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Assessing the Impacts of the Three Distinct Promotion Campaigns for Fluid Milk

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Abstract

Impacts of the "Got Milk?", "Milk Life," and "#GOTMILKCHALLENGE" campaigns concerning fluid milk consumption were analyzed using a time-varying parameter model over the period July 1995 to December 2022. The long-run promotion elasticity for fluid milk without consideration of individual campaigns was estimated to be 0.043. The individual advertising impacts were quite dynamic, changing within thematic periods, and these impacts were not uniform across themes. Unlike the "Milk Life" campaign, the "Got Milk?" and the "#GOTMILKCHALLENGE" campaigns were consistent with the hypothesis of advertising wearout. This work addressed the effectiveness of the overall generic message and the messages linked to the respective campaigns.

Keywords: demand for fluid milk, econometric analysis, advertising wearout, and advertising/promotion campaigns for fluid milk

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Introduction

Created by the Fluid Milk Promotion Act of 1990, The Milk Processor Education Program (MilkPEP) uses advertisements to promote and inform U.S. consumers of the dietary benefits of fluid milk. Funded by a conglomerate of milk processors, the program strives to maintain the reputation of and to increase the demand for milk. The “Got Milk?” campaign commenced in 1993, two years prior to the “Milk Mustache” campaign. The original Got Milk? campaign was developed and executed by Goodby, Silverstein, and Partners in 1993. In 1995, MilkPEP licensed the “Got Milk?” tagline and incorporated it into its “Milk Mustache” campaign. Hence, beginning in 1995, MilkPEP created the first of three consecutive national fluid milk promotional campaigns (Daddona, 2018). The “Got Milk?”, “Milk Life,” and “#GOTMILKCHALLENGE” campaigns ran from January 1995 to February 2014, from March 2014 to July 2020, and from August 2020 to the present, respectively. These three campaigns differed not only in tagline but also in approach.

The original “Got Milk?” campaign utilized a variety of television commercials that regularly involved subjects requiring milk to complement food choices. Posters with glossy photos of celebrities, from actors to athletes, sporting milk mustaches, and milk facts also were a mainstay of the “Got Milk?” campaign. In 2014, MilkPEP retired the “Got Milk?” campaign and replaced it with the “Milk Life” campaign (Schultz, 2014). Gone were the celebrities, as younger people in action became the focal point of the promotional efforts. Milk mustaches vanished and were replaced by a flow of milk encompassing the subject. Humor took a backseat in television spots as the “Milk Life” campaign conveyed a more sentimental and informative approach. Commercials promoted the nutritional attributes of milk and questioned those of plant-based alternatives. The “Milk Life” campaign did not have the same longevity as its predecessor. It was retired in February/March 2020 after just six years.

After a brief intermission, MilkPEP resurrected the “Got Milk?” campaign in 2020 to capitalize on stay-at-home orders brought about by the pandemic (Durbin, 2020). The current campaign known as the “#GOTMILKCHALLENGE” campaign, supplants milk mustaches with user-generated video clips, exploiting the use of social media. Participants demonstrate various talents while holding a glass of milk. While all three campaigns employ unique approaches, the ubiquitous theme revolves around the importance of drinking milk.

Objectives

The overarching goal of the “Got Milk?”, “Milk Life,” and “#GOTMILKCHALLENGE” campaigns is to increase the demand for fluid milk. The objectives of this study are fourfold: (i) to identify and assess the factors associated with the per capita consumption of fluid milk; (ii) to analyze the impacts of each of the three previously mentioned promotion campaigns concerning per capita consumption of fluid milk; (iii) to determine whether the impacts of the respective promotion campaigns vary over time; and (iv) if so, to determine whether the impacts of the respective campaigns exhibit advertising wearout, defined as declining effectiveness associated with increasing exposure.

Model Development

While these campaigns are of primary interest, other factors are likely to influence milk demand as well. These factors must be accounted for in a quantitative analysis of market demand to accurately isolate (or minimize confounding) the impacts of the three advertising and promotion campaigns. The econometric model concerning the per capita consumption of fluid milk in this analysis considers as explanatory factors: (i) the retail price of fluid milk; (ii) the retail prices of substitute/complementary products, in particular, the prices of other non-alcoholic beverages (bottled water, fruit juices, and plant-based alternatives to milk), (iii) disposable personal income; (iv) inflation; (v) population; (vi) changes in demographics or population dynamics, specifically regarding proportions of the population of children 0 to 5, 6 to 11, and 12 to 17 years of age; (vii) the retail price of cheese; (viii) the retail price of breakfast cereal; (ix) the percent of food expenditures in the away-from-home market; (x) seasonality; (xi) advertising and promotion expenditures for fruit drinks; (xii) generic demand-enhancing expenditures for fluid milk; and (xiii) the pandemic. This specification is consistent with previous work by Kaiser (2010), Davis et al. (2011), Davis et al. (2012), and Capps and Brown (2023). Through this specification, we filter out the effects of other factors and directly quantify the net impacts associated with the "Got Milk?" "Milk Life," and "#GOTMILKCHALLENGE" campaigns pertaining to fluid milk consumption.

Retail prices of fluid milk products capture own-price effects of consumption. Holding all factors invariant, as retail prices of fluid milk change, consumption of fluid milk is expected to change in the opposite direction. As economic theory suggests, prices of competing or complementary products as well as disposable personal incomes of consumers also may affect the consumption of fluid milk.

Historically, children and fluid milk consumption have been positively linked (Stewart, Dong, and Carlson, 2013). To capture the influence of children, we consider proportions of the U.S. population of preschool children (0 to 5 years of age), of elementary school and middle school children (6 to 11 years of age), and of adolescents (children 12 to 17 years of age).

We also must account for away-from-home eating and drinking trends. Roughly half of the share of the consumer dollar for food and beverages currently is spent away from home (USDA-ERS, n.d.). Further, fluid milk consumption is expected to be negatively impacted by the lack of availability of fluid milk products in away-from-home establishments as well as by the expanding availability of alternatives to fluid milk (plant-based alternatives) in the at-home market.

Importantly, generic marketing and promotion activities by fluid milk processors, dairy producers, and qualified programs (QPs) are expected to increase the consumption of fluid milk, holding all other factors constant. The generic fluid milk marketing, advertising, and promotion activities include all media activities, such as television, print, radio, outdoor, and web advertising by fluid milk processors and dairy farmers as well as health and nutrition educational programs, public relations, school milk programs, food service programs, retail programs, trade service communications, and other miscellaneous activities. At issue is whether consumer interest associated with generic advertising for fluid milk can be sustained by adjustments in creative approach or thematic appeal.

Additionally, we explore whether the promotion elasticities associated with the three distinct advertising campaigns or themes are constant or vary over time. We hypothesize that the respective promotion elasticities are not constant but exhibit inverted-U shaped patterns over time. This hypothesis is consistent with previous work by Kinnucan, Chang, and Venkateswaran (1993) in analyzing the impacts of five different fluid milk advertising themes in the New York City market over the period 1971–1984. Various theories labeled as life cycle, learning-based, information processing, and elaboration were related to explain the wear-out phenomenon. We hypothesize that each of three distinct advertising campaigns eventually lose their effectiveness as consumers assimilate the thematic information and find further repetitions superfluous.

In this light, we develop a single equation structural model presented in equation (1) as follows:

$$CDFLUIDMILK_t/POP_t = \alpha + \beta * Z_t + \gamma_t * GW_t + e_t, \quad (1)$$

where $CDFLUIDMILK_t/POP_t$ corresponds to per capita consumption of fluid milk, defined as commercial disappearance divided by population; Z_t denotes a vector of exogenous variables, GW_t is advertising goodwill. Note that the parameters to be estimated are α, β, and γ; e_t is a random error term. Because γ has a subscript t, we allow for this parameter to vary over time.

The respective exogenous variables considered are: (i) the retail price of fluid milk, adjusted for inflation, denoted as $RETAIL\_PRICE\_FLUIDMILK_t/CPI\_NONALCBEV\_SA_t$ (the consumer price index for nonalcoholic beverages, seasonally adjusted; (ii) the consumer price index for cheese, seasonally adjusted, divided by the consumer price index for all items, seasonally adjusted denoted as $CPI\_CHEESE\_SA_t/CPI\_ALLITEMS\_SA_t$; the consumer price index for breakfast cereal, seasonally adjusted, divided by the consumer price index for all items, seasonally adjusted denoted as $CPI\_BREAKFAST\_CEREAL\_SA_t/CPI\_ALLITEMS\_SA_t$; real per capita disposable personable income denoted as $RPCDPI_t$; the percentage of the U.S. population corresponding to children 0 to 5 years of age (preschool) denoted as $PERCENT\_CHILDREN\_0TO5_t$; the percentage of the U.S. population corresponding to children 6 to 11 years of age (preadolescents) denoted as $PERCENT\_CHILDREN\_6TO11_t$; the percentage of the U.S. population corresponding to children 12 to 17 years of age (adolescents) denoted as $PERCENT\_CHILDREN\_12TO17_t$; the percent of sales from away-from-home eating establishments denoted by $FAFH\_PERCENT_t$; and promotion expenditures associated with fruit juices and drinks denoted by $JUICES\_AD\_D11_t/CPI\_ALLITEMS\_SA_t$ We also control for seasonality and the pandemic through the use of dummy variables.

Advertising goodwill, GW_t is defined as

$$GW_t = \sum_{k=0}^{m} \delta_k * \ln AD_{t-k} \quad (2)$$

where AD_{t-k} pertains to advertising and promotion expenditures in period t-k, m is the length of the distributed lag process, and the δ_ks are the lag weights. Upon substitution of equation (2) into equation (1) we arrive at the model specification given as:

$$\ln CDFLUIDMILK_t/POP_t = \alpha + \beta * Z_t + \gamma_t * \sum_{k=0}^{m} \delta_k * \ln AD_{t-k} + e_t, \quad (3)$$

The generic advertising and promotion expenditures for fluid milk correspond to the combined efforts of Dairy Management, Inc. (DMI), MilkPEP, and Qualified Programs (QPs). The set of AD variables in equations (2) and (3) correspond to real generic demand-enhancing promotion expenditures for fluid milk, seasonally adjusted, denoted as $DMI\_MILKPEP\_QP\_A\_D11_t/CPI\_ALLITEMS\_SA_t$. To be consistent with economic theory, advertising must be subject to diminishing marginal returns (Simon and Arndt, 1980). As such, we adopt the logarithmic transformation in equations (2) and (3). The double log model is consistent with the diminishing marginal returns hypothesis. The weights of the goodwill variable δs are assumed to be time invariant. The contemporaneous impact (short-run elasticity) of advertising and promotion on the part of DMI, MilkPEP, and QPs across the campaigns is given by δ_0, while the cumulative impact (long-run elasticity) is given by $\sum_{k=0}^{m} \delta_k$.

Importantly, in vetting the impacts of marketing or generic promotional expenditures, carryover effects likely are evident. Previous studies support the hypothesis that demand-enhancing activities have carryover or lagged effects (e.g., Nerlove and Waugh, 1961; Williams, Capps, and Palma, 2008; Kaiser, 2010; Williams and Capps, 2019; Williams, Capps, and Dang, 2010; and Williams and Capps, 2020). However, economic theory provides relatively little guidance as to the structure and length of these dynamic processes. To capture the dynamics of these carryover effects, we use a polynomial distributed lag process (Almon, 1965) in the model specification. This approach is consistent with the quantitative evaluation of checkoff programs in general (Forker and Ward, 1993; Kaiser et al., 2005; Capps, Bessler, and Williams, 2016; Capps and Brown, 2023).

In equation (3), the lag weights used in the construction of the goodwill variable are estimated jointly with α and β. In this estimation, we rely on the Almon (1965) procedure, with head and tail constraints, and we assume the lag weights to follow a second-degree polynomial. Aside from the distribution of the lag weights, another key issue is the length of the lag structure associated with the respective real and seasonally adjusted promotion expenditures for fluid milk. We follow the conventional procedure of using statistical criteria like the Akaike Information Criterion (AIC), the Schwarz Loss Criterion (SLC), or the Hannan-Quinn Criterion (HQC) in allowing the data to suggest the optimal number of lags (m) to include in the specification. We account for the dynamics of promotion expenditures associated with fruit juices and drinks in precisely the same manner.

The coefficient associated with advertising goodwill is expressed as a time-varying parameter:

$$\gamma_t = f(T), \quad (4)$$

where T corresponds to a time trend and *f* corresponds to the specified functional form. Based on equation (4), we can test the hypothesis concerning whether the impacts of advertising goodwill are constant or varying. Additionally, if we ascertain that the impacts are time sensitive, then we are in position to ascertain if the advertising wearout hypothesis holds.

Empirical Specification

The empirical version of equations (3) and (4) is specified as:

ln $CDFLUIDMILK_t/POP_t$, = a_0 + a_1 *ln ($RETAIL\_PRICE\_FLUIDMILK_t$ / $CPI\_NONALCBEV\_SA_t$) + a_2*ln $RPCDPI_t$ +a_3*ln ($CPI\_CHEESE\_SA_t$/ $CPI\_ALLITEMS\_SA_t$) + a_4 *ln ($CPI\_BREAKFAST\_CEREAL\_SA_t$,/ $CPI\_ALLITEMS\_SA_t$) + a_5 *ln($PERCENT\_CHILDREN\_0TO5$)$_t$, + a_6 * ln($PERCENT\_CHILDREN\_6TO11$)$_t$ + a_7 *ln($PERCENT\_CHILDREN\_12to17$)$_t$ + a_8 *ln $FAFH\_PERCENT_t$ + a_9 *$MILKLIFE_t$ + a_{10}*#$GOTMILKCHALLENGE_t$ + $\sum_{k=11}^{21} a_k$*@SEAS(k) + a_{22}*D2020m04 + a_{23}*D2020m05 + a_{24} *Pandemic_JuntoDec2020 + a_{25} *Pandemic_2021+ a_{26} *Pandemic_2022 + $\sum_{l=1}^{3} \gamma_{lt}$*$GW_t$*$THEME_l$ +v_t. (5)

In this specification, the subscript t represents monthly observations over the period January 1995 to December 2022. Consequently, the number of observations available for analysis is 336.

The dependent variable labeled as $CDFLUIDMILK_t/POP_t$, denotes the commercial disappearance of fluid milk per capita in the United States. Hence, we account for fluid milk consumption as well as population in the analysis. The commercial disappearance of fluid milk corresponds to estimated fluid milk product sales available from the Agricultural Marketing Service, USDA. These sales data measured in pounds are dispositions (deliveries) of fluid milk products in consumer type packages from milk processing (bottling) plants to outlets in Federal Order marketing areas. These outlets include food stores, convenience stores, warehouse stores/wholesale clubs, non-food stores, schools, the food service industry, and home delivery.

$RETAIL\_PRICE\_FLUIDMILK_t$ denotes the retail price of fluid milk; $CPI\_NONALCBEV\_SA_t$ denotes the consumer price index of nonalcoholic beverages. The retail price of whole milk in terms of dollars per gallon is a proxy for the price of fluid milk. By dividing by CPI_NONALCBEV_SAt, the real price of fluid milk indirectly considers the price of nonalcoholic beverages. RPCDPIt denotes real per capita disposable income, measured in 2017 dollars. CPI_CHEESE_SAt and CPI_BREAKFAST_CEREAL_SAt denote the seasonally adjusted consumer price index of cheese and related products and the seasonally adjusted consumer price index of breakfast cereals. CPI_ALLITEMS_SAt denotes the seasonally adjusted consumer price index for all items. The consumer price index of cheese and related products adjusted for inflation (CPI_CHEESE_SAt / CPI_ALLITEMS_SAt) reflects the substitution of cheese for fluid milk. The consumer price index of breakfast cereals adjusted for inflation (CPI_BREAKFAST_CEREAL_SAt,/ CPI_ALLITEMS_SAt) reflects the complementarity of breakfast cereals with fluid milk.

The explanatory variables labeled as PERCENT_CHILDREN_0TO5, PERCENT_CHILDREN_6TO11, and PERCENT_CHILDREN_12TO17 represent the percentage of the U.S. population that falls within the specified age brackets. These measures control for population dynamics among preschool children, elementary and middle school children, and adolescents. FAFH_PERCENT denotes the percent of sales from away-from-home eating establishments.

The explanatory variables $MILKLIFE_t$, and $\#GOTMILKCHALLENGE_t$ denote the "Milk Life" and "#GOTMILKCHALLENGE" campaigns, respectively. Both are dummy variables, and the reference or base category is the original "Got Milk?" campaign. The respective campaigns are mutually exclusive and exhaustive. The coefficients associated with these variables capture how much higher or lower, on average, per capita consumption of fluid milk is relative to the "Got Milk?" campaign. These coefficients do not capture the effects of the three distinct campaigns.

Dummy variables are included in the model specification to account for seasonality. The variables labeled @SEAS(k), k =11,12..., 21, represent the 11 months of each calendar year, respectively. The month of December is excluded to avoid the dummy variable trap and corresponds to the base or reference month.

The World Health Organization formally declared COVID-19 a pandemic on March 11, 2020. Two days later on March 13, 2020, the Trump Administration declared COVID-19 a national emergency. We adopt this period to indicate the start of market disruption attributed to COVID-19. That said, we acknowledge that initial consumer reaction to the pandemic could have happened before March 11, 2020, given that the first COVID-19 case in the United States could be traced back to January 21, 2020, and given that the CDC expressed a warning of a looming pandemic on February 25, 2020. In this analysis, the dummy variables D2020m04 (defined as 1 if April 2020 and 0 otherwise) and D2020m05 (defined as 1 if May 2020 and 0 otherwise) represent the months immediately following the pandemic. We also consider dummy variables associated with the pandemic for the remainder of 2020 (defined as 1 if June, July, August, September, October, November, and December 2020 and 0 otherwise) as well as consider the impacts of the pandemic for calendar years 2021 (defined as 1 for months in calendar year 2021 and 0 otherwise) and 2022 (defined as 1 for months in calendar year 2022 and 0 otherwise).

$THEME_l$ corresponds to dummy variables to indicate theme changes in advertising copy. $Theme_1$ corresponds to the "Got Milk?" campaign, and $Theme_1 = 1$ if $t \leq 230$, 0 otherwise; $Theme_2$ corresponds to the "Milk Life" campaign, and $Theme_2 = 1$ if $231 \leq t \leq 307$, 0 otherwise; and $Theme_3$ corresponds to the "#GOTMILKCHALLENGE" campaign, and $Theme_3 = 1$ if $308 \leq t \leq 336$, 0 otherwise; and v_t is a random error term.

Equation (5) allows goodwill elasticities to differ depending on the campaign theme. Like Kinnucan, Chang, and Venkateswaran (1993), advertising wearout is introduced into the model by specifying γ_t associated with each theme-specific campaign as:

$$\gamma_{lt} = \Omega_{0l} + \Omega_{1l} * T_l + \Omega_{2l} * T_l^2, \quad (6)$$

where l=1,2,3 denotes campaign themes and T_l are trend terms defined as follows:

T_1 = 1, 2,..,,230, and zero otherwise (for the "Got Milk?" Theme),

T_2 = 1,2,…,77., zero otherwise (for the "Milk Life" Theme), and

T_3 = 1,2,….29, zero otherwise (for the "#GOTMILKCHALLENGE" Theme).

Equation (6) is the empirical analogue of equation (4).[1]

Attributed to equation (5), the goodwill promotion elasticity associated with each campaign theme is calculated to be $\gamma_{lt} * GW_t * Theme_l$. To be consistent with advertising wearout, we expect Ω_{1l} to be positive and Ω_{2l} to be negative. If $\Omega_{1l} = \Omega_{2l} = 0$, then $\gamma_{jt} = \Omega_{0l}$, implying that the impact of each promotion campaign is not time sensitive.

Data

Because data pertaining to the retail price of whole milk were only first available in July 1995, the econometric analysis runs from July 1995 to December 2022. The sample size then for the econometric analysis is 330 observations. Promotion expenditures for fluid milk are not available after 2022.

Retail prices for whole milk, the consumer price index for nonalcoholic beverages (a proxy for alternatives to fluid milk), the consumer price index for breakfast cereals, the consumer price index for all items, and the consumer price index for cheese were obtained from the Bureau of Labor Statistics. Data for disposable personal income and population were available from the Federal Reserve Bank of St. Louis. Data pertaining to the proportion of children in various age groups as well as data concerning retail sales for food and beverages (at-home and away-from-home) were obtained from the U.S. Bureau of the Census. The source of the information on demand-enhancing expenditures for fluid milk was the U.S. Department of Agriculture's Agricultural Marketing Service. Finally, information on advertising and promotion expenditures associated with fruit juices and drinks was procured from Competitive Advertising Intelligence, Ad Intel.

Descriptive statistics of the econometric analysis are exhibited in Table 1. Per capita quarterly consumption of fluid milk ranged from 9.89 pounds[2] to 18.20 pounds, averaging 14.37 pounds over the period January 1995 to December 2022. From Figure 1, it is clear that per capita fluid milk consumption not only has been on a steady decline over the past 28 years, but also exhibits a seasonal pattern. The downward trend likely reflects changes in the frequency of fluid milk intake

[1]Reberte et al. (1996) examined two major generic fluid milk advertising campaigns in New York City over the period 1986 to 1992. Estimates from a time-varying parameter model were consistent with a bell-shaped pattern. In that study, $\gamma_{lt} = \exp(\Omega_{0l} + \Omega_{1l} * T_l + \Omega_{2l} * T_l^2)$.

[2]A gallon of milk is equivalent to 8.6 lbs.

rather than changes in portions (Stewart, Dong, and Carlson, 2013). Most Americans born in the 1990s tend to consume fluid milk less often than those born in the 1970s, who in turn consume fluid milk less often than those born in the 1950s. U.S. per capita milk consumption has declined roughly 36% since 1995, largely due to changing consumption habits as well as increased competition from other beverages. Moreover, according to Stewart et al. (2021), U.S. consumers of all ages are drinking less milk and milk drinks.

Table 1. Descriptive Statistics of the Continuous Variables in the Econometric Analysis, July 1995 to December 2022

Variable Name	Mean	Variable Name	Mean
Disappearance of fluid milk per capita (pounds)			
CDFLUIDMILK/POP	14.32		
Advertising/promotion campaigns			
GOT_MILK? (*Reference/Base Category)*	0.6788		
MILK_LIFE	0.2333		
#GOT_MILK_CHALLENGE	0.0879		
Nominal retail price of milk ($/gallon)		Nominal seasonally adjusted advertising/promotion expenditures fluid milk (dollars)	
RETAIL_PRICE_FLUIDMILK	$3.17	DMI_MILKPEP_QP_A_D11	$32,173,048
Real per capita disposable personal income (2017 dollars)		Nominal seasonally adjusted advertising/promotion expenditures fruit juices (1,000 dollars)	
RPCDPI	$40,313	JUICES_AD_D11	$137,930
Consumer price indices (1982-84=100)		Population dynamics (proportion of the U.S. population)	
CPI_NON_ALCOHOLIC_BEV	156.0422	PERCENT_CHILDREN_0TO5	7.8425
CPI_ALLITEMS_SA	212.8428	PERCENT_CHILDREN_6TO11	8.0566
		PERCENT_CHILDREN_12TO17	8.2488
		Food away from home expenditures (% of the dollar spent on food away from home)	
		FAFH_PERCENT	44.2801

Source: Calculations made by the authors using the EViews 11.0 (2020) econometrics software package.

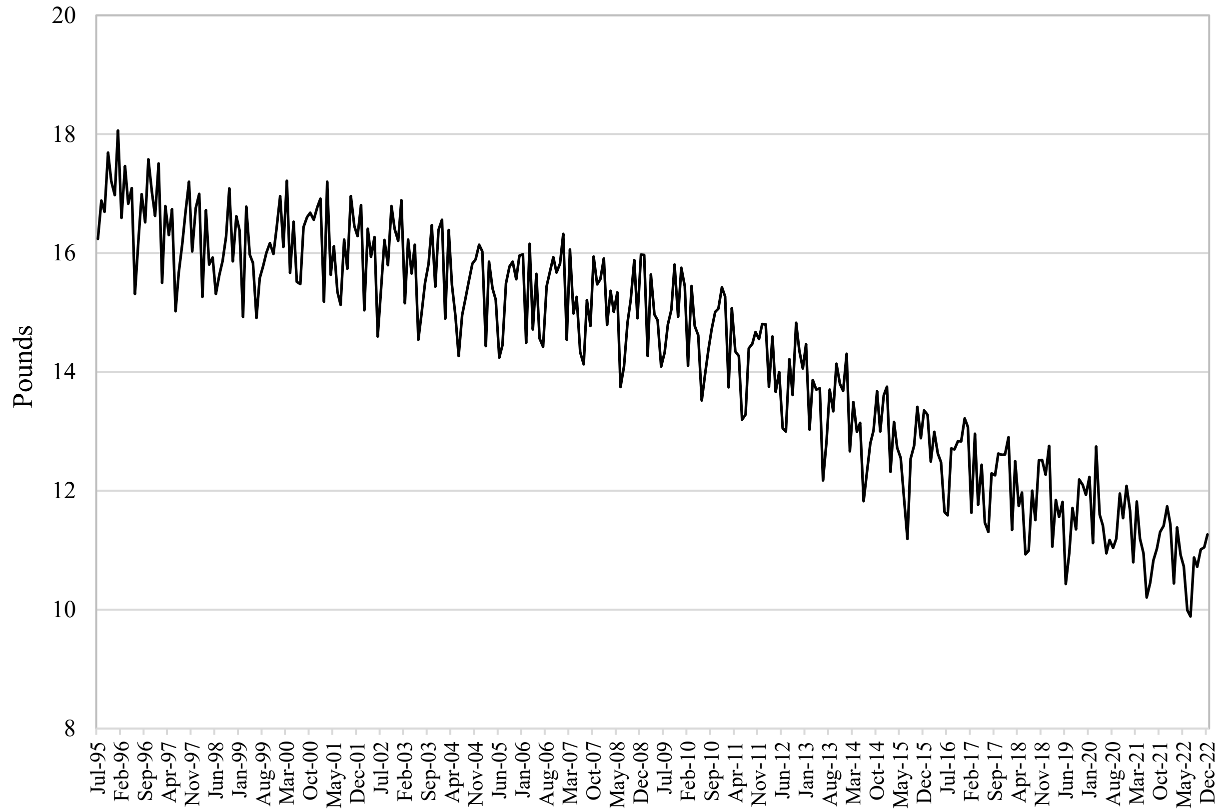

Figure 1. Per Capita Fluid Milk Consumption in Pounds, July 1995 to December 2022

Source: United States Department of Agriculture

The retail price of whole milk is used to measure own price on a dollar per gallon basis. Holding all else constant, fluid milk consumption is expected to be inversely related to price in accord with economic theory. The nominal retail price of whole milk ranged from $2.46/gallon to $4.22/gallon over the sample period, $3.17/gallon on average.

We use the ratio of the retail price of fluid milk to the consumer price index for nonalcoholic beverages in the model specification. This price ratio then accounts not only for inflation, but also for prices of alternative beverages to milk. Consequently, interest lies with the impact of the retail price of whole milk relative to the price of nonalcoholic beverages.

Real per capita disposable personal income serves to account for income, population, and inflation. Holding all other factors constant, fluid milk is expected to be a normal good, and as such we hypothesize that fluid milk consumption is positively related to income. Over the sample period, real per capita disposable personal income measured in 2017 dollars varied from $30,686 to $62,509, averaging $40,314.

Seasonally adjusted consumer price indices of cheese, nonalcoholic beverages, breakfast cereals, and all items serve to isolate the effects of other prices and inflation. Over the sample period, the share of the U.S. population of children 0 to 5 years of age averaged 7.84%; the share of the U.S. population of children 6 to 11 years of age averaged 8.06%; and the share of the U.S. population of children 12 to 17 years of age averaged 8.25%. Because these measures of population dynamics were only available annually, interpolations were done to place these figures on a monthly basis.

Sales from food service and drinking establishments as a percent of the sum of spending at food and beverage stores and food-service and drinking establishments are used as a measure of food-away-from home spending. Since 1995 food-away-from-home expenditures have risen consistently, climbing from roughly 30% to 52% over the sample period, averaging slightly more than 44%. Food-away-from-home expenditures plummeted from 51% to 37% in March 2020, 31% in April 2020, and 36% in May, respectively, due to the COVID-19 pandemic and stay-at-home orders. Since June 2020, sales from food service and drinking establishments as a percent of the sum of spending at food and beverage stores and food-service and drinking establishments have risen monotonically. Fluid milk often is not consumed or on the menu at food-service or drinking places. Hence, milk consumption is expected to decrease with increases in the shares of food-away-from-home expenditures.

The COVID-19 pandemic accounts for using several dummy variables. The first set of dummy variables corresponds to April 2020 only and May 2020 only, designed to capture the impact of the initial onset of the pandemic. A second dummy variable represents the pandemic from June 2020 to December 2020. In this way, we ascertain the impacts of the pandemic, initially and subsequently, in 2020. The final set of dummy variables corresponds to calendar year 2021 and calendar year 2022. We hypothesized that the COVID-19 pandemic negatively affects per capita consumption of fluid milk. The base or the reference period is the pre-pandemic period.

On average, nominal seasonally adjusted advertising and promotion expenditures for fluid milk ranged from $12.27 million to $62.75 million, averaging $32.17 million over the period July 1995 to December 2022. On average, nominal seasonally adjusted advertising and promotion expenditures for fruit juices and drinks ranged from $52.09 million to $310.73 million, averaging $137.93 million over the sample period. The advertising/promotion demand-enhancing expenditure variables were seasonally adjusted using the X13 procedure developed by the Census Bureau.

To measure the impact of three previously mentioned advertising/promotion campaigns, we created three dummy variables. The "Got Milk?" campaign corresponds to the period July 1995 to February 2014. The "Milk Life" campaign corresponds to the period March 2014 to July 2020. The "#GOTMILKCHALLENGE" campaign corresponds to the period August 2020 to December 2022. Nominal advertising expenditures for fluid milk from Dairy Management, Inc. (DMI), MilkPEP, and Qualified Programs (QPs) amounted to $35.71 million per quarter on average for the "Got Milk?" campaign; $26.32 million per quarter on average for the "Milk Life" campaign; and $20.81 million per quarter on average for the "#GOTMILKCHALLENGE" campaign. Consequently, the amount of advertising and promotion expenditures was not constant across the respective campaigns.

Empirical Results

Because of the term $\sum_{l=1}^{3} \gamma_{lt}$*$GW_t$*$THEME_l$, equation (5) corresponds to a nonlinear model. Consequently, the method of estimation is nonlinear least squares. In the search for the optimal lag lengths, second- and third-degree polynomials with lags up to 12 months were considered along with alternative choices of head and tail (endpoint) restrictions for GW_t as well as for promotion expenditures associated with fruit juices and drinks. Based on the AIC, SIC, and HQC, a second-order polynomial distributed lag specification was identified as a lag length of three months for real and seasonally adjusted promotion expenditures of fruit juices and drinks and 12 months for real and seasonally adjusted fluid milk promotion expenditures. To arrive at this empirical specification, a plethora of different combinations of lag structures were considered. For estimation purposes, we adopted the use of logarithmic transformation for all continuous variables in the model.

To mitigate irreconcilable degrading collinearity issues**,** we restricted Ω_{0l} to be 0 for l = 1,2,3, and we dropped the consumer price index for breakfast cereal, the consumer price index for cheese, the percent of the population associated with children 6 to 11 years of age, and the percent of the population associated with children 12 to 17 years of age from the model.[3] Additionally, based on R-student statistics and hat diagonal elements (Belsley, Kuh, and Welsch, 1980), one observation, namely July 2015, was deemed to be an influential data point (outlier and leverage point). To mitigate this issue, we created a dummy variable associated with this observation (1 for July 2015, and 0 otherwise).

The parameter estimates, standard errors, and *p*-values for the explanatory variables of the econometric model obtained from the use of the software package EViews 11.0 (EViews, 2020) are exhibited in Table 2. The R^2 metric was 0.9863 and the adjusted R^2 metric was 0.9850. The standard error of of variability in the per capita consumption of fluid milk, with a negligible variability in the regression.

Table 2. Parameter Estimates, Standard Errors, and *p*-values for the Explanatory Variables of the Econometric Model for Fluid Milk (Dependent Variable: LOG(PERCAPITA_FLUIDMILK)

Variable	Coefficient	Std. Error	*t*-statistic	*p*-value
C	2.3150	0.7629	3.03	0.0026
LOG(RETAIL_PRICE_FLUID_MILK*100/CPI_NON_ALCOHOLIC_BEV)	-0.0700	0.0175	-4.00	0.0001
LOG(REAL_PERCAPITA_DPI)	0.0532	0.0618	0.86	0.3896
LOG(PERCENT_CHILDREN_0TO5)	0.4706	0.1493	3.15	0.0018
@SEAS(1)	0.0121	0.0047	2.57	0.0107
@SEAS(2)	-0.0887	0.0047	-18.86	0.0000
@SEAS(3)	-0.0047	0.0047	-0.99	0.3245

[3]These collinearity issues were revealed based on examination of variance inflation factors, condition indices, and variance decomposition proportions (Belsley, Kuh, and Welsch, 1980).

Table 2 (cont.)

Variable	Coefficient	Std. Error	*t*-statistic	*p*-value
@SEAS(4)	-0.0540	0.0048	-11.32	0.0000
@SEAS(5)	-0.0417	0.0048	-8.77	0.0000
@SEAS(6)	-0.1187	0.0048	-25.20	0.0000
@SEAS(7)	-0.0971	0.0047	-20.65	0.0000
@SEAS(8)	-0.0411	0.0047	-8.84	0.0000
@SEAS(9)	-0.0388	0.0047	-8.34	0.0000
@SEAS(10)	0.0047	0.0046	1.01	0.3157
@SEAS(11)	-0.0192	0.0046	-4.13	0.0000
LOG(FAFH_PERCENT)	-0.2279	0.0455	-5.01	0.0000
D2020M04	-0.0895	0.0281	-3.19	0.0016
D2020M05	-0.0747	0.0223	-3.36	0.0009
GW*GOT_MILK_TREND	0.0012	0.0005	2.29	0.0230
GW*MILK_LIFE_TREND	-0.0026	0.0009	-3.00	0.0029
GW*GOT_MILK_CHALLENGE_TREND	0.0094	0.0040	2.35	0.0192
GW*GOT_MILK_TSQ	-9.25E-06	1.23E-06	-7.51	0.0000
GW*MILK_LIFE_TSQ	-4.53E-06	1.06E-05	-0.43	0.6698
GW*GOT_MILK_CHALLENGE_TSQ	-0.0004	0.0001	-2.99	0.0031
D2015M07	-0.0748	0.0176	-4.26	0.0000
GOT_MILK_CHALLENGE	-0.2650	0.0459	-5.77	0.0000
MILK_LIFE	-0.1136	0.0353	-3.21	0.0015
R-squared	0.9863			
Adjusted R-squared	0.9850			
Standard error. of regression	0.0170			
F-statistic	770.84	Durbin-Watson statistic 2.08		
p-value (F-statistic)	0.0000			

Lag Distribution of LOG(JUICE_AD_EXPENDITURES_SA/CPI_ALLITEMS_SA)	i	Coefficient	Std. Error	*t*-statistic	*p*-value
	0	-0.0054	0.0017	-3.26	0.0012
	1	-0.0081	0.0020	-3.26	0.0012
	2	-0.0081	0.0020	-3.26	0.0012
	3	-0.0054	0.0017	-3.26	0.0012
	Sum of lags	-0.0270	0.0083	-3.26	0.0012

Within sample, the mean absolute error (MAE) was 0.18 pounds, and the mean absolute percent error (MAPE) was 1.30%. These measures corroborate the exceptional goodness-of-fit statistics. Based on the Durbin-Watson statistic, no autocorrelation in the residuals was evident.

Importantly, at the 0.05 level of significance, all estimated coefficients associated with the explanatory variables were statistically significant except for real disposable personal income and the interaction of GW with the square of the "Milk Life" trend term. With the use of logarithmic transformations, the estimated coefficients associated with all retail price of fluid milk, real per capita disposable income, percent of the population associated with children 0 to 5, and percent of food-away-from-home expenditures are elasticities.

The own-price elasticity for fluid milk was estimated to be -0.07, meaning that for every 10% change in the price of fluid milk relative to the price of nonalcoholic beverages, per capita fluid milk consumption changes by 0.70% in the opposite direction. The demand for fluid milk then is inelastic, that is, relatively unresponsive to price changes. This result is consistent with economic theory and with the extant literature (Kaiser, 2010; Dong and Stewart, 2013).

The percentage of the population associated with children from 0 to 5 years of age was a key determinant affecting per capita fluid milk consumption. A 1% rise in the proportion of children under 5 years of age resulted in a 0.47% increase in per capita fluid milk consumption. Clearly, econometric evidence exists to demonstrate that very young children are important drivers of fluid milk consumption. As this segment of the U.S. population declines, per capita fluid milk consumption will follow suit, all other factors being invariant.

The elasticity with respect to the percent of food-away-from-home expenditures was estimated to be -0.23. For every 1% rise in this percentage, per capita fluid milk consumption would fall by 0.23%, *ceteris paribus*. As mentioned previously, real per capita disposable income was not a statistically significant factor associated with per capita fluid milk consumption.

Because the model specification involves the logarithmic transformation of the per capita fluid milk consumption, we invoked the use of the Halvorsen and Palmquist (1980) convention to interpret all estimated coefficients associated with dummy variables.[4] Regarding seasonality, per capita fluid milk consumption was highest in January by 1.21% relative to December. On the other hand, per capita consumption of fluid milk was lower in all remaining months relative to December. In particular, per capita consumption of fluid milk was lower by 8.49% in February, 5.26% in April, 4.09% in May, 11.19% in June, 9.25% in July, 4.03% in August, and 3.80% in September relative to December.

Per capita consumption of fluid milk was lower by 8.56% in April 2020 and by 7.20% in May 2020, immediately following the onset of the pandemic. In subsequent months of 2020, calendar months of 2021, and calendar months of 2002, no statistically significant differences in per capita consumption of fluid milk were evident relative to the pre-pandemic period. Consequently, these explanatory variables were dropped from the econometric analysis.

The impacts of advertising for fruit juices were negative on per capita consumption of fluid milk, as expected. The short-run elasticity of advertising for fruit juices and drinks was estimated to be

[4]With this convention, the percentage change associated with any included dummy variable with respect to its base or reference category is given as (exp(the estimated coefficient) minus 1)*100.

-0.0054, whereas the cumulative or long-run elasticity was estimated to be -0.0270. The optimal cumulative effects of advertising on fruit juices and drinks were over a period of three months.

The estimated coefficients of lag distribution of weights associated with the GW variable exhibited in Table 3 support the hypothesis that the efforts of MilkPEP, DMI, and the QPs to enhance the demand for fluid milk were successful across campaigns. Based on these estimated coefficients, the impacts of the check-off expenditures from milk processors, dairy producers, and the QPs indeed boosted per capita consumption of fluid milk, holding all other factors constant. The optimal cumulative effect of these demand-enhancing promotion activities associated with the GW variable occurred over a period of 12 months. This distribution corresponds to a polynomial distributed lag process of degree 2 with endpoint constraints (both head and tail constraints).[5] The cumulative or long-run elasticity for fluid milk with respect to marketing, advertising, and promotion activities on the part of MilkPEP, DMI, and QPs across campaigns was estimated to be 0.043. Our estimate of the magnitude of the impact of advertising and promotion for fluid milk is in accord with previous studies. Schmit and Kaiser (2004) estimated the average promotion elasticity of fluid milk to be 0.040 over the period 1975 to 2001, using national quarterly data. Kaiser (2010) estimated the advertising and promotion elasticity for fluid milk for the United States to be 0.037 over the period 1997 and 2009.

Table 3. Parameter Estimates, Standard Errors, and *p*-values for the Promotion Expenditures Associated with Fluid Milk in the Econometric Model

Lag Distribution of LOG(PROM_EXPENDITURES_D11* 100/CPI_ALLITEMS_SA)	**i**	**Coefficient**	**Std. Error**	***t*-statistic**	***p*-value**
	0	0.0012	0.0006	2.00	0.0467
	1	0.0023	0.0011	2.00	0.0467
	2	0.0031	0.0016	2.00	0.0467
	3	0.0038	0.0019	2.00	0.0467
	4	0.0043	0.0021	2.00	0.0467
	5	0.0045	0.0023	2.00	0.0467
	6	0.0046	0.0023	2.00	0.0467
	7	0.0045	0.0023	2.00	0.0467
	8	0.0043	0.0021	2.00	0.0467
	9	0.0038	0.0019	2.00	0.0467
	10	0.0031	0.0016	2.00	0.0467
	11	0.0023	0.0011	2.00	0.0467
	12	0.0012	0.0006	2.00	0.0467
	Sum of lags	0.0429	0.0215	2.00	0.0467

Source: Calculations by the authors using EViews 11.0.

[5]Because of the lag distribution associated with GW, we lose 12 observations in the estimation of the model. Hence the period for this analysis runs from July 1996 to December 2022.

However, despite the positive and statistically significant impact of the generic advertising and promotion expenditures for fluid milk relative to the original “Got Milk?” campaign, per capita consumption of fluid milk was lower by 10.74% for the “Milk Life” campaign. As well, relative to the original “Got Milk?” campaign, per capita consumption of fluid milk was lower by 23.28% for the “#GOTMILKCHALLENGE” campaign.

We reject the hypothesis that $\Omega_{11} = \Omega_{21} = 0$, implying that the impact of each promotion campaign is time invariant. The “Got Milk?” campaign and the “#GOTMILKCHALLENGE” campaign were consistent with the hypothesis of advertising wearout because Ω_{11} was estimated to be positive and Ω_{21} was estimated to be negative. However, the “Milk Life” campaign was not consistent with the wearout hypothesis. Indeed, the time-varying parameter associated with the “Milk Life” campaign declined monotonically during this campaign.

The goodwill promotion elasticity associated with each campaign theme is calculated as γ_{lt}*GW_t*$Theme_l$. The magnitudes of the goodwill promotion elasticities for each of the three campaigns are exhibited in Figures 2, 3, and 4. For the “Got Milk?” campaign, the goodwill promotion elasticity was estimated to be 0.0054 at the beginning of the campaign, peaking at 0.0116 50 months later, and then declining to -0.0531 at the end of the campaign. The goodwill promotion elasticity associated with the “Got Milk?” campaign turned negative after 114 months.

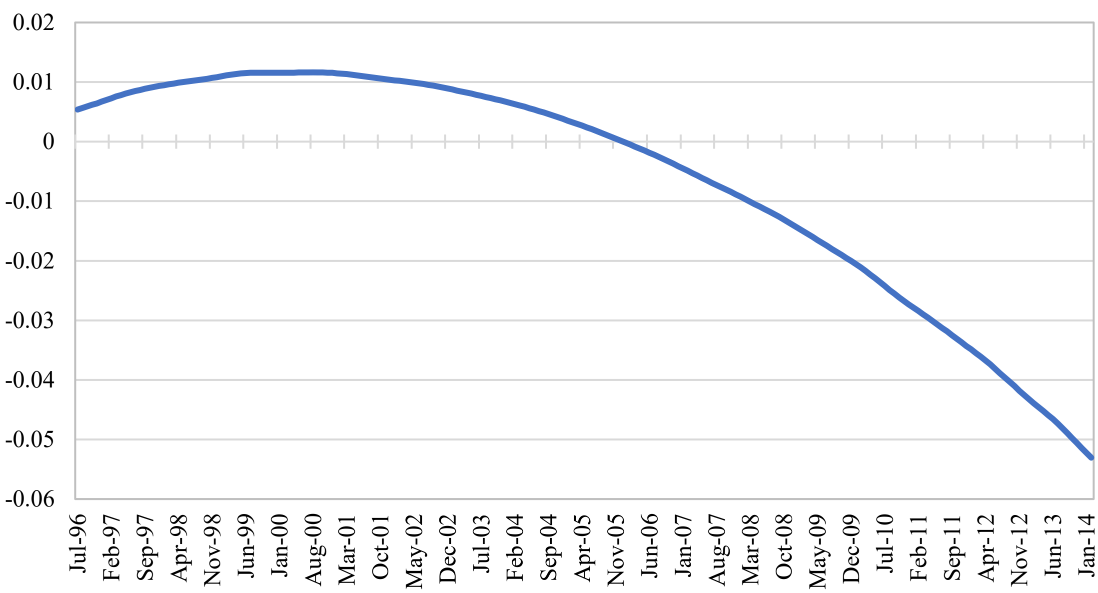

Figure 2. The Goodwill Elasticities Associated with the “Got Milk?” Campaign, July 1996 to February 2014

Source: Calculations by the authors.

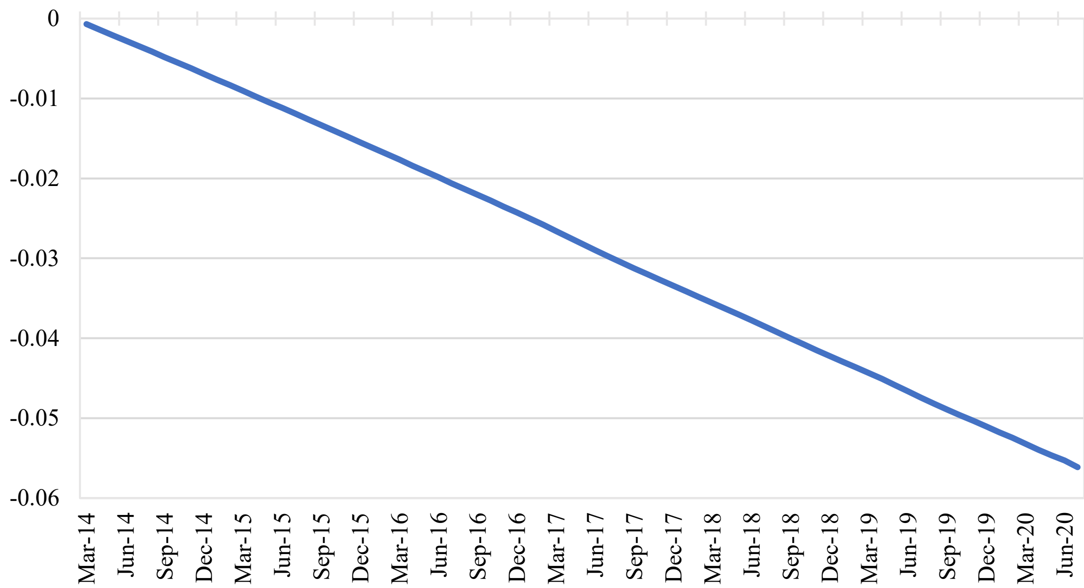

Figure 3. The Goodwill Elasticities Associated with the "Milk Life" Campaign, March 2014 to July 2020

Source: Calculations by the authors.

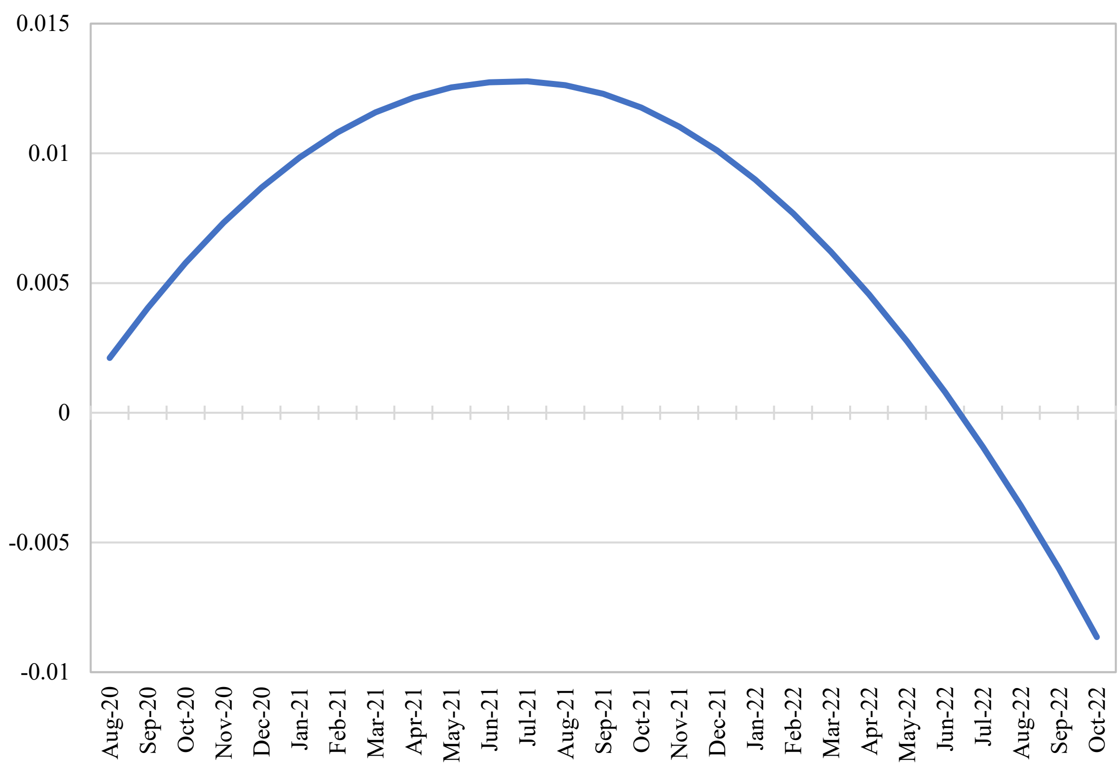

Figure 4. The Goodwill Elasticities Associated with the "#GOTMILKCHALLENGE" Campaign, August 2020 to December 2022

Source: Calculations by the authors.

For the “Milk Life” campaign, the goodwill promotion elasticity was estimated to be -0.0007 at the beginning of the campaign. This impact was also the peak of this campaign. Subsequently, the goodwill promotion elasticity associated with the “Milk Life” campaign declined to -0.0560 at the end of this campaign. For the “#GOTMILKCHALLENGE” campaign, the goodwill promotion elasticity was estimated to be 0.0021 at the beginning of the campaign, peaking at 0.0128 12 months later, then declining to -0.0086 at the end of the campaign. The goodwill promotion elasticity associated with the “#GOTMILKCHALLENGE” campaign turned negative after 23 months.

Without question, advertising impacts are quite dynamic, changing within thematic periods. Additionally, the advertising impacts are not uniform across themes. The peak impacts for the “#GOTMILKCHALLENGE” campaign and for the “Got Milk?” campaign were estimated to be 0.0128 and 0.0116, respectively. Both campaigns were instrumental in positively affecting per capita consumption of fluid milk up to a point in time. On the other hand, the “Milk Life” campaign negatively affected per capita consumption of fluid milk throughout.

Concluding Remarks

The impacts of the “Got Milk?”, “Milk Life,” and “#GOTMILKCHALLENGE” campaigns on per capita fluid milk consumption were analyzed using econometric analysis over the period July 1995 to December 2022. Accounting for a myriad of statistically significant factors, relative to the original “Got Milk?” campaign, per capita consumption of fluid milk was lower by 10.74% for the “Milk Life” campaign and lower by 23.28% for the “#GOTMILKCHALLENGE” campaign.

The long-run elasticity for fluid milk with respect to marketing, advertising, and promotion activities on the part of MilkPEP, DMI, and QPs without consideration of individual campaigns was estimated to be 0.043. This finding implies that the downward trend in per capita fluid milk consumption would have been exacerbated but for the advertising/promotion expenditures made by DMI, MilkPEP, and QPs. This finding also suggests that consumer interest in the generic message of drinking more milk can be maintained even with varying themes.

However, differences in advertising impacts were evident across themes. We reject the hypothesis that the impact of each promotion campaign was time invariant. The “Got Milk?” campaign and the “#GOTMILKCHALLENGE” campaign were consistent with the hypothesis of advertising wear out. Once consumers were familiar with the gist of the respective themes, repeated exposures were eventually tuned out. On the other hand, the “Milk Life” campaign was not consistent with this hypothesis. Indeed, the time-varying parameter associated with the “Milk Life” campaign declined monotonically throughout this campaign.

The respective advertising impacts were quite dynamic, changing within thematic periods. Additionally, the advertising impacts were not uniform across themes. The “Got Milk?” and the “#GOTMILKCHALLENGE” campaigns were instrumental in positively affecting per capita consumption of fluid milk up to a point in time. On the other hand, the “Milk Life” campaign negatively affected per capita consumption of fluid milk throughout.

Going forward, time-varying parameter models in assessing effectiveness of advertising campaigns should be implemented. The models should evaluate not only the effectiveness of the overall generic message (drink more milk in this analysis) but also the effectiveness of the messages linked to the respective campaigns.

As climate change and environmental concerns continue to grow, consumers are moving toward decreased consumption of animal products. Further, concerns over animal welfare and the safety of the milk supply (e.g., the issue of recombinant bovine somatotropin [rBST]) also could be responsible for changes in milk consumption. For future work, to minimize any confounding of impacts of various factors, it may be worthwhile to consider not only the environmental effects associated with dairy cows and the related greenhouse gases from their manure, but also concerns over animal welfare as possible determinants of the decline in per capita consumption of fluid milk.

To further study the impacts of the respective promotion campaigns for fluid milk, neuroeconomics can be utilized. Neuroeconomics is a relatively new discipline that merges concepts from economics, psychology, and neuroscience. Neuroeconomics uses a wide range of neurophysiological measures to study the connection between the nervous system, the body, and decision making (Palma, 2021). Neurophysiological equipment, including eye-tracking and facial expression analysis, can assess emotions to analyze the effectiveness of the three promotional campaigns for fluid milk in generating visual attention, recall, and propensity to purchase fluid milk. With the use of neuroeconomics, we would be able to compare and to contrast the findings gleaned from the use of econometric analysis.

Competing Interest Statement

Both authors have contributed equally to this article.

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Data Availability Statement

All data were obtained from secondary sources cited in the manuscript and are also available from the authors upon request.

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