-34	0.201 (0.172 to 0.234)	0.85 (0.67 to 10.09)
35-49	0.253 (0.233 to 0.275)	1.16 (0.96 to 1.39)
50-64	0.265 (0.244 to 0.288)	1.23 (1.02 to 1.48)
65+ (reference category)	0.227 (0.198 to 0.259)	1.00 (. to .)
Social grade of household		
Medium-High and High	0.246 (0.221 to 0.274)	1.05 (.88 to 1.26)
Medium-Medium	0.237 (0.216 to 0.259)	1.00 (.84 to 1.18)
Medium-Low	0.224 (0.201 to 0.248)	0.93 (0.77 to 10.11)
Low (reference category)	0.237 (0.210 to 0.266)	1.00 (. to .)
Autonomous Community in which household located		
Community of Madrid	0.225 (0.201 to 0.251)	1.15 (0.80 to 1.65)
Basque Country	0.252 (0.206 to 0.303)	1.33 (0.88 to 2.03)
Navarre	0.217 (0.136 to 0.327)	1.10 (0.57 to 2.11)
Catalonia	0.200 (0.177 to 0.224)	0.99 (0.69 to 1.42)
Aragon	0.258 (0.199 to 0.329)	1.38 (0.86 to 2.22)
Balearic Islands	0.291 (0.216 to 0.379)	1.63 (0.97 to 2.73)
La Rioja	0.317 (0.203 to 0.458)	1.84 (0.92 to 3.65)
Castile and León	0.276 (0.237 to 0.318)	1.51 (1.03 to 2.23)
Cantabria	0.257 (0.174 to 0.363)	1.37 (0.75 to 2.49)
Galicia	0.212 (0.173 to 0.258)	1.07 (0.70 to 1.62)
Asturias	0.181 (0.133 to 0.242)	0.88 (0.53 to 1.44)
Valencian Community	0.237 (0.206 to 0.271)	1.23 (0.85 to 1.79)
Murcia	0.234 (0.180 to 0.298)	1.21 (0.76 to 1.93)
Canary Islands	0.213 (0.153 to 0.288)	1.07 (0.64 to 1.80)
Castilla–La Mancha	0.237 (0.192 to 0.289)	1.23 (0.81 to 1.88)
Andalusia	0.227 (0.204 to 0.252)	1.17 (0.82 to 1.67)
Extremadura (reference category)	0.201 (0.152 to 0.261)	1.00 (. to .)

Supplement Figure 3
Substitution ratio (the drop in volume of higher strength beer/the increase in volume of zero-alcohol beer) by days of follow-up since first new purchase of zero-alcohol beer. Data for 1719 newly purchasing households, hypothesis 1



Supplement Table 3
Sensitivity analysis, with different time intervals between first purchase of same-branded higher-strength beer and same-branded zero-alcohol beer. Coefficients (95% confidence intervals) for the changes in the dependent variables associated with the event for the interrupted time series analysis

	Interrupted time series analyses		
	Time interval		
	6 months	12 months	18 months
Branded zero-alcohol beer (ml)	140.43 (122.28 to 158.58)	147.66 (131.34 to 163.99)	147.60 (125.12 to 170.08)
Branded low-alcohol beer (ABV>0.0 and ≤3.5%) (ml)	Non-significant	-8.81 (-14.98 to -2.63)	Non-significant
Branded higher-strength beer (ABV>3.5%) (ml)	-23.66 (-38.72 to -8.60)	-73.31 (-90.39 to -56.22)	-113.26 (-134.58 to -91.93)
Grams of alcohol in all branded beers	-1.35 (-1.97 to -.73)	-3.48 (-4.57 to -2.39)	-4.68 (-5.50 to -3.87)
Grams of alcohol in all products	-4.54 (-8.27 to -.81)	-5.45 (-7.01 to -3.88)	-5.14 (-6.82 to -3.45)
Other non-branded beer (ABV>3.5%) (ml)	-15.75 (-27.97 to -3.53)	-24.67 (-37.97 to -11.38)	-23.53 (-39.48 to -7.59)
Wine (ABV>9.5%) (ml)	-1.36 (-2.45 to -.27)	-1.14 (-2.12 to -.15)	Non-significant
Spirits (ABV>35%) (ml)	Non-significant	Non-significant	Non-significant

Supplement Table 4

Coefficients (95% confidence intervals) for the changes in the dependent variables associated with the event for both the before- and after- analyses and the interrupted time series analysis, by gram group (groups of weekly purchases of alcohol (grams) prior to 1st purchase of zero-alcohol beer)

	Dependent variables											
	Zero-alcohol beer			Higher strength beer			Branded grams of alcohol			Grams of all alcohol		
	Before and after analyses		ITS	Before and after analyses		ITS	Before and after analyses		ITS	Before and after analyses		ITS
Gram Group	Intercept	Event		Intercept	Event		Intercept	Event		Intercept	Event	
≤12	0.0	103.06 (95.46 to 110.66)	140.06 (111.73 to 168.40)	267.55 (253.16 to 281.94)	-62.47 (-82.89 to -42.05)	-62.53 (-85.36 to -39.70)	13.55 (12.97 to 14.14)	-3.84 (-4.66 to -3.01)	-3.84 (-4.72 to -2.95)	44.01 (42.67 to 45.35)	1.81 (-.09 to 3.72)	Ns
>12-≤25	0.0	74.98 (68.58 to 81.39)	124.18 (100.10 to 148.26)	437.33 (420.63 to 454.03)	-79.64 (-103.31 to -55.98)	-79.64 (-103.29 to -55.99)	19.52 (18.82 to 20.21)	-3.70 (-4.68 to -2.72)	-3.70 (-4.68 to -2.72)	65.26 (63.94 to 66.59)	-3.68 (-5.57 to -1.80)	Ns
>25-≤49	0.0	82.98 (77.14 to 88.83)	83.25 (78.42 to 88.08)	536.63 (519.39 to 553.88)	-45.50 (-69.89 to -21.10)	-45.50 (-69.88 to -21.11)	24.58 (23.90 to 25.26)	-3.87 (-4.83 to -2.91)	-3.87 (-4.83 to -2.91)	83.25 (81.99 to 84.50)	-5.64 (-7.42 to -3.87)	-5.64 (-7.42 to -3.87)
>49	0.0	100.84 (94.81 to 106.87)	141.12 (117.23 to 165.01)	884.74 (863.56 to 905.91)	-122.64 (-152.59 to -92.70)	-122.57 (-152.46 to -92.68)	37.12 (36.35 to 37.89)	-8.32 (-9.41 to -7.23)	-8.32 (-9.56 to -7.09)	136.46 (134.83 to 138.09)	-9.35 (-11.65 to -7.04)	-9.35 (-11.65 to -7.05)

Supplement Table 5

Coefficients (95% confidence intervals) for the primary outcome variable (grams of alcohol) associated with the event for before- and after- interaction analyses between the event and the group of levels of alcohol consumption, grams per week: >49; >25-≤49; >12-≤25; ≤12 (reference category)

Intercept	44.01 (42.61 to 45.40)
>49	92.45 (90.48 to 94.43)
>25-≤49	39.24 (37.27 to 41.21)
>12-≤25	21.26 (19.28 to 23.23)
≤12 (reference category)	.00 (. to .)
Event	1.81 (-.17 to 3.80)
>49*event	-11.16 (-13.96 to -8.37)
>25-≤49*event	-7.46 (-10.25 to -4.66)
>12-≤25*event	-5.50 (-8.29 to -2.70)
≤12*event (reference category)	.00 (. to .)

Supplement Figure 4
Mean ratio of the volume of purchases of zero-alcohol beer/higher strength beer by days of follow-up since first new purchase of zero-alcohol beer. Data for 337 households that had never previously purchased a same-branded higher strength beer (-ve/+ve households), hypothesis 2