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Economic Impact on Beverage Consumption in Developing Economies

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Abstract

This study aims to find out the long-term relationship between macroeconomic factors and beverage market volume in different countries from 2005 to 2020. Per capita market volume is investigated in aggregated form to gain a clear understanding of the impact on beverage products, covering product type, product process, product distribution per country, and given period. According to the current literature on demographic and macroeconomic factors influencing food and beverage consumption, population, education level, GDP, income, or price levels are some of the key major determinants of beverage consumption. Unlike most studies that have focused on national data, such as US data and alcohol consumption, which discovered alcohol consumption to be pro-cyclical with macroeconomic factors, this paper adds to the limited existing literature on beverage consumption by identifying the key macroeconomic factor that accounts for variations in beverage market volumes of milk, 100% juice, coffee or tea and sugar-sweetened beverages in developing economies. The study analyses cross-national data of 112 countries where data is available in between 2005-2008 (inclusive) with fixed effects panel data approach separately for developing and developed economies. The results show that GDP per capita has a greater positive effect on beverage consumption in developing economies than in developed economies, with coffee or tea and sugar-sweetened beverages having the greatest effect and milk products having the least.

Table of Content

1 Introduction

Globally, food and beverage consumption has been impacted by demographic, epidemiological, social, and economic changes that have had an impact on food habits, lifestyle, and population health. In the context of socioeconomic and demographic evolution, changes in dietary patterns and physical activity are described as determining factors for obesity. Overall consumers' health, environmental, and economic concerns have not changed significantly, even with the Covid-19 pandemic but there is an expected economic impact on consumer behavior. Obesity rates are increasing due to an increase in inactive routines and a wide-spread diet driven by poor nutritional food and beverage tastes and preferences, which has a significant impact on life quality and health care expenditure.

The global shift in social and cultural norms has resulted in an increase in the size of the non-alcoholic beverage sector, which is expected to grow at a compound annual growth rate of 5.6% between 2022 and 2030 (Non-alcoholic Beverages Market Report, 2022). Non-alcoholic beverages now account for more than half of the global beverage market and have grown in popularity in recent years. According to Fortune Business Insights (2020), the increase in consumption of non-alcoholic beverages was driven by innovative packaging that enticed consumers to mentally grab and go, as evidenced by the 24% sales growth estimated by the Food Export Association for ready-to-drink tea and coffee drinks in 2019 over the previous four years.

Food and beverage consumption habits change over time driven by a variety of factors and interconnections. Household income, food price levels, consumer tastes and preferences, marketing strategies, beliefs, and cultural traditions, as well as geographical, environmental, social, and economic factors, all influence food and beverage consumption patterns (FAO/WHO 2003). The disparity in economic development levels between countries results in widely disparate consumption patterns. Residents in developed economies that are considered wealthier consume more, but spend less on food, beverages, and other necessities. Consumption trends among a given basket of goods and services can be easily evaluated by aggregating consumption on a larger national or regional level.

The importance of planning food and beverage production and physical availability in various individual markets and countries while extremely aware of different levels of economic development is crucial for businesses in the food and beverage industry. It is critical to

recognize and investigate how changes in economic deterministic factors influence changes in beverage consumption over time.

1.1 Research Objective and Purpose

The global food market is changing, particularly in developing countries, due to rising consumer living standards influencing the changing lifestyles and varying global consumption trends.

The primary objective of this study is to investigate the relationship between the selected macroeconomic indicators, primarily GDP per capita trends in different countries, and beverage product consumption patterns. Importantly, data from a multinational food packaging and processing company will be used to test the hypothesis that changes in the consumption of four mutually exclusive beverage categories are significantly influenced by the trends in macroeconomic factors varying across different countries over a sixteen-year period (2005-2020). Furthermore, the study's findings will indicate whether the significantly observed macroeconomic features are applicable in predicting short-term or long-term market volumes for the beverage company's future growth opportunities.

To put the hypothesis to the test, all beverage products are divided into four mutually exclusive categories:100% juice, milk, coffee or tea, and sugar-sweetened, which will allow us to observe if this relationship varies across them. Further to that, country classification will be used through the k-means clustering algorithm, which will divide all countries into two groups based on the degree of homogeneity of beverage consumption by GDP per capita, employment rate, and inflation (price change) rate on per capita market volume in each country into developing economies and developed economies.

The fundamental annual shift of a country's macroeconomics sets in motion a chain of events that necessitate significant societal adjustment on the part of all businesses and consumers. Analyzing beverage consumption patterns yields unique insights that can be used as input for beverage company decision-making teams to improve competitive advantage and uncover unknown growth opportunities focused on specific similar segments globally. Beverage consumption patterns provide a good overview of societal reaction to a macroeconomic shock change in the social or economic environment, allowing for a variety of guidelines to be

implemented to maintain growth and profitable businesses, ranging from unique business strategies to dietary effects and public health concerns.

Furthermore, by identifying such a cause-and-effect relationship, businesses may be able to improve their ability to forecast future consumption or demand volumes in the medium to long term by precisely forecasting the effective economic factors that could be applied to predict future market volumes. In the case of short-term forecasts, time-series-based methods can be aggregated to improve forecasting accuracy.

An increased uncertainty of macroeconomic factors affects the economic decisions of both households and companies and ultimately affects macroeconomic outcomes for key variables such as GDP per capita, inflation and unemployment rate (Huang et al. 2020).

According to Modis (2013), long-term GDP forecasts and future GDP growth are regarded as a natural-growth process that can be described by the logistic-growth equation.

Yu, Chen, & Yang (2013) used a cluster-based regularized sliced inverse regression to forecast many macroeconomic features with high collinearity, assuming the variables could be clustered into several similar blocks and any two variables belonging to different blocks were independent. Market trends are important predictors of financial success in the future , a model is available to forecast retail demand for fluid milk and cheese, as well as farm milk supply and price over the next decade (Schmit & Kaiser, 2006).

2 Literature

Beverage companies operate in an open system influenced by a wide variety of macroeconomic, demographic, and social factors. In addition to many internal and external factors, macroeconomic factors play a significant role in generating revenue and income for these businesses by influencing demand for their products, costs, and other aspects of the business. Despite extensive research on the food and beverage industry, relatively little attention has been paid to a comprehensive analysis of macroeconomic fundamentals on beverage consumption on a global or regional scale.

According to observed behavior, household surveys of food and beverage consumption and expenditure provide most of the evidence on the relationship between income and beverage consumption. Because there are no comparable data for international differences, GDP per capita is frequently used as a substitute. Hansen (2013) observed that while disposable income growth slowed slightly during the previous economic crisis, reducing absolute food expenditure of households, food expenditure remained relatively constant in relative terms. Even though absolute spending patterns suggested changes in consumer purchasing behavior, a good implication of consumers switching to cheaper products, consumers spent the same proportion of their disposable income on food.
When compared to fruits and vegetables, gross national income per capita has a positive impact on adolescent consumption of carbonated soft drinks (Ferreira et al. 2022). According to Muhammad et al. (2011), low-income countries spend a large portion of their budget on necessities like food, whereas higher-income countries spend a larger portion of their income on luxuries like recreation. Muhammad et al. (2017) examined the income and price elasticities of food consumption across the rich-poor spectrum, finding that changes in income and food prices affect consumption in low-income countries much more than consumption in higher-income countries, indicating heterogeneous associations between income, prices, and food intakes. Income and prices influence dietary intake patterns regardless of gender, age, region, or country, and people in low-income countries are more price sensitive than people in higher-income countries.

Ng et al. (2014) used time dummies and an employment economic factor to regress recalled daily calorie consumption, discovering that while the unemployment variable did not differ statistically from zero, their time variables became increasingly negative year after year,

leading them to conclude that declining consumption of food and beverages (particularly beverages) was not due to lower income.
There is a strong positive relationship between income and animal protein consumption, with milk consumption increasing at the expense of staple foods, and developing countries are increasing milk consumption at much lower levels of GDP than industrialized countries did 20 to 30 years ago, owing to recent sharp price drops.
De Alwis et al. (2009) discovered that individuals who have a higher monthly income and level of education have a higher demand in milk consumption. Ebru and Neslihan (2013) revealed a relationship between age, family average monthly income, and packaged milk consumption. Consumers with higher incomes were more likely to buy milk products, and those with a higher level of education were more likely to consume dairy products.
Guo et al. (2021) found that the prevalence of sugar-sweetened beverage consumption in children in China is greater in high-income households than in low-income households, with sugar-sweetened beverage consumption of mother's playing a significant role for children's consumption patterns.

Another important factor to consider when evaluating the effects of macroeconomic factors on national beverage consumption is inflation price change rate. A negative relationship between inflation price change rate and consumption of beverages has been widely documented. According to Silver et al. (2017), an increase in the inflation-adjusted price of most sugar-sweetened beverages was associated with a decrease in beverage sales when compared to the sales of beverages; water, fruit, vegetable, tea drinks, and plain milk whose prices were not increased. Paraje (2016) reported the consumption of sugar-sweetened beverages as price sensitive, as are non-sugar-sweetened beverages, suggesting that production subsidies could be implemented to control price increases. The study concluded that households in the lowest socioeconomic levels have higher price elasticities than those in the highest levels implying that the lowest socioeconomic group of households would experience the greatest reduction in sugar-sweetened beverage consumption. Vo et al. (2022) discovered that in comparison to baseline prices, a hypothetical 20% increase in sugar-sweetened beverage prices was predicted to reduce intentional sugar-sweetened beverage purchases and increase non-sugar-sweetened beverage purchases in a study analyzing commonly purchased sugar-sweetened beverages in Australia. Following a review of the price elasticity of demand for major food categories, a 10% increase in the price of soft drinks could result in an 8-10% decrease in purchases (Andreyeva, Long, & Brownell, 2010).

According to Paulsen et al. (2016), between 2010 and 2011, Norwegian adults' beverage consumption differed between weekdays and weekends. Higher education was linked to a healthier beverage consumption pattern, but also to increased alcohol consumption. Higher age was strongly associated with coffee, tea, and wine consumption, whereas younger age was associated with water and sugar-sweetened beverages consumption. When revising dietary guidelines, knowledge about beverage consumption patterns in the general population and subgroups of the general population may be considered.

Nielson and Popkin (2004) explored changes in American beverage consumption between 1977 and 2001, concluding that sugar-sweetened beverage percentages increased in per capita consumption while fluid milk consumption decreased in every location and age group.
The average beverage consumption varies by age, gender, and race/ethnicity, according to Storey et al. (2006) concluding that the differences in beverage consumption patterns must be recognized by food and nutrition professionals as well as nutrition policymakers.
Several of these differences in beverage consumption could be attributed to difficult-to-measure factors such as cultural differences or a higher prevalence of physiological conditions such as lactose intolerance.

Chen and Gan (2022) discovered that in high-income countries, the population share of young adults had a significant positive impact on the market volume of healthy products versus unhealthy products. However, because young adults in low-income countries are heavily influenced by the marketing of unhealthy beverages and lack general health awareness, the population share of young adults in middle- and low-income countries had no significant impact on the market volume of healthy products. In extension of these findings, which looked at demographic and social factors, this study aims to examine patterns in consumption of beverage categories in relation to employment, inflation, and GDP per capita, economic changes using data from a food and beverage packaging company and national datasets compiled by the World Bank databank between 2005 and 2020.

Few studies have looked at how different beverage categories (coffee, tea, fruit drinks, sugar-sweetened beverages, and milk) differ across countries, as well as the impact of different macroeconomic trends on beverage consumption, rather than the intensity of their individual effects on the food and beverage sector.

There has been little discussion of the effect of macroeconomic factors on per capita consumption of various beverage categories, or preference for one over the other. However, observations will be made about the relationship between GDP per capita, inflation, employment, overall beverage consumption and consumption across four mutually exclusive beverage categories in the two country groups.

3 Hypothesis

Previous studies and papers have been written about beverage consumption, mostly at the national level, with most of them investigating some demographic or socioeconomic or macroeconomic deterministic factors that have an impact on beverage consumption with varying results. Macroeconomic factors have an impact on a company's performance and can lead to persistent changes in supply and demand conditions in the food and beverage industry.

Given beverage consumption volume data for 112 countries from 2005 to 2020 provided by a beverage company, and the increasing influence of macroeconomic factors, consumption patterns in all these countries are observed to be diverse due to differences in macroeconomics, population demographics, and culture. Importantly, GDP per capita influences a country's purchasing level of consumer goods, the employment rate indicates an economy's health and where most of the population is employed, consumption would rise, and the inflation rate, which explains a rise or decline in the average cost of goods or services over time and helps identify how much prices have changed over a specific period and the implications in consumption of goods and services.

The purpose of this study is to investigate the significance of the relationship between GDP per capita and beverage consumption volumes in developing economies versus developed economies. The study will primarily investigate and quantify this relationship.

The research will investigate the main hypothesis of the diverse relationship between GDP per capita, which represents the purchasing level of consumer goods, and market volumes of different mutually exclusive beverage categories in developing economies versus developed economies. When compared to beverage consumption in developed economies, an increase in GDP per capita in developing economies is expected to have a positive significant effect on consumption of the four different beverage categories.

4 Data

Data for this study was gathered from a variety of sources. The global beverage market volume dataset covers 112 countries (markets) between 2005 and 2020 and includes several beverage product parameters such as product process, package size, distribution, and packaged product type. According to the company, the unique distinct beverage product entered the panel data after being launched in each market, hence some of the beverage products were not all observed in all countries for the total duration studied. The data on beverage consumption was provided by a food and beverage processing company that operates in all 112 countries and is interested in observing macroeconomic factors that influence the varying consumption trends for different beverage products across these countries. The purpose of this research is to determine how macroeconomic factors can be used to estimate beverage consumption trends and how significant determinants can benefit forecasting procedures for future beverage consumption in various countries.
Since the market volume of multiple beverage products in various countries was tracked over a sixteen-year period, the variable of interest and additional explanatory variables are monitored for each country over the same period using data from the World Bank's online databank.

The World Bank calculates GDP per capita as the ratio of real GDP to the average (or mid-year) population of a given year, adjusted for the cost of living in each country valued in current international dollars. The indicator summarizes consumer affordability in each country and reveals the purchasing power to understand how much income the residents have realistically.
In addition to GDP per capita, this study investigated the effect of employment rate which defines the total employment to population ratio of individuals aged +15 in each country, and inflation, as measured by the GDP implicit deflator's annual growth rate, reflects the rate of price change in the economy over a given period which is meaningful in accounting for consumer goods price changes in an economy.
The additional variables investigated, the employment rate and the inflation rate, are potential macroeconomic factors that also influence changes in consumption patterns across countries. When the employment rate rises and most of the population is employed, their spending and consumption rise. The inflation GDP deflator ratio explains how the average cost of goods or

services rises or falls over time, as well as how consumption rises or falls in different countries for different beverage products.

4.1 Data Processing

The market volume per capita variable used in this study was calculated by dividing the volume of each beverage product by the total population annually and by country.
To control for observable individual characteristics that could bias estimates at the country-product level, additional explanatory variables, inflation, and employment ratio were included. The employment rate is defined as a country ratio of the proportion of working-age individuals over the age of fifteen who reported working hours in the previous week or have a working contract to the total country population. Furthermore, the inflation price change indicator represents the rate of change in consumer goods prices over a given period in each country. This combined dataset was highly varied; GDP per capita figures were reported in tens of thousands, inflation and employment ratios were reported in percentages, and market volume per capita figures were determined in tens of tens.

The marginal impact of outliers in the dataset was investigated and controlled using interquartile range (IQR) across all key numerical variables since anomalies in the dataset cause extra false positives which adversely affects the statistical outcome. Vinutha, Poornima, and Sagar (2018) used the interquartile range method to identify data points that deviate from the general pattern, concluding that removing outliers from the dataset is critical. Because there were outliers in all four numeric variables, a few sample observations from the Democratic Republic of Congo, Singapore, and the United Arab Emirates were removed from the dataset. Taiwan, Qatar, Syria, and Turkmenistan had all their observations removed completely from the dataset.

Apart from the employment rate, which was identified to be symmetrically skewed, the remaining numerical variables were found to be highly skewed. First, various transformation techniques were tried on the numerical variables, with the best performing for each variable being used to allow for conforming to regression assumptions and enabling amplified predictive power, which would improve the overall quality of the regression analysis mode. Since inflation rate data contained both positive and negative values, the logarithmic

transformation of this variable was impossible, so it was left in its original scale. Except for inflation, the remaining numeric variables were transformed using the logarithmic transformation without affecting or hindering the general linear regression assumptions required for the analysis.

4.2 Country and beverage product categorization

The hypothesis focused on investigating the macroeconomic effect on per capita market volume of different beverage categories in developing economies with lower GDP per capita when compared to developed economies.

This study included beverages consumed over an annual period from 2005 to 2020, and it reported on the process, distribution, package size, package type, and location of each beverage item consumption. All observed beverage products were systemically categorized using the USDA Food and Nutrient Database and the FAO Food Categorization System (GSFA), identifying 4 interdependently unique beverage classifications in the company data (from 19 unique beverage items) including 1) Sugar-sweetened (energy drinks, fruit flavored still drinks, lactic acid drinks, sports drinks, sweetened condensed milk, nectar, rice-nut-grain and seed-based drinks), 2) 100% juice, 3) milk (including yoghurt and cream), and 4) coffee or tea (Popkin et al., 2006: Duffey & Popkin, 2012). It should be noted that some milk, coffee, or tea may contain added sugar. Concerns about the validity of product classifications may arise as consumer lifestyles and preferences change. One factor driving current beverage sales is consumer perceptions of the health benefits of various types of beverages. Consumers, for example, are becoming more concerned about obesity and are avoiding regular soft drinks to reduce sugar and calorie intake from beverage consumption, whereas trends in diet soft drink consumption may differ due to the lack of sugar content, implying that regular and diet soft drinks could be classified as two distinct categories.

Beverage products such as beer, carbonated soft drinks, hot coffee, hot tea, spirits (20-40% alcohol), traditional cultured drinks and wine (0-19% alcohol) were not considered in the study because they do not lend themselves to carton packaging or shelf storage of main concern to the beverage company.

Except for countries like Cuba and North Korea, which are not monitored because they are not members of the IMF, the IMF World Economic Outlook classification criteria uses key global indicators of GDP valued at purchasing power parity, total exports of goods and services, and population to divide the world into two major groups: advanced economies and emerging and developing economies, using an evolving classification criterion that allows for a meaningful method of organizing large amounts of data (IMF, April 2021).

Using this same economic context, the k-means clustering algorithm was applied to the cleaned data with the intention of grouping and segmenting observations with similar trend properties to achieve separate country classes for further regression analysis, considering the feature variables for analysis; per capita market volume, GDP per capita, inflation, and employment rate across all beverage products in all countries present in the dataset. The optimal number of clusters observed in the dataset was '2' causing all the countries to be ranked into two country groups using the labels "developed" and "developing" economies. The divisive thresholds were observed across the GDP per capita levels ranging from 669 to 29,254 for developing economies and 29,320 to 83,002 for developed economies. Following the application of the clustering algorithm, regression analysis was to be performed on each cluster category to analyze the hypothesis.
The corresponding representation in Table 1 refers to the previously discussed guidelines and criteria, representing the total per capita beverage market volumes across the four beverage categories in each country group.

Table 1. Per capita beverage consumption by beverage and country classification between 2005 to 2020

Beverage Categories	**Developing Economies**	**Developed Economies**
Coffee or Tea	0.046	0.06
100% juice	0.04	0.08
Milk	0.26	0.25
Sugar-sweetened	0.25	0.22

Overall, per capita beverage consumption of milk and sugar-sweetened beverage categories was observed to be predominant across the two country groups, with developing economies having a slightly higher consumption than developed economies. Furthermore, 100% juice

consumption was higher in developed economies as well as coffee or tea beverages, though that variation was narrower between the two country groups.

4.3 Descriptive Statistics

The country-product observations in the sample, which were allotted into two cluster country groups, were subjected to descriptive statistical analysis. Immediately it was observed that the two country groups exhibited significant differences in the statistical summary metrics shown in table 2 below. The developed economies with the highest GDP per capita above 24,300 had a higher average employment of 57% than developing economies, while inflation price change rate was reversed, with a low average of 1.72% in the developed economies category compared to 4.11% in developing economies. As previously observed in the above section, developed economies have a higher per capita market volume than developing economies.

Table 2. Sample descriptive statistics of country-product observations by country groups

	Developing Economies		**Developed Economies**	
Sample size	26849		21681	
Countries	87		44	
Variables	Mean	Std. Dev	Mean	Std. Dev
Market Volume Per Capita	0.000022	0.00003	0.00003	0.000034
GDP per capita	14540	7450	44034	10518
Employment Ratio	55.8	9.48	57.7	5.8
Inflation Rate	4.11	2.98	1.72	1.88

4.4 Model Specification

To investigate the effect of GDP per capita, employment rate, and inflation price change rate on the per capita market volume of beverage products in the two country cluster groups, a fixed-effects methodology was implemented using a panel dataset in the period 2005–2020 on individual country-product observations for each category.

$$\ln (\mathrm{MVPC})_{\mathrm{ipt}} = \beta_0 + \beta_1 \ln(\mathrm{GDPPC})_{\mathrm{it}} + \beta_2 \ln(\mathrm{ER})_{\mathrm{it}} + \beta_3 \mathrm{Inf}_{\mathrm{it}} + \theta_{ip} + \pi_t + \varepsilon_{\mathrm{ipt}}$$

Where $MVPC_{\mathrm{it}}$ stands for the market volume per capita of beverage product, *p* in country *i* of period *t*. Whereas included control variables, *ER* and *Inf* are continuous representing the total employment ratio and inflation rate respectively of a given country *i* in period *t*.
The main independent variable GDPPC denotes the per capita GDP of each country *i* in year *t*. The variables θ_{ip} and π_t are country-product and time fixed effects, respectively and $\varepsilon_{\mathrm{it}}$ are idiosyncratic errors that are uncorrelated with X_{it} representing the residual error of regression and it captures the variance in the outcome variable market volume per capita.

To address the potential unobserved heterogeneity problem caused by any correlation between the time-invariant unobserved features in the error term and the independent variable, a fixed effects specification is used since the model yields unbiased standard errors whenever the country effect is permanent. The fixed effects model removes the part that is fixed and unique to the individual item, leaving only the variation of that individual item over time.

A fixed effects model outperforms the random effect model when there exist biased estimates if the time-invariant element of the error term is correlated with the independent variables since it is impossible to observe all the independent variables that influence the outcome variable. In contrast to fixed effects models, random effects models assume that time-invariant unobserved heterogeneity has no relationship with any of the independent variables (Wooldridge, 2015).

Standard errors are used at the product and country levels to control for a potentially correlated error term (autocorrelation). Whether the country-product and time effects are permanent or temporary, standard errors clustered on two dimensions 'year' and individual 'country-product' are unbiased and produce appropriately sized confidence intervals (Petersen, M. 2009).

Furthermore, evaluating the above intuition with the F-statistic for the inclusion of both individual and time effects in the model yielded statistically significant results for the regression procedure used.

5 Empirical Findings

5.1 All beverage products in each country group

Table 3 shows the estimated results of the multiple linear regression used to investigate the relationships between the dependent variable and the independent variables for each country group and all products. The variables are introduced on a logarithmic scale, with the exception of the inflation rate, which has both negative and positive values.

Table 3. All beverage products

Covariates	**Developing Economies**		**Developed Economies**	
	β (s.e)	**p-value**	**β (s.e)**	**p-value**
log (GDPPC)	0.82 (0.0573)	0.0000	0.37 (0.1157)	0.001
log (ER)	-0.12 (0.0778)	0.13	0.19 (0.1628)	0.23
Inflation	9.9e-07 (0.0021)	0.9996	-0.0114 (0.0028)	0.0000
Within R-squared	0.0685		0.0027	
Country-product fixed effect	Yes		Yes	
Time (Year) fixed effect	Yes		Yes	
Robust standard errors	Yes		Yes	
Observations	26186		21123	

Note: Control variables: Employment ratio and inflation rate. The robust standard error is indicated in parentheses.

The findings show that the coefficients for the independent factors differ for developing and developed economies and in some cases, the disparity in coefficients for the same independent variable is significant. The coefficient for GDP per capita (logarithm) predicting per capita beverage volume in developing economies is 0.82(sign. = 0.0000) and 0.37(sign. = 0.001) in developed economies, suggesting that the coefficient is 0.45 times stronger in developing economies. When comparing the inflation coefficient for predicting per capita beverage volume, it is negative and significant (β=-0.0114, sign. = 0.0000) for developed economies, but not for developing economies. The employment (logarithm) coefficient is

negative in developing economies and positive in developed economies (β=-0.12, sign. = 0.13; β=0.19, sign. = 0.23). The results demonstrate that as GDP per capita rises, so does per capita beverage volume in both developing and developed economies. With increasing inflation, the per capita beverage volume decreases in developed economies but not in developing economies. In both country groups, the employment factor had no detectable effect on overall beverage consumption.

5.2 Different beverage categories in each country group

Table 4 displays the estimates of the relationships between the variables (on a logarithmic scale), except for inflation, between the two country groups and across the different beverage categories.

Table 4. Different Beverage Categories in both Country Groups (2005-2020)

Covariates	**Milk**		**Coffee or Tea**		**Sugar-sweetened**		**100% juice**	
	β (s.e)	**p-value**	**β (s.e)**	**p-value**	**β (s.e)**	**p-value**	**β (s.e)**	**p-value**
Developing economies								
log(gdpc)	0.63 (0.08)	0.0000	1.37 (0.24)	0.0000	0.88 (0.09)	0.0000	0.78 (0.17)	0.0000
log(employment)	-0.07 (0.11)	0.52	0.95 (0.35)	0.01	-0.29 (0.13)	0.03	-0.62 (0.23)	0.01
inflation	-0.004 (0.003)	0.16	-0.007 (0.009)	0.42	0.0007 (0.004)	0.85	0.02 (0.007)	0.004
Developed economies								
log(gdpc)	0.06 (0.1355)	0.65	1.12 (0.5555)	0.04	0.62 (0.2255)	0.01	0.35 (0.2609)	0.18
log(employment)	-0.05 (0.2048)	0.81	0.27 (0.6809)	0.40	0.23 (0.3158)	0.46	0.98 (0.4068)	0.02
inflation	1.9e-05 (0.0039)	0.99	-0.0256 (0.0096)	0.01	-0.0223 (0.0053)	0.0000	-0.0066 (0.0064)	0.30

Note: Control variables: Employment ratio and inflation rate. Robust standard error indicated in parentheses. Country-Product fixed effects and Year (Time) fixed effects included.

5.2.1 Beverage product categories in developing economies

The findings in Table 4 show that the coefficients of the independent variables differ for the different beverage categories, with some variables showing a significant difference between beverage categories and country groups. In developing economies, the coefficients for GDP per capita (logarithm) predicting per capita market volume are positive and highly significant for all four beverage categories, with the largest effect observed in coffee and tea beverages (β=1.37, sign. = 0.0000), followed by sugar-sweetened beverages (β=0.88, sign. = 0.0000) and the smallest effect in milk (β=0.63, sign. = 0.0000).

The employment (logarithm) coefficient is negative and significant effect for both sugar-sweetened and juice beverages, with the juice category having the greatest negative effect, on the other hand, it indicates a positive and significant impact on coffee and tea beverages (β=0.95, sign. = 0.01). However, in developing economies, the employment factor seems to have no effect on the milk beverage category.

Only the juice beverage category showed a positive significant effect for the inflation factor in predicting per capita beverage volumes in developing economies (β=0.02, sign. = 0.004). The inflation factor had no effect on the other three beverage categories.

The results confirm that with growing GDP per capita, the per capita beverage volume of the four mutually exclusive beverage categories increases for developing economies representing countries with a GDP per capita less than $25,000. The differences between the coefficients of employment and inflation across the four beverage categories are substantial, indicating different forms of asymmetries among the consumption. For example, with rising employment, coffee and tea beverages consumption increases whereas there's reduced consumption for both sugar-sweetened and juice beverage categories. With a rising inflation rate, the per capita beverage volumes of juice beverages would increase for developing economies.

The results indicate that as GDP per capita rises, so does the per capita beverage volume of the four mutually exclusive beverage categories for developing economies represented by countries with GDP per capita less than $25,000. The differences in employment and inflation coefficients across the four beverage categories are significant, indicating different types of consumption asymmetries. For example, as employment increases, so does consumption of coffee and tea beverages, while consumption of sugar-sweetened and juice beverages decreases. With rising inflation, developing economies' per capita beverage volumes of juice beverages would rise.

5.2.2 Beverage products categories in developed economies

In developed economies, the GDP per capita (logarithm) coefficients show a positive and significant effect for both coffee and tea beverages and sugar-sweetened beverages (β=1.12, sign. = 0.04; β=0.62, sign. = 0.01 respectively).

The employment (logarithm) coefficient for juice beverages is positive and significant (β=0.98, sign. = 0.02), but has no effect on milk, coffee or tea, or sugar-sweetened beverages.

For this country group, the inflation rate coefficients are both negative and significant for sugar-sweetened and coffee or tea beverages (β=-0.0223 and β=-0.0256, respectively), but there is no effect on consumption of both milk and juice beverage categories.

The findings also confirm the disparity in beverage consumption across different beverage categories. An increase in GDP per capita has a positive effect on coffee or tea consumption and sugar-sweetened beverages, whereas an increase in inflation rate has a negative effect on consumption of those two beverage categories.

Increased employment only has a positive effect on juice beverage consumption in developed economies with GDP per capita ranging between $25,000 and $83,000. Significant effects are less likely in developed economies than in developing economies, particularly in the milk beverage category in developed economies.

6 Discussion

The main objective was to (i) identify the relationship between the macroeconomic factors and beverage consumption volumes of all beverage products between the two segmented country groups over time; (ii) identify significant effects on consumption of different beverage categories in developing economies compared to developing economies.

The findings support the hypothesis about the relationship between developing economies' GDP per capita and market volumes of all beverage products compared to market volumes in developed economies. The relationship is positive for both country groups, but the GDP per capita factor predicts general beverage consumption two times higher in developing economies than in developed economies. In developed economies, inflation had a negative relationship with overall beverage consumption but had no effect on beverage consumption in developing economies. By categorizing beverage products into similar product groups, such as 100% juice, coffee or tea, sugar-sweetened, and milk beverages, a deeper analysis of the relationship between each beverage category and the various macroeconomic factors compared in both country groups was possible because of the larger sample sizes. The observed changes in per capita consumption of individual beverage categories were complex. Importantly, the study demonstrated that the relationship between macroeconomic factor of interest, GDP per capita, and per capita market volumes across the four beverage categories in developing economies is significant and positive. The relationship between each beverage category and GDP per capita was found to be positive, with coffee or tea beverages experiencing the greatest increase in consumption, a growth of 1.37%, followed by sugar-sweetened beverages at 0.88% and 100% juice at 0.78%, and milk beverages experiencing the least growth, 0.67%, from a one percent increase in GDP per capita. GDP per capita had a positive and significant effect on coffee or tea and sugar-sweetened beverages in developed economies, with a one percent increase in the macroeconomic factor increasing consumption of coffee or tea beverages by 1.12% and sugar-sweetened beverages by 0.62%.
According to the findings, consumption of beverage categories rises more rapidly in developing economies, with coffee or tea products rising the most, followed by sugar-sweetened products and 100% juice. Milk consumption is growing, but at a slower rate than consumption of other products. Beverage consumption in developed economies is increasing, with coffee or tea beverages leading the way, followed by sugar-sweetened beverages, but at a

slower rate than in the other country group. The findings above are consistent with those of Gerbens-Leenes et al. (2010), who found that large changes in food consumption occur for countries with relatively low annual per capita GDPs, while consumption changes in countries with higher annual GDP per capita become quite stable. According to projected dairy product consumption levels to 2050, global milk consumption will steadily decline, at least in developed countries (Kearney, 2010). According to Cavadini et al. (2000), while milk consumption in the United States fell steadily from 1965 to 1996, it was matched by rising demand for carbonated beverages like soft drinks and juices. According to Ng & Popkin (2007), milk consumption is steadily increasing in low-income developing countries, driving the global growth in the production and consumption of these beverages. The use of clustering to identify and group product-country observations based on trends between beverage market volumes and macroeconomic factors distinguishes the current study, resulting in larger sample sizes for comparison of these relationships rather than considering individual country observations and the categorization of similar beverage products.

When it comes to the employment macroeconomic factor, coffee or tea beverages had the greatest positive increase of 0.95%, while 100% juice had the greatest decrease of 0.62%, and sugar-sweetened beverage consumption fell by 0.29% in developing economies. In developed economies, 100% juice consumption had the only significant and positive effect of 0.98% given a one percent increase in employment ratio, which was an expected observation. The rising employment in developing economies increasing the consumption of coffee or tea beverages implies a preference for these ready-to-drink mixed products over other beverages such as milk and 100% juice, whose consumption is also frequently associated with consumption of coffee or tea such as during breakfast. Growth in a country's employment rate would indicate an expected increase in future income at the country level as a higher proportion of the population receives compensation for their services and worth demonstrated when employed. As a country's employment rate rises, so does its economic growth, which might cause consumption prioritization in the purchase of luxurious goods over the purchase of necessities such as food and beverages. According to Dave and Kelly (2012), a higher unemployment rate is associated with less consumption of fruits and vegetables, with estimates indicating increased consumption of unhealthy foods such as snacks and fast food. It is worth noting that employment had a negative effect on the consumption of 100% juice and sugar-sweetened beverages, but a positive effect on coffee or tea beverages in developing economies. After controlling for socio-demographics, Baeur et al. (2012) discovered that full-

time employed parents reported fewer family meals, less frequent encouragement of their adolescents' healthful eating, lower fruit and vegetable intake, more frequent sugar-sweetened beverage consumption by parents, and less time spent on food preparation than part-time and non-employed parents.

The model further pointed to price changes over time affecting the consumption for some of the beverage categories. In the case of policy decisions such as those involving taxation or subsidies, parameters of consumption for a category of products (e.g., 100% juice, coffee or tea) are necessary to predict the magnitude of policy-induced changes in consumer demand. Only the consumption of 100% juice was shown to have a positive and significant relationship with the inflation rate factor in developing economies, implying that consumption of 100% juice would increase with an increase in the macroeconomic factor.
In contrast, the consumption of coffee or tea, and sugar-sweetened beverages had a negative and significant relationship with the inflation rate factor, implying that consumption decreased as the inflation price change rate increased in developed economies. The results suggest healthier beverage purchasing behaviour in response to price changes in developing economies. When prices rise, the availability of healthy and safe potable water on tap in developed economies such as North America, most of Europe, Australia, and New Zealand may influence the decline in beverage consumption when compared to consumption in developing economies that lack access to clean and healthy water.
The findings contradict Stewart et al. (2021) who discovered no evidence that changes in beverage prices affected the magnitude of consumption trends between milk and other major beverage categories. The consumption of sugar-sweetened beverages and coffee or tea beverages in developed economies is price sensitive, implying that the implementation of taxes, demand-pull inflation or cost-push inflation resulting in rising price changes on said beverages could effectively lead to a reduction in consumption in developed economies.
A higher price elasticity observed for sugar-sweetened soft drinks is encouraging, as this is the category most suitable for a tax (Powell et al., 2013). Other beverage categories may compete with milk products in ways other than price. Okrent and MacEwan (2014) have previously demonstrated that advertising by a diverse range of beverage manufacturers, including producers of classic beverages such as bottled water and 100% juice, can divert consumers' attention away from milk, aside from price changes.

Furthermore, the finding that the composition of beverage consumption in developed economies is less likely to change in response to changing economic conditions implies that there is an abundance of supply of these products, emphasizing the need for accurate per capita market volume forecasts to meet rising demand in developing countries. According to Ebru and Neslihan (2013), to increase milk consumption in a country, milk production and supply should be increased, and promotion and education programs about the benefits of milk should be developed for consumers of all ages.

Okrent and MacEwan (2014) have previously demonstrated that advertising by a diverse range of beverage manufacturers, including producers of traditional mainstays such as bottled water and 100% juice, can divert consumers' attention away from milk.

7 Conclusion

Understanding the various relationships between macroeconomic factors and beverage consumption is critical for food and beverage companies as well as many other institutions because it is necessary to account for consumption changes as the economic environment changes across different countries. As a result, the purpose of this study was to examine the impact of various macroeconomic factors on countries' beverage consumption, to determine which macroeconomic factors are important in driving consumption. Data from 112 countries is analysed using fixed effects panel data models for beverage product categories in developing economies and other developed economies separately from 2005 to 2020 (inclusive). From these standpoints, this paper adds to the existing literature by attempting to analyse data from all countries in the world over a recent sixteen-year period, with countries classified according to their GDP per capita levels.

It can be concluded that an increase in GDP per capita in developing economies would increase beverage market volumes across all four beverage categories, whereas in developed economies, this would only increase beverage market volumes in coffee or tea and sugar-sweetened beverage categories. Similarly, when compared to other beverage categories, consumption of coffee or tea and sugar-sweetened products had the greatest effect from GDP per capita in both countries. In contrast to developing economies, effects in developed economies are less explanatory, with fewer significant effects on beverage consumption. Compared to the positive GDP per capita effect on beverage consumption in both country groups, employment and inflation had very different effects on different beverage categories. In developed economies, employment had only a positive effect on the consumption of 100% juice products; however, in developing economies, it had a positive impact on coffee or tea beverages and a negative impact on the consumption of 100% juice and sugar-sweetened beverages. Furthermore, in developed economies, the rate of inflation had a positive impact on consumption of 100% juice beverages but a negative impact on consumption of sugar-sweetened beverages and coffee or tea beverages.
Changes in beverage consumption have been observed over a sixteen-year period in the two country groups impacted by changes in the three macroeconomic factors investigated, GDP per capita, employment rate, and inflation price change rate.

Businesses in the food and beverage industry should be fully conscious of annual changes in the economic environment as well as strategic forecasts for the growth or decline in consumption of various beverage product categories due to changes in various macroeconomic factors in countries based on their economic development levels. For example, annual forecasting of beverage volumes should consider the rise in GDP per capita to either increase or decrease consumption based on growth opportunities or challenges for different beverage categories based on a country's economic climate in the short term.

Macroeconomic factor long-term baseline projections exist for longer-term market volume forecasts, which food and beverage companies can use to strategically plan for growth opportunities in existing individual country markets and observed emerging markets in individual countries or regions. Understanding the market scope, considering the economic, physical, and socio-demographic factors forecast changes, emerging opportunities, and challenges can be strategically planned for to maintain competitive advantages over competing businesses and expand business growth.

There are several disadvantages to using cross-country data in this study. It is impossible to control for individual behavior, so that while overall trends are consistent, consumption among some groups may be more sensitive to economic changes than others, with significant negative consequences for health outcomes (Black and Ruhm, 2002).

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Appendix

APPENDIX A Definition of beverage consumption countries from 2005 to 2020

APPENDIX B Non-alcoholic beverage category definition

1. Sugar-sweetened beverages (SSBs) includes all sodas, fruit drinks, sport drinks, low-calorie drinks, and other beverages [sweetened tea, rice drinks, bean beverages, sugar cane beverages].

a) Sport drink includes all energy drinks (energy drinks, sports drinks: 2 items).

b) Fruit drink includes all fruit drinks, fruit juices, and fruit nectars with added sugar (fruit flavoured still drinks, nectar: 2 items).

c) Soda includes all carbonated beverages with added sugar (lactic acid drinks: 1 item).

d) Other SSBs include sweetened tea, rice drinks, bean beverages, sugar cane beverages, etc (rice-nut-grain and seed-based drinks, sweetened condensed milk: 2 items).

2. Milk includes all whole, low-fat, skim milk, and flavoured milk (flavoured milk, white milk, buttermilk, drinking yoghurt, liquid cream, soy milk, non-dairy cream, evaporated milk, baby & toddler dairy drinks: 9 items).

3. 100% Juice (FJ) includes all 100% juices (e.g., apple and orange) and all unsweetened juices (Juice: 1 item).

4. Coffee or tea includes all coffee drinks and unsweetened teas (tea-based drinks, coffee-based drinks: 2 items).

List of Developing Economies in the Sample (n=87)

Albania	Hungary	Poland
Algeria	India	Portugal
Angola	Indonesia	Republic of Korea
Argentina	Iraq	Romania
Bangladesh	Iran	Russia
Belarus	Israel	Rwanda
Bosnia and Herzegovina	Jordan	Senegal
Botswana	Kazakhstan	Serbia
Brazil	Kenya	Slovakia
Bulgaria	Kyrgyzstan	Slovenia
Cambodia	Latvia	South Africa
Cameroon	Lebanon	Spain
Chile	Libya	Sri Lanka
China	Lithuania	Sudan
Colombia	Malawi	Tajikistan
Costa Rica	Malaysia	Tanzania
Côte d'Ivoire	Mexico	Thailand
Croatia	Moldova, Republic of	Tunisia
Cyprus	Morocco	Turkey
Czechia	Mozambique	Uganda
Democratic Republic Congo	Myanmar	Ukraine
Dominican Republic	Namibia	Uzbekistan
Ecuador	New Zealand	Venezuela
Egypt	Nicaragua	Vietnam
El Salvador	Nigeria	Yemen
Estonia	North Macedonia	Zambia
Ghana	Pakistan	Zimbabwe
Greece	Panama	
Guatemala	Peru	
Honduras	Philippines	

List of Developed Economies in the Sample (n=44)

Australia	Lithuania*
Austria	Malaysia*
Bahrain	Netherlands
Belgium	New Zealand*
Canada	Norway
Croatia*	Oman
Cyprus*	Panama*
Czechia*	Poland*
Denmark	Portugal*
Estonia*	Republic of Korea*
Finland	Romania*
France	Russia*
Germany	Saudi Arabia
Greece*	Singapore
Hong Kong	Slovakia*
Hungary*	Slovenia*
Ireland	Spain*
Israel*	Sweden
Italy	Switzerland
Japan	United Arab Emirates
Kuwait	United Kingdom of Great Britain & Northern Ireland
Latvia*	United States of America

Note: * denotes countries in both country groups (n=20)