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Carbonating the household diet: A Pakistani tale

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Abstract

Objective: Carbonated beverage consumption is associated with various adverse health conditions such as obesity, type 2 diabetes and cardiovascular diseases. Pakistan has a high burden of these health conditions. At the same time, the carbonated beverage industry is rapidly growing in Pakistan. In this context, we analyze the trends and socioeconomic factors associated with carbonated beverage consumption in Pakistan.

Design: We use six waves of the cross-sectional household surveys from 2005–06 to 2015–16 to analyze carbonated beverage consumption. We examine the trends in carbonated beverage consumption prevalence for different economic groups categorized by per capita household consumption quintiles. We estimate the expenditure elasticity of carbonated beverages for these groups using a two-stage budgeting system framework. We also construct concentration curves of carbonated beverage expenditure share to analyze the burden of expenditure across households of different economic status.

Setting: Nationally representative sample of households in Pakistan.

Results: We find that the wealthier the household, the higher is the prevalence of carbonated beverage consumption; and the prevalence has increased for all household groups over time. From the expenditure elasticity analysis, we observe that carbonated beverages are becoming essential part of food consumption particularly for the wealthier households. And, lastly poorer households are bearing larger share of carbonated beverage expenditure in 2015–16 than that in 2006–2008.

Conclusion: Carbonated beverages are becoming an increasingly essential part of household food consumption in Pakistan. Concerns about added sugar intake can prompt consideration of public health approaches to reduce dietary causes of the disease burden in Pakistan.

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BKD formulates the research questions, carries out empirical analysis, and contribute in writing. MJH contributes in study design, data analysis and writing.

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None

Ethical Standards Disclosure:
Not required as the study uses publicly available secondary data.

Keywords

Carbonated beverages; Soft drinks; Pakistan; Expenditure elasticity

Introduction

Frequent intake of sugar sweetened beverages (SSBs) is a major risk factor associated with obesity, type 2 diabetes, and cardiovascular diseases, kidney diseases, non-alcoholic liver disease, gout (a type of arthritis), tooth decay and cavities[1,2,3,4,5,6,7]. Obesity is a growing public health concern in Pakistan. With nearly one in every four adult (age 20+) males and one in every three adult (age 20+) females being overweight or obese, the country ranked ninth in the world in number of individuals with obesity[8]. A large number of Pakistanis also suffer from diabetes mellitus, an epidemic that is emerging rapidly in recent years. A recent study reports 11% prediabetes and 17% type 2 diabetes prevalence in age 20+ years population in Pakistan[9]. The burden of cardiovascular diseases (CVD) in Pakistan is also high. CVD is the number one cause of death in Pakistan and accounts for 29% of the total deaths in 2016[10]. SSBs, being closely associated with these health conditions, have important policy relevance for population health in Pakistan.

SSBs refer to any beverage with added sugar or other sweeteners, including soda, pop, cola, tonic, fruit punch, lemonade (and other “ades”), sweetened powdered drinks, as well as sports and energy drinks. Carbonated beverages, commonly known as soda or soft drinks, are the most consumed type of SSBs in Pakistan. Data from the Pakistan household income expenditure surveys[11,12,13,14,15,16], used in this study, show that carbonated beverages constitute nearly 60% to 70% of the household level consumption of nonalcoholic beverages (see appendix Table A1 for details). Carbonated beverage industry is also an important and thriving manufacturing sector, which is a major source of revenue for the government of Pakistan in the form of federal excise duty and domestic sales tax[17]. Despite being a sizable economic sector on one side and an important public health issue on the other side, there is lack of analyses on the trend and other socioeconomic aspects of carbonated beverage consumption in Pakistan. In this paper, we analyze the household level consumption of carbonated beverages over a decade (i.e. 2006 to 2016) to better understand the socioeconomic factors associated with carbonated beverage consumption, which could inform policy makers to promote health awareness and to adopt other preventive measures.

Several studies show the increasing global trends and regional heterogeneity in SSBs consumption in recent years[18,19]. Several other studies provide country specific elasticity estimates of SSBs[20,21,22,23]. Demand for cola carbonates is rapidly growing in Pakistan, escalating battle for market share amongst the major global cola producers[24]; yet no in-depth analysis of household level carbonated beverage consumption is available for Pakistan. Production of carbonated beverages in Pakistan has been increasing gradually over time, accompanied by a declining trend in real price (Figure 1). Together it contributed in greater affordability of carbonated beverages in Pakistan. Though the real price shows some upward trend in recent years (2015–2016), it is still way below the price in 2006. Study shows that SSBs became more affordable in Pakistan from 1990 to 2016 as the real price of SSBs

decreased by USD 3.84 (constant 2010 dollars) during that period[25]. In this context, studying the socioeconomic aspects of carbonated beverages consumption in Pakistan is crucial for public health interventions to prevent and control obesity, type 2 diabetes, cardiovascular diseases, and other adverse health conditions.

Using data from the household income expenditure surveys, this study is aimed to: first, analyze the trend in carbonated beverage consumption across households of different economic status over a decade (from 2006 to 2016); second, estimate the expenditure elasticity of carbonated beverages for different income groups; third, analyze the evolution of expenditure elasticities over time; and fourth, analyze the carbonated beverage expenditure share burden across income groups over time.

Methods

Data

We use data from the 2005–06, 2007–08, 2010–11, 2011–12, 2013–14, and 2015–16 waves of the Pakistan Household Integrated Economic Survey (HIES) [11,12,13,14,15,16]. HIES is a stratified two-stage nationally representative survey that covers large number of rural and urban households from 27 administrative divisions of Pakistan in four provinces[26]. HIES provides detailed information on household food and non-food consumption, including fortnightly (two week) consumption (quantity and expenditure) of carbonated beverages. According to the Pakistan Standard, carbonated beverages are defined as nonalcoholic beverages that contains dissolved carbon dioxide with optional addition of mineral salts, sugar and/or other sweetener, flavors, colors, and other food additives[27]. We derived households' monthly carbonated beverage consumption using the fortnightly expenditure data reported in HIES.

Consumption Trend

We examine the trends in household level prevalence of carbonated beverage consumption from 2006 to 2016. To smooth out short term fluctuations, we pooled two consecutive HIES cohorts of 2005–06 and 2007–08, 2010–11 and 2011–12, and 2013–14 and 2015–16 into three time periods – 2006 to 2008, 2011 to 2012, 2014 to 2016, and compare prevalence across the time periods. We analyze the consumption trend by household's economic status. We categorize households by monthly household expenditure per capita quintiles and compare prevalence across quintiles. We then compare mean expenditure share of carbonated beverages as percentage of monthly food expenditure across quintiles and time periods. We also examine the trends in mean consumption quantity per capita and the mean expenditure per liter.

Expenditure Elasticity Estimation

We use a two-stage budgeting system methodology[28] for estimating expenditure elasticity of carbonated beverages in Pakistan. In the first stage, we categorized household consumptions in several broad groups (e.g. food, clothing, housing, etc.) and estimate expenditure elasticity of the broad food category. In the second stage, we estimate expenditure elasticity of carbonated beverages within the broad food category. The idea

behind the two-stage budgeting is that households first decide how much to spend on each broad category, and then allocate spending for within category consumption in the second stage. A similar method was applied by Menezes et al. (2008) for estimating elasticities for food products in Brazil[29].

Household expenditures in HIES are categorized in eleven broad categories, which are – food, tobacco, clothing, housing, education, fuel and utilities, personal care, transportation, recreation, medical spending, and miscellaneous. Food items are categorized in 16 sub-categories, which are – dairy, meat and fish, fresh fruits, dried fruits and nuts, vegetables, condiments and spices, sugar, readymade food, baked and fried products, cereals, legumes, edible oil and fats, tea and coffee, carbonated beverages, other nonalcoholic beverages, and miscellaneous food items. Hence, we estimate a system of eleven equations in the first stage, and another system of 16 equations in the second stage. The miscellaneous category in both first and second stage is omitted to satisfy the summation restriction (i.e. category expenditure shares add up to 1). Like the consumption trend analysis, we estimate the equations for three time periods by pooling two rounds of HIES in each period.

We estimate a Quadratic Almost Ideal Demand System (QAIDS) proposed by Banks et al. (1997) using the seemingly unrelated regression (SUR) model[30]. The empirical analysis is conducted using the Stata 13.1 software. We assume that commodities are weakly separable in household's utility function and estimate the following equation in the first stage:

$$w_{ij} = \alpha_0 + \alpha_1 \ln Y_i + \alpha_2 (\ln Y_i)^2 + \boldsymbol{X_i \alpha_3} + \sum_d \sum_t \gamma_{dt} Division_d * Year_t + \varepsilon_{ij} \quad (1)$$

Where, w_{ij} is the expenditure share of j^{th} category of household i, $ln\ Y_i$ is the log of total monthly expenditure (constant 2008 Rs.) of non-durable commodities, $\boldsymbol{X_i}$ is a vector of household specific socio-demographic characteristics, $Division_d * Year_t$ is the division-year fixed effect, and ε_{ij} is the idiosyncratic error term. Since we do not observe prices faced by the households, following the lead of Deaton (1988), we utilize spatial variation in commodity prices across administrative divisions over time[31]. We assume that all households located in division d in year t face similar prices for commodity j. Therefore, along with other division level unobserved factors (e.g. food habits, social norms, etc.) division-year fixed effects accounts for prices in the regression. A squared term of log expenditure, $(ln\ Y_i)^2$ is added in the model to allow for commodities be necessity or luxury depending on household i's expenditure level. The vector $\boldsymbol{X_i}$ includes controls for household's urban or rural residence, dwelling type, occupancy status, source of drinking water, whether the household has gas connection, type of toilet used, type of sewerage system, whether the household receives remittance from abroad, whether the household receives government cash transfer, whether the household produces food crops, whether the household owns poultry, whether the household owns livestock, whether the household takes loan to finance consumption expenditure during the survey period, share of children aged under five, share of elderly (age 65+), whether the household has school going age (6 to 14) children, whether the household has reproductive age female (15 to 49), share of adult male (age 18+), household size, and household head's education. These covariates are included in the model to account for household specific behaviors that may impact certain commodity

consumption; and to obtain more precise estimates of α_1 and α_2. The coefficient estimates of α_1 and α_2 jointly determine, along with the level of expenditure Y, the marginal effect of log of total household expenditure on household's expenditure share of a certain broad category. In the context of our study, the coefficients alone are not meaningfully interpretable, rather they are later used to estimate the expenditure elasticities.

Expenditure elasticity describes how responsive the households are in adjusting consumption of a certain commodity, following any changes in household income or expenditure. The higher the expenditure elasticity, the larger is the responsiveness of quantity demanded to any change in expenditure or income. Higher (greater than one) expenditure elasticity means the commodity is a luxury item in household's consumption basket. An increase in expenditure in such case is associated with more than proportionate increase in quantity demanded. Conversely, decrease in expenditure elasticity, therefore, refers to relatively less responsiveness of quantity demanded, meaning consumers do not change their consumption by much following any changes in expenditure. A less than one expenditure elasticity means the commodity is a necessity in household's consumption basket.

Using the estimates of α_1 and α_2 of respective period, we estimate expenditure elasticities for each quintile for each of the three periods. The expenditure elasticity of the j^{th} commodity for the q^{th} quintile, η_{jq}, is calculated using Equation 2:

$$\eta_{jq} = 1 + \frac{1}{\overline{w_{jq}}}[\alpha_1 + 2\alpha_2 \overline{\ln Y_q}] \quad (2)$$

Where, $\overline{w_{jq}}$ is the j^{th} commodity's mean expenditure share at the q^{th} quintile and $\overline{\ln Y_q}$] is the mean log monthly expenditure at the q^{th} quintile. We assume that households do not move across quintiles during the two survey-cohort period. We also calculate η_j for all households where w_j and $ln\ Y$ are averaged over the full sample for respective periods.

A similar specification like Equation 1 is estimated in the second stage, where w_{ij} is replaced with f_{ik}, the food expenditure share of the k^{th} food category; and Y_i is replaced with F_i, the monthly food expenditure. Expenditure elasticity of the k^{th} food category of q^{th} quintile, $\eta_{(j)kq}$ is then estimated using Equation 2, respectively replacing w with f and Y with F. Following Carpentier and Guyomard (2001), total expenditure elasticity of the k^{th} food category, E_k is then calculated using the following formula[32]:

$$E_{kq} = \eta_{jq} * \eta_{(j)kq} \quad (3)$$

In the Results section, we report the expenditure elasticity of food, η_{Food}, from the first stage estimation; within food category expenditure elasticity of carbonated beverages, $\eta_{(Food)CB}$, from second stage estimation; and the total expenditure elasticity of carbonated beverage, E_{CB}, calculated using the estimates from the first and second stage elasticities. We compare the total expenditure elasticities across three time periods and across quintiles.

Expenditure Share Burden

Finally, we examine how the expenditure share of carbonated beverage consumption is spread across households of different economic status (e.g. poor vs. rich) over the periods. We organize households by per capita consumption percentile in each period and calculate the share of carbonated beverage spending for each percentile. We then generate concentration curves by plotting the cumulative expenditure share against household consumption per capita percentile for each period. A point (p,s) on the concentration curve of a period, where p and s respectively refer to the coordinates of horizontal and vertical axes, can be interpreted as s% of the carbonated beverage expenditure share in that period being borne by the bottom p% of all households. We compare the concentration curves of 2006–2008, 2011–2012, and 2014–2016 to examine how the burden of carbonated beverage expenditure changed over time.

Results

HIES provides household level consumption information of 15453, 15512, 16341, 15807, 17991, and 24238 households in respective survey waves. The household level prevalence of carbonated beverage consumption is reported in Table 1. For each period, it is evident that higher the quintile (i.e., wealthier the household), the higher is the consumption prevalence. The difference in prevalence between the top (5^{th}) and the bottom (1^{st}) quintile is more than 40 percentage points. The prevalence gradually increased over time for every household group. During 2006–2008, around 26% of the households in Pakistan consumed carbonated beverages, which increases by more than ten percentage points in 2014–2016. The increase in prevalence is the highest for the 4^{th} quintile (13.4 percentage point) and lowest for the 1^{st} quintile (7.8 percentage point).

The average carbonated beverage expenditure share also demonstrates the similar pattern that higher the quintile the higher is the expenditure share (Table 1). However, unlike the prevalence, the average expenditure share decreases from 2006–2008 to 2014–2016. In Table 2, we further explore this issue by examining trends in consumption per capita and average unit expenditure. We find that average per capita monthly carbonated beverage consumption increases from 0.85 liter in 2006–2008 to 1.03 liter in 2014–2016; whereas average expenditure per liter decreases from Rs. 39 to Rs. 31.5 during the same period. Together this suggests that the decrease in average expenditure share over time is due to decrease in average unit expenditure and not because of decrease in quantity consumed.

The expenditure elasticity results are presented in Table 3. The higher the absolute values of the elasticity, the greater is the responsiveness of households to an increase or decrease in household expenditure. It shows that 1% increase in household expenditure is associated with respectively 1.66% and 1.36% increase in expenditure for carbonated beverages in Pakistan in 2006–2008 and 2014–2016. Decline in elasticity values refer that carbonated beverages have become relatively integral part of household consumption over the years. We find that the expenditure elasticities of carbonated beverages are positive for all quintiles, and the higher the quintile, the lower is the expenditure elasticity at every period. This means an increase in household expenditure (income) at the bottom quintile would result in relatively larger increase in quantity demanded of carbonated beverages, compared to that at

the upper quintiles. This suggests that carbonated beverage consumption in Pakistan is strongly associated with households' economic status and becomes relatively necessary part of households' diet as expenditure (income) increases.

The expenditure elasticity of the broad food category does not change much over time (for all quintiles). The within food category expenditure elasticities of carbonated beverages, on the other hand, show changes over time for all household quintiles. The within food category elasticity changes are, therefore, the main driver of changes in estimated total elasticities. The total expenditure elasticity of carbonated beverages decreases by 0.30 percentage points from 2006–2008 to 2014–2016. The decrease occurs for all quintiles, and is the highest for the 1st quintile (0.71 percentage points) and lowest for the 5th quintile (0.11 percentage points). The expenditure elasticity for the 5th quintile becomes less than 1 in 2014–2016, suggesting that carbonated beverage becomes a necessary commodity for the wealthier households in Pakistan. We also estimated the elasticities without controlling for household characteristics variables, and the unadjusted estimates were found very similar to the adjusted estimates presented in Table 3 (see appendix Table A2 for unadjusted elasticity estimates).

Finally, the analysis of expenditure burden share is presented in Figure 2. The distant the concentration curve from the equality line, the lesser is the bottom x% of the households' share in carbonated beverage consumption. We find that the concentration curve has gradually shifted upward over time i.e. got closer to the equality line, meaning the bottom *x* % of the households are bearing greater share of carbonated beverage expenditure in 2014–2016 than that in 2006–2008. The bottom 30% households bore 9.2% of the expenditure share in 2006–2008, which increases to 11.6% in 2011–2012, and further increases to 13.2% in 2014–2016. For the bottom 50% households, it increases from 21.4% to 25.3% to 27.7% during the same periods. Hence, not only more poorer households are consuming carbonated beverages in Pakistan in recent years, the expenditure share burden of carbonated beverage spending of the poorer households has increased as well. This shift in burden over time may have detrimental consequences for poorer households, who otherwise could have spent the money on other food items.

Discussion

Our analyses provide evidence on two important aspects of household level prevalence of carbonated beverage consumption in Pakistan. First, we find the prevalence has strong association with households' economic status. The wealthier the household, the higher is the prevalence of carbonated beverage consumption. And second, the prevalence has increased for all household groups (e.g. poor, middle class, rich) over time. Our analyses also inform two vital socioeconomic observations related to carbonated beverage consumption. First, carbonated beverages have gradually become integral part of Pakistani diet, and particularly for the rich households it became an essential consumption good. And second, poorer households are bearing larger share of carbonated beverage expenditure in 2015–16 than that a decade ago. These results have important socioeconomic and public health considerations.

Over the years, expenditure elasticities of carbonated beverages in Pakistan have been gradually declining for all income groups. For example, at the bottom quintile, 1% increase in expenditure in 2006–2008 was associated with 3.24% increase in quantity demanded, which decreases to 2.53% in 2014–2016 – a relatively lower degree of response, meaning consumers change consumption by a lower amount than that in 2006–2008 due to the same change in real expenditure (income). This suggests, carbonated beverages have become relatively essential consumption in Pakistan over time. This is a serious public health concern since sugar-sweetened carbonated beverage consumption is associated with various adverse health conditions.

Though there are several studies that estimate the price elasticities of SSBs[21,22,23], very few provide estimates of expenditure elasticities. One study on soft-drinks consumption in Guatemala, reports expenditure elasticity estimate of 0.99[20]. This estimate is lower than our overall expenditure elasticity estimate of 1.36 in 2014–2016, but very close to that (0.95) for the wealthiest households during the same period. Future research in this area, using data from various other countries, will facilitate cross country comparison of the expenditure elasticities, and will enhance our understanding of this issue in the global context.

The finding that poorer households are bearing larger shares of carbonated beverages in 2014–2016 than that in 2006–2008 raises equity concerns. Since the expenditure elasticities of food remain unchanged over time, poorer households are likely to substitute other food consumptions with carbonated beverages. If they substitute carbonated beverage with some nutritious food item like milk, then that could adversely affect health outcomes, particularly for the children. HIES data show that expenditure on dairy products as percentage of total food expenditure for the bottom quintile decreases from 17% in 2006–2008 to 14% in 2014–2016, indicating a possibility of substitution. The increase in consumption prevalence for the poorer households may also increase the risk of associated adverse health conditions. Studies show that medication expenditures of major noncommunicable diseases (e.g. blood pressure, diabetes) are strongly associated with incurring catastrophic health expenditures in Pakistan[33]. Carbonated beverage attributable health conditions thus could further aggravate the poor households' quality of life.

Lichtenstein (2019) argues that enough evidence on the adverse effect of SSBs have already been documented, and now it is time to focus on understanding the drivers of SSBs consumption, so that efforts can be made to fix the bigger public health problem without further delay[34]. Our study has great relevance to this view as we assess the socioeconomic factors associated with household level carbonated beverage consumption in Pakistan. Our expenditure elasticity estimations for different periods and for different economic groups portray a reliable depiction of the evolution of carbonated beverage consumption in Pakistan by controlling for a rich set of socioeconomic variables. Thus, our findings provide insights for effective public health policy interventions.

One limitation of our study is the lack of actual price data, which we proxy by assuming that households residing within an administrative division in the survey year face similar product pricing. Though we obtain unit values by dividing expenditure amount by quantity consumed, we do not treat these values as prices because of endogeneity concerns emanated

from measurement errors and ignoring quality variations. Knowing the actual price data could deliver more precise estimates. Second, HIES does not provide information on different types and brands of carbonated beverages consumed by the households. Some of the carbonated beverages consumed by households may be unsweetened and diet or low-calorie beverages which we cannot distinguish in our analysis. Third, we analyze the household level consumption of carbonated beverage, and could not derive the individual level consumption. Behavioral determinants of carbonated beverage consumption could be useful in designing targeted awareness campaigns and prevention programs for certain demographic groups (e.g. teenagers). However, our data do not permit individual level or within household consumption of carbonated beverages. Future research in addressing this gap will be very helpful.

Conclusion

Our analyses generate evidence on the trend and economic group specific pattern of carbonated beverage consumption. These findings could be utilized as background information to initiate efforts for reducing carbonated beverage consumption. Efforts may include promoting behavioral changes through awareness campaigns or influencing consumption through fiscal interventions like taxation. Imposing tax on sugary beverages may lead to reduction in consumption and could also result in healthcare cost savings[35,36]. Though Pakistan has a federal excise duty and general sales tax on carbonated beverages, the existing tax rates may not be adequate to curb carbonated beverage consumption. We observe a declining trend in real prices (measured by average per unit expenditure) of carbonated beverages over time, which may escalate the increase in consumption prevalence. Policy makers in Pakistan may therefore need to reassess the tax structure associated with carbonated beverages to decrease affordability and thereby reduce consumption.

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Appendix

Table A1: Share of carbonated beverages in households' nonalcoholic beverage consumption

Survey*	Households' total monthly expenditure† on nonalcoholic beverages‡ (million Rs.)	Households' total monthly expenditure† on carbonated beverages (million Rs.)	Share of carbonated beverages in households' total expenditure of nonalcoholic beverages (%)
2005–06	464.80	334.00	71.86
2007–08	650.80	459.00	70.53
2010–11	1135.00	843.00	74.27

Survey*	Households' total monthly expenditure† on nonalcoholic beverages‡ (million Rs.)	Households' total monthly expenditure† on carbonated beverages (million Rs.)	Share of carbonated beverages in households' total expenditure of nonalcoholic beverages (%)
2011–12	964.50	759.00	78.69
2013–14	1992.60	1430.00	71.77
2015–16	2739.90	1690.00	61.68

*Pakistan Household Integrated Economic Survey, various waves. Pakistan Bureau of Statistics, Islamabad: Government of Pakistan.

†Total monthly expenditure is the aggregate average monthly expenditure of all households and calculated using wave specific complex survey weights.

‡Nonalcoholic beverages include carbonated beverages, squashes and syrups, fresh and packed fruit juices, and mineral water.

Table A2: Expenditure elasticity estimates without controlling for household characteristics

	Expenditure Elasticity of Food (η_{Food})			Within Food Category Expenditure Elasticity of Carbonated Beverages ($\eta_{(Food)CB}$)			Total Expenditure Elasticity (E_{CB})†		
	2006–2008	2011–2012	2014–2016	2006–2008	2011–2012	2014–2016	2006–2008	2011–2012	2014–2016
Q1	0.90 (0.89, 0.90)*	0.92 (0.92, 0.93)	0.89 (0.88, 0.89)	3.08 (2.94, 3.21)	2.54 (2.44, 2.64)	2.55 (2.46, 2.63)	2.76	2.34	2.26
Q2	0.87 (0.86, 0.87)	0.89 (0.88, 0.89)	0.86 (0.86, 0.87)	2.34 (2.27, 2.42)	1.98 (1.93, 2.04)	1.82 (1.77, 1.86)	2.03	1.76	1.57
Q3	0.84 (0.84, 0.85)	0.87 (0.86, 0.87)	0.85 (0.84, 0.85)	1.92 (1.87, 1.97)	1.74 (1.70, 1.79)	1.56 (1.52, 1.59)	1.62	1.51	1.32
Q4	0.81 (0.81, 0.82)	0.84 (0.83, 0.84)	0.82 (0.82, 0.82)	1.73 (1.69, 1.77)	1.54 (1.51, 1.57)	1.37 (1.35, 1.40)	1.41	1.29	1.12
Q5	0.68 (0.67, 0.69)	0.72 (0.72, 0.73)	0.74 (0.73, 0.75)	1.42 (1.39, 1.44)	1.34 (1.32, 1.37)	1.20 (1.18, 1.22)	0.96	0.97	0.89
All	0.83 (0.83, 0.84)	0.86 (0.85, 0.86)	0.83 (0.83, 0.84)	1.82 (1.78, 1.87)	1.66 (1.62, 1.70)	1.52 (1.48, 1.55)	1.52 2.76	1.42 2.34	1.26 2.26

*95% confidence intervals, calculated using the delta method, are in parenthesis.

†E_{CB} is the product of η_F and $\eta_{(F)CB}$.

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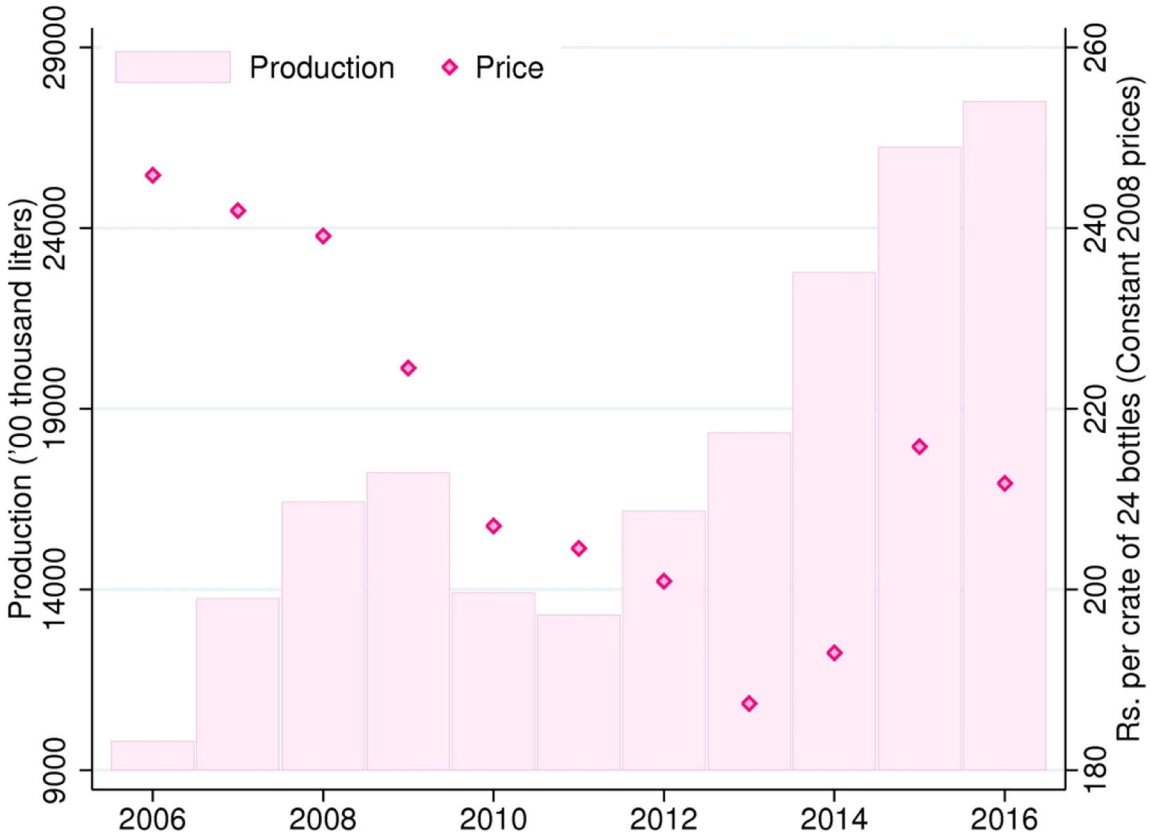

Figure 1.

Price and production of carbonated beverages in Pakistan. Production data are obtained from quantum index of large-scale manufacturing industries reported by the Pakistan Bureau of Statistics, and from the Industrial Commodity Statistics Database of the United Nations Statistics Division. Nominal price data are obtained from the Pakistan Statistical Year Book. Prices are of crate of 24 bottles of Coca Cola and 7 Up. Constant prices are obtained using annual consumer price index (CPI) measures.

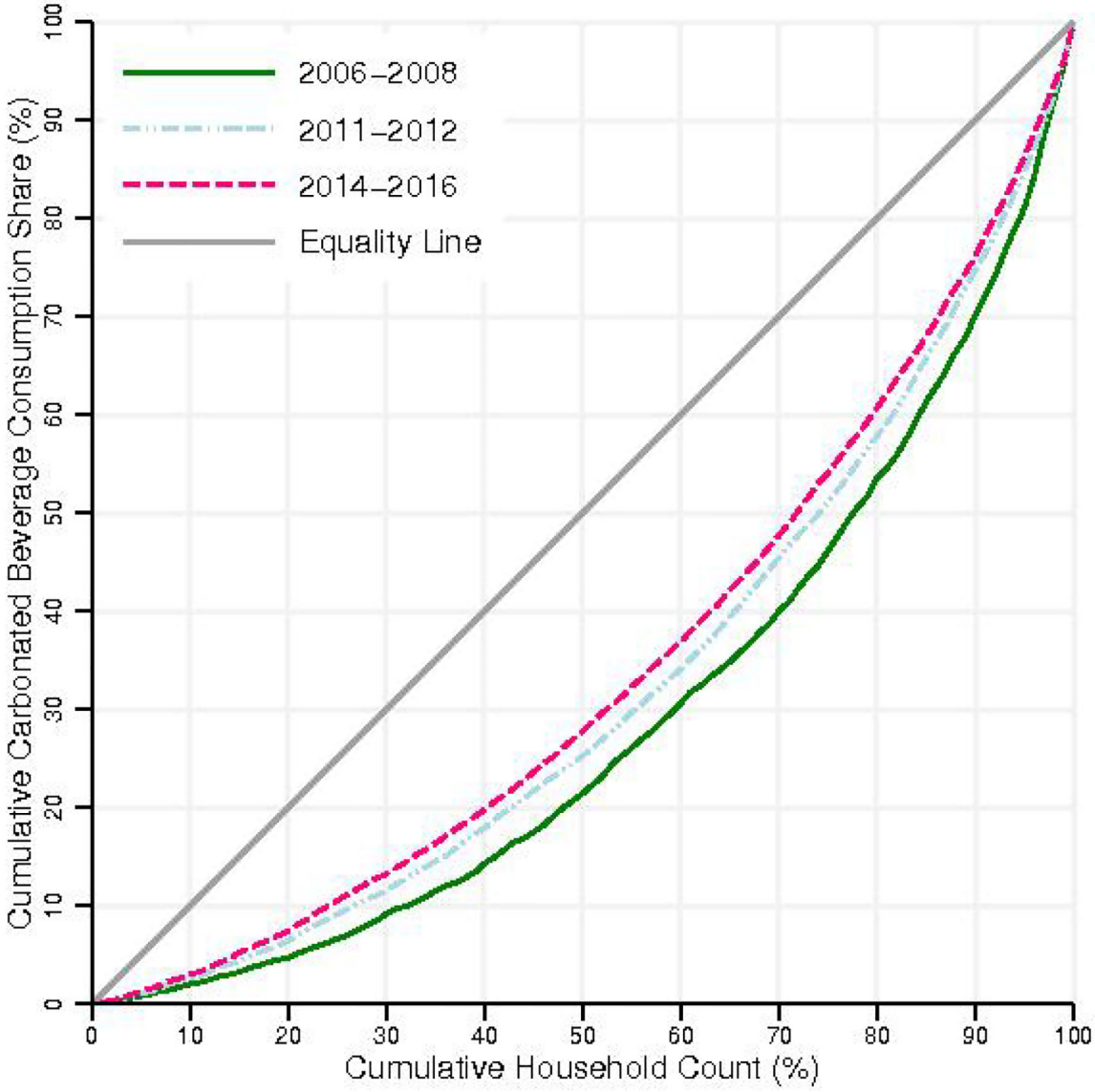

Figure 2.

Concentration curve of expenditure share. Cumulative household count is based on household's economic status in ascending order. x% in the horizontal axis refers to poorest x % households.

Table 1

Household level carbonated beverage consumption prevalence and expenditure share

	Proportion of households consuming carbonated beverages (%)			Average expenditure† as share of food expenditure (%)		
	2006 – 2008	2011–2012	2014–2016	2006 – 2008	2011–2012	2014–2016
Quintile 1	9.24 (8.54, 9.94)*	14.25 (13.39, 15.10)	17.08 (16.23, 17.93)	0.12 (0.11, 0.13)	0.16 (0.15, 0.17)	0.10 (0.10, 0.11)
Quintile 2	16.2 (15.28, 17.11)	21.95 (20.95, 22.94)	26.97 (26.02, 27.93)	0.19 (0.18, 0.20)	0.24 (0.23, 0.25)	0.16 (0.15, 0.17)
Quintile 3	23.51 (22.45, 24.58)	28.99 (27.89, 30.09)	35.33 (34.30, 36.35)	0.28 (0.27, 0.30)	0.31 (0.30, 0.32)	0.21 (0.20, 0.22)
Quintile 4	31.29 (30.08, 32.50)	39.77 (38.54, 41.00)	44.69 (43.64, 45.73)	0.36 (0.35, 0.38)	0.42 (0.40, 0.44)	0.26 (0.25, 0.27)
Quintile 5	51.25 (49.97, 52.52)	59.26 (58.04, 60.48)	59.71 (58.71, 60.70)	0.66 (0.63, 0.68)	0.64 (0.62, 0.66)	0.32 (0.31, 0.33)
All	25.79 (25.29, 26.28)	32.55 (32.04, 33.07)	37.75 (37.29, 38.21)	0.32 (0.31, 0.33)	0.35 (0.34, 0.36)	0.22 (0.21, 0.22)

*95% confidence interval in parenthesis.

†Calculation of average expenditure share includes both user and non-user households.

Table 2

Per capita consumption and average unit expenditure of households consuming carbonated beverages

	Consumption per capita† (liter)			Average unit expenditure per liter‡ (constant 2008 Rs.)		
	2006–2008	2011–2012	2014–2016	2006–2008	2011–2012	2014–2016
Quintile 1	0.35 (0.33, 0.36)*	0.34 (0.33, 0.35)	0.48 (0.46, 0.50)	40.15 (39.47, 40.84)	45.68 (44.19, 47.16)	32.15 (31.54, 32.76)
Quintile 2	0.43 (0.41, 0.44)	0.46 (0.44, 0.47)	0.61 (0.59, 0.62)	39.44 (38.85, 40.03)	43.86 (42.75, 44.96)	31.95 (31.53, 32.37)
Quintile 3	0.54 (0.52, 0.56)	0.58 (0.56, 0.59)	0.76 (0.74, 0.78)	39.19 (38.71, 39.68)	42.49 (41.54, 43.43)	31.53 (31.19, 31.87)
Quintile 4	0.71 (0.62, 0.80)	0.72 (0.70, 0.74)	0.95 (0.93, 0.97)	38.42 (38.02, 38.82)	41.07 (40.28, 41.86)	31.34 (31.04, 31.65)
Quintile 5	1.31 (1.26, 1.37)	1.28 (1.24, 1.31)	1.54 (1.50, 1.57)	38.79 (38.47, 39.11)	38.68 (38.11, 39.26)	31.11 (30.87, 31.35)
All	0.85 (0.82, 0.88)	0.82 (0.81, 0.84)	1.03 (1.02, 1.05)	38.97 (38.77, 39.17)	41.27 (40.89, 41.66)	31.45 (31.30, 31.60)

*95% confidence interval in parenthesis.

†Consumption per capita is calculated by dividing the monthly consumption quantity (in liter) by household size.

‡Average unit expenditure is calculated by dividing monthly consumption expenditure by monthly consumption quantity. Constant Rs. are obtained using general consumer price index (CPI) measures.

Table 3

Expenditure elasticity estimates

	Expenditure Elasticity of Food (η_{Food})			Within Food Category Expenditure Elasticity of Carbonated Beverages ($\eta_{(Food)CB}$)			Total Expenditure Elasticity (E_{CB})†		
	2006–2008	2011–2012	2014–2016	2006–2008	2011–2012	2014–2016	2006–2008	2011–2012	2014–2016
Q1	0.88 (0.87, 0.88)*	0.89 (0.88, 0.90)	0.87 (0.86, 0.87)	3.70 (3.52, 3.87)	2.59 (2.42, 2.76)	2.93 (2.82, 3.03)	3.24	2.31	2.53
Q2	0.86 (0.85, 0.86)	0.87 (0.86, 0.88)	0.85 (0.84, 0.85)	2.67 (2.56, 2.77)	2.01 (1.91, 2.11)	2.02 (1.96, 2.08)	2.28	1.75	1.72
Q3	0.84 (0.83, 0.85)	0.85 (0.85, 0.86)	0.83 (0.83, 0.84)	2.12 (2.05, 2.18)	1.76 (1.69, 1.84)	1.70 (1.66, 1.75)	1.78	1.50	1.42
Q4	0.82 (0.81, 0.82)	0.83 (0.82, 0.84)	0.81 (0.81, 0.82)	1.87 (1.82, 1.92)	1.55 (1.5, 1.61)	1.47 (1.44, 1.51)	1.53	1.29	1.20
Q5	0.72 (0.71, 0.73)	0.75 (0.74, 0.76)	0.76 (0.75, 0.76)	1.47 (1.44, 1.5)	1.35 (1.31, 1.39)	1.26 (1.23, 1.29)	1.06	1.01	0.95
All	0.83 (0.83, 0.84)	0.85 (0.84, 0.85)	0.83 (0.82, 0.83)	2.00 (1.94, 2.06)	1.68 (1.61, 1.74)	1.65 (1.61, 1.7)	1.66	1.42	1.36

*95% confidence intervals, calculated using the delta method, are in parenthesis.

†E_{CB} is the product of ηF and $\eta(F)CB$.