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Consumption Patterns of Sugar-Sweetened Beverages in Indonesia

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Abstract

Indonesia is undergoing a nutrition transition toward processed foods and beverages, which means there should be a better understanding of the consumption patterns of sugar-sweetened beverages (SSBs) in the country. However, only a few studies have used nationally representative and longitudinal data to analyze such patterns. This study aims to fill the gap by analyzing the consumption patterns of SSBs using the last four waves of the Indonesian Family Life Survey. The results showed that the expenditure share for SSBs is comparatively small relative to other foods expenditure. In particular, the expenditure share in Java-Bali is higher than in provinces outside this region. The average age of household members, real household expenditure, household size, and household average years of schooling are correlated to SSB consumption. Therefore, policies that explicitly target factors influencing SSB-related spending are required to initiate changes in consumer preferences from SSBs to healthier foods and beverages.

Keywords: Sugar-sweetened beverages, household expenditure, consumption patterns, Indonesia, panel analysis

1. Introduction

Many countries are monitoring nutrient intake from sugar-sweetened beverages (SSBs) using national nutrition surveys, the results of which have been used to develop and implement nutritional policies that reflect changes in dietary consumption (Aburto, Poti, & Popkin, 2018; Han & Powell, 2013; Laverty, Magee, Monteiro, Saxena, & Millett, 2015; Lim, Lee, Choue, & Wang, 2018; Russo, Northridge, Wu, & Yi, 2020; Vercammen, Moran, Soto, Kennedy-Shaffer, & Bleich, 2020). Socioeconomic characteristics, such as household income level, ethnicity/race, and education, are also used in those studies to examine the determinants of SSB consumption.

While SSB consumption has decreased in developed countries in recent years, it has shown an increasing trend in developing countries. In a developed country like the US, the overall prevalence of heavy SSB intake declined significantly from 2003 to 2004 and from 2015 to 2016 for both children and adults (Vercammen et al., 2020). Han and Powell (2013) also found a decreasing trend of SSB consumption among adolescents (from 22% to 16%) and young adults (from 29% to 20%) from 1999 to 2000 and from 2007 to 2008. Meanwhile, in Mexico, a developing country, a significant increase in per-capita and per-consumer intake of total SSB has been found over the 1999–2012 period among school-aged children and women (Aburto et al., 2018). Lim et al. (2018) also reported an increasing trend of SSB consumption in South Korea from 1998 to 2009.

Furthermore, Han and Powell (2013), Russo et al. (2020), and Vercammen et al. (2020) consistently found higher consumption rates of SSB in lower socioeconomic and ethnic minority groups in the US based on data from the National Health and Nutrition Examination Survey during the last decade. In the UK, Laverty et al. (2015) reported higher consumption of SSBs

in lower socioeconomic and ethnic minority groups based on data from the Millennium Cohort Study. Interestingly, results from two Indonesian studies have shown different results from those in the US, UK, and Mexico (Bourke & Veerman, 2018; Daeli & Nurwahyuni, 2019): low-income groups consume lower amounts of SSBs than high-income groups. This result is supported by the findings of Daeli and Nurwahyuni (2019) who reported that low-income households consume lower SSBs than high-income households. These contrasting results indicate that the patterns of SSB consumption in developed countries vary from those observed in developing countries.

However, not all SSB consumption patterns in developed countries are different from those in developing countries. For instance, Russo et al. (2020) revealed that age is positively associated with SSB consumption across most races/ethnicities in the US, whereas female gender is negatively associated with water intake. In Indonesia, members of the older population spend more money on SSBs, as do males, who tend to spend more on SSBs than females (Daeli & Nurwahyuni, 2019). Therefore, it would be interesting to explore the patterns of SSB consumption, especially in a highly diverse country like Indonesia.

In 2015, Indonesia had the third highest consumption of SSBs (20.23 liter/person) among ASEAN countries (Ferretti & Mariani, 2019). Indonesia's SSB consumption was behind Singapore (76.32 liter/person) and Thailand (59.81 liter/person). According to an analysis of 32 cities in Indonesia, the most frequently consumed SSB in 2016 is ready-to-drink tea (Laksmi et al., 2018). Understanding the pattern of SSB consumption is important because Indonesia is undergoing a nutrition transition (Shrimpton & Rokx, 2013; Vaezghasemi, 2017) characterized by a lower expenditure share for staples/rice, smaller shares of self-produced food, higher consumption of packaged foods, some animal products, readymade meals, and SSBs (Colozza & Avendano, 2019). This transition can potentially affect public health policies conducted by the government.

However, few studies have used nationally representative and longitudinal data to analyze the consumption pattern of SSBs in Indonesia. For instance, Daeli and Nurwahyuni (2019) used the National Socio-Economic Survey (Susenas) 2017 data to identify the determinants of SSB consumption. From their sample of 279,331 households, 187,691 (67.19%) have reported spending on SSBs. Age, gender, marital status, education, occupation, area of residence, and economic status consistently contribute to increased household expenditure and consumption of sweetened drinks. Another study (Laksmi et al., 2018) found a low intake of SSBs among participants in 32 cities in May 2016, although 24% of children, 41% of adolescents, and 33% of adults reported consuming at least one serving per day.

Other studies only observed the consumption pattern of SSBs in specific regions. For example, Green et al. (2019) used a sample of 594 children in Bandung, Indonesia to assess the prevalence and patterns of consumption of commercially produced snack foods and SSBs between January and March 2018. They found that among the children in the sample, 81.6% consumed commercial snack foods and 40.0% consumed SSBs in the day prior to the interview. Drinks made of sweetened milk and sweetened tea were the most common beverages consumed. They also found that the factors associated with SSB consumption were child age and consumption of a commercially produced complementary food or breastmilk substitute.

Amid this background, our study aims to analyze the consumption patterns of SSBs in Indonesia and their determinants based on multiple waves of the Indonesia Family Life Survey (IFLS) data. To the author's knowledge, this is the first study using panel data to analyze the consumption pattern of SSBs in Indonesia. Employing panel data enables us to obtain deeper insights into the consumption patterns of SSBs in Indonesia and their determinants. Studying such patterns will provide additional references for policymakers as they design and implement better food policies.

2. Overview of the SSB Industry in Indonesia

The SSB industry in Indonesia, particularly soft drinks, has experienced negative demand shock following the COVID-19 pandemic, which resulted in a revenue drop of around 11% revenue in 2020 (Statista, 2021). However, the industry's revenue and volume are expected to rebound by an average of 5.76% annually from 2021 to 2026 and by 4.6% in 2022 alone. Nevertheless, a market forecast predicts that sales will not return to their pre-pandemic level for a while (Euromonitor International, 2021).

According to Statista, around 44% of soft drinks revenue in Indonesia comes from non-carbonated drinks, such as ready-to-drink tea. However, the share of carbonated soft drinks is on the rise with an expected revenue share of 27% in 2026, almost double the 2013 figure. Despite the fact that the pandemic has forced limited movements, most sales still come from offline rather than online retailers. Particularly, the bulk of revenues (~70%) in 2021 came from purchases for home consumption. Price-wise, the average soft drink's price is relatively stagnant at around USD1.3 per unit.

In terms of demographics, about 60% of soft drink consumers in Indonesia are aged 18 to 34 years. The majority of consumers (44%) are categorized as having high income (Statista, 2021), and when combined with middle-income consumers, the share increases to 78%. Finally, there is a slight gender difference in which the share of male consumers (53%) is higher than that of their female counterparts (47%).

The market for SSBs is directly related to the food sweetener industry, where the latter is changing the demand toward non-caloric sweeteners. Such a change is attributed to the growing obese population and the general concern toward healthy living. This, in turn, is expected to increase the market by an annual rate of 4.5% (Mordor Intelligence, 2021).

3. Methods

3.1. Sample and Data

This study used longitudinal data from the last four waves of the IFLS. The IFLS is a socioeconomic and health survey, whose sample represents about 83% of the Indonesian population living in 13 of the country's 26 provinces. The first wave, IFLS-1, was conducted in 1993–1994, followed by IFLS-2 in 1997–1998, IFLS-3 in 2000, IFLS-4 in 2007–2008, and IFLS-5 in 2014–2015 (Strauss, Witoelar, & Sikoki, 2016). IFLS data are accessible from the RAND Corporation website. The data are open access for registered users and have been used in hundreds of research undertakings since 1995; in 2021 alone, 12 published journal articles used IFLS data (RAND, 2022). In addition, we also used the consumer price index to deflate expenditure data when needed.

However, one of the limitations of the IFLS is that it does not provide detailed information on who (the individual) consumes SSBs; therefore, this study is limited only to observations at the household level. The dataset also does not specify what kinds of SSBs are consumed. At most, we can only infer from the questionnaire that the SSBs are soft drinks, which include carbonated water and ready-to-drink tea.

3.2. Variables

We used household-level data from IFLS-2 to IFLS-5 as our sample. Particularly, we were interested in household expenditures for both food and non-food items, as stipulated in the Consumption Section of Book 1. We excluded the consumption module from IFLS-1 because it was not comparable to the rest of the survey. The food expenditure is grouped into ten types of food, as shown in Table 1.

Table 1. Food Item Classification

Food Type	Example
Staple Food	Rice, corn, cassava
Vegetables and Fruits	Spinach, beans
Meat and Animal Products	Beef, mutton
Fish	Fresh fish, salted fish
Dried Food	Noodles, cookies
Condiments	Garlic, chili sauce, cooking oil
Sugar-Sweetened Beverages	Soft drinks
Tobacco	Betel nut, cigarettes, tobacco
Other Beverages	Coffee, tea, cocoa
Other Food	Tofu, tempeh, prepared food

To complement the expenditure data, we used household information (e.g., household size) and individual information aggregated at the household level (e.g., the proportion of household members aged 10–30 years). The data for these were taken from the AR Section of Book K (the Control Book) and from the KK section of Book IIIB (Health Conditions). Table 2 provides a short description of the variables used in this study.

Table 2. Descriptions of variables

Variable	Measurement unit	Description
Share of expenditure	Proportion (0 to 1)	Food expenditure by type of food relative to total household expenditure (including non-food items)
Age	Continuous (years)	Age of household member
Real household expenditure	Continuous (million Rupiah)	Household expenditure deflated by the consumer price index
Household size	Discrete (a minimum of 1 individual per household)	Number of people living in the household during the survey
Years of schooling	Discrete (from 0 if never went to school to 22 if completed a doctorate)	The average length of schooling attended by household members
Share of young adults	Proportion (0 to 1)	The number of household members aged 10–30 years relative to household size
Healthy	Proportion (0 to 1)	The number of household members that feel very healthy or somewhat healthy relative to household size

3.3. Statistical Analysis

We started with a descriptive analysis to demonstrate the changes in consumption patterns. Then, we estimated the effect size by geographical location before using use panel fixed effects to show the correlation between demographic characteristics with average spending for each food group and then for beverages and granulated sugar. Furthermore, we ran a robustness analysis by re-estimating the model using a balanced panel and dividing the observations into subsamples based on whether the households lived in urban or rural districts.

3.3.1. Effect size: Cohen's d and Hedges' g

Effect size refers to a number that reflects the magnitude of the relationship between two variables or groups. For example, if a study reports

the mean and standard deviation for the treated and control groups, we might compute the standardized mean difference between groups. As suggested by Cohen (1988) and Glass (1976), the standardized mean difference can be obtained by dividing the mean difference in each variable or group by the standard deviations of those variables or groups.

Let μ_1 and σ_1 be the true (population) mean and standard deviation of the first group, respectively, and let μ_2 and σ_2 be the true (population) mean and standard deviation of the other group, respectively. If the two population standard deviations are the same (as is assumed in most parametric data analysis techniques) so that $\sigma_1 = \sigma_2 = \sigma$, then the standardized mean difference parameter or population standardized mean difference is defined as:

$$\delta = \frac{\mu_1 - \mu_2}{\sigma}. \quad (1)$$

We can estimate the standardized mean difference (δ) from studies that used two independent groups as follows:

$$d = \frac{\bar{Y}_1 - \bar{Y}_2}{S_{Within}} \quad (2)$$

In the numerator, $\bar{Y}_1$ and $\bar{Y}_2$ are the sample means in the two groups, respectively. In the denominator, S_{Within} is the within-groups standard deviation, which is pooled across groups:

$$S_{Within} = \sqrt{\frac{(n_1 - 1)S_1^2 (n_2 - 1)S_2^2}{n_1 + n_2 - 2}} \quad (3)$$

where n_1 and n_2 are the sample sizes in the two groups, respectively, and S_1 and S_2 are the corresponding standard deviations in the two groups.

This index, the sample estimate of the standardized mean difference, is often called Cohen's d in research synthesis. Confusion about the

terminology has resulted from the fact that the index δ, which Cohen originally proposed as a population parameter for describing the size of effects for statistical power analysis, is also sometimes called d.

It turns out that d has a slight bias, tending to overestimate the absolute value of δ in small samples. This bias can be removed by a simple correction that yields an unbiased estimate of δ. This estimate is sometimes called Hedges' g (Hedges, 1981). To convert d to Hedges' g, we use a correction factor, J, which is defined as:

$$J(df) = 1 - \frac{3}{4df - 1} \tag{4}$$

In this expression, df is the degrees of freedom used to estimate S_{Within}, which for two independent groups is $n_1 + n_2 - 2$. Then, we have:

$$g = J(df)d \tag{5}$$

The correction factor J is always less than 1.0; hence, g will always be less than d in absolute value, and the variance of g will always be less than that of d (Borenstein, 2009). We used these analytical tools rather than the t statistics because the effect size is not affected by the sample size. Under the t-test, the significance level increases with the sample size.

3.3.2. Panel fixed effects regression

We employed panel fixed effects regression because all our data are continuous variables. If we wanted to add some binary variables in our model, it would be more appropriate to use random effects regression. Fixed effects estimation builds on the error components model expressed as:

$$y_{it} = x_{it}\beta + \alpha_i + \epsilon_{it} \tag{6}$$

where y_{it} denotes the observed outcome of person i at time t, x_{it} is the $(1 \times K)$ vector of covariates of this person measured contemporaneously, and β is the corresponding $(K \times 1)$ vector of parameters to be estimated. Specifically,

we used the following variables for the demographic characteristics: average age within a household, the average number of people in the household, average years of education of household members, and quintile of per capita expenditure in the household. We also used robust standard error in the regressions.

The error term of this model is split into two components. Variable α_i refers to stable household-specific characteristics that are often unobserved by the researcher but frequently related to the covariates. Hence, the α_i are unobserved effects capturing time-constant household heterogeneity. The second component ϵ_{it} is an idiosyncratic error that varies across subjects and over time (Brüderl & Ludwig, 2015). However, one limitation of using fixed effects regression is that it cannot include time-invariant variables, such as geographical location, as one of its independent variables. Thus, in the robustness analysis, we re-estimated the regression model using different subsamples that are based on such variables.

4. Results and Discussion

4.1. Descriptive Analyses

Table 3 shows the overview and distribution of the households surveyed from the four waves of IFLS, as well as the recontact rates. The number of respondents successfully recontacted was high at more than 90%, thus showing the strength of the survey in terms of its tracking protocol. This also signifies the longitudinal quality of the data, as the likelihood of a bias due to non-random attrition is minimized.

Table 3. Overview of Households Surveyed, IFLS 2–IFLS 5

Information	IFLS 2 (1997)	IFLS 3 (2000)	IFLS 4 (2007)	IFLS 5 (2014)
Recontact rates	94.4%	95.3%	93.6%	92%
Number of households surveyed	7,698	10,574	13,995	16,931
Number of households completed the consumption survey	7,566	10,256	12,977	15,144

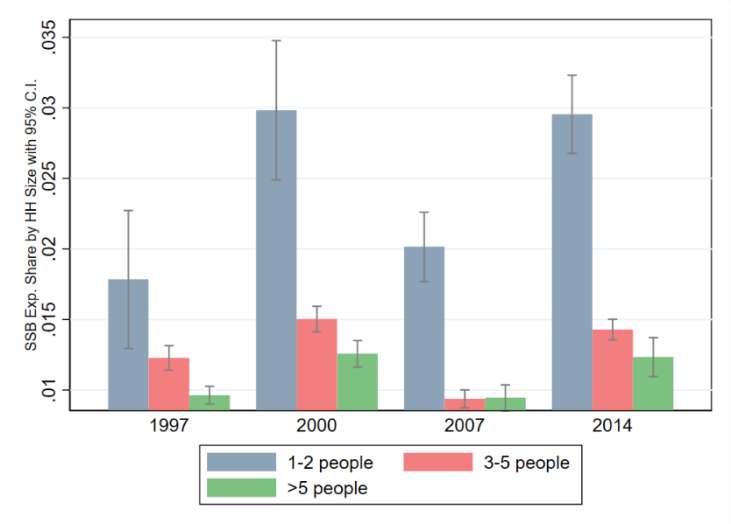
Table 4 summarizes the average spending for each type of food from the last four waves of IFLS with longitudinal household-level weight (considering attrition), as provided by the survey. The expenditure share for SSBs is comparatively small relative to other food expenditures, comprising between 0.8%–1.5% of total food expenditures during the four waves of IFLS. While Staple Food remains the largest component of food spending, Indonesians spent less on this food item, indicating a drop from around 22% to 17% of all food spending. Most groups that are usually bought in raw form, including Vegetables and Fruits, Meat and Animal Products, and Condiments, also show declining trends. This decline is compensated by increases in the Other Food category (including prepared food), tobacco, and SSBs.

Table 4. Shares in Food Expenditure by Type of Food, IFLS 2–IFLS 5

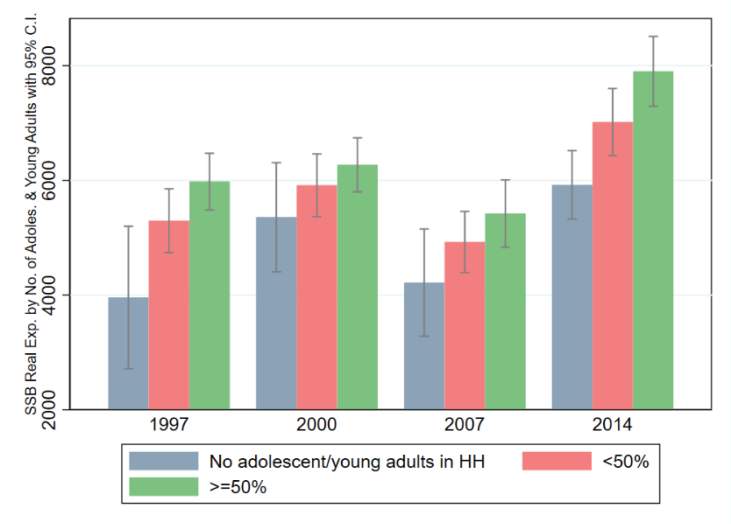
	IFLS 2 (1997)	IFLS 3 (2000)	IFLS 4 (2007)	IFLS 5 (2014)
Staple Food	0.2243	0.1805	0.1934	0.1684
Vegetables and Fruits	0.1111	0.1036	0.0820	0.0953
Meat and Animal Products	0.1100	0.1095	0.1052	0.1214
Fish	0.0745	0.0788	0.0671	0.0642
Dried Food	0.0655	0.0752	0.0805	0.0663
Condiments	0.1440	0.1417	0.1450	0.1340
SSBs	0.0116	0.0154	0.0088	0.0152
Tobacco	0.0976	0.1240	0.1265	0.1387
Other Beverages	0.0782	0.0709	0.0684	0.0699
Other Food	0.1162	0.1396	0.1483	0.1576

In Figure 1, we can see that the expenditure for SSBs (with 95% confidence interval, CI) from four waves of IFLS, along with several demographic characteristics. Figures 1a and 1c use expenditure share, while Figures 1b and 1d use real expenditure (in Rupiah). We found that smaller households with 1–2 people consistently have higher expenditure shares from 1997 to 2014 (Figure 1a). Furthermore, real expenditure is increasing with the number of young members and adolescents (ages 10–30 years) in the household (Figure 1b). Unsurprisingly, the higher the quintile for real per capita expenditure (for all goods and services, not only foods), the higher their expenditure share (Figure 1c). This observation was also confirmed when we used a household's real expenditure instead (Figure 1d).

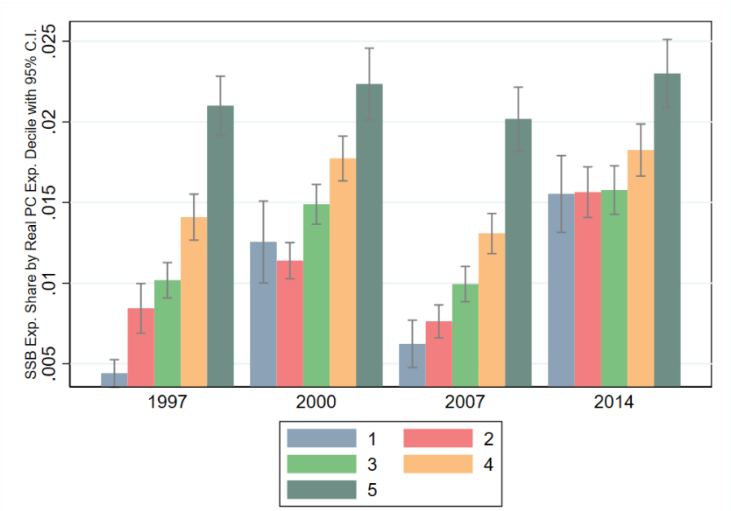
Figure 1. SSB Expenditure and Demographic Characteristics



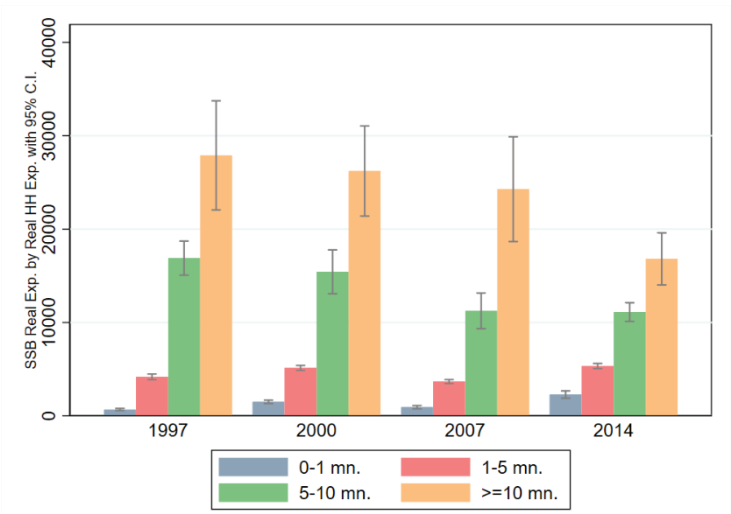
(a)



(b)


SSB Exp. Share by Real PC Exp. Decile with 95% C.I.
.005
.01
.015
.02
.025
1997
2000
2007
2014
1
2
3
4
5

(c)

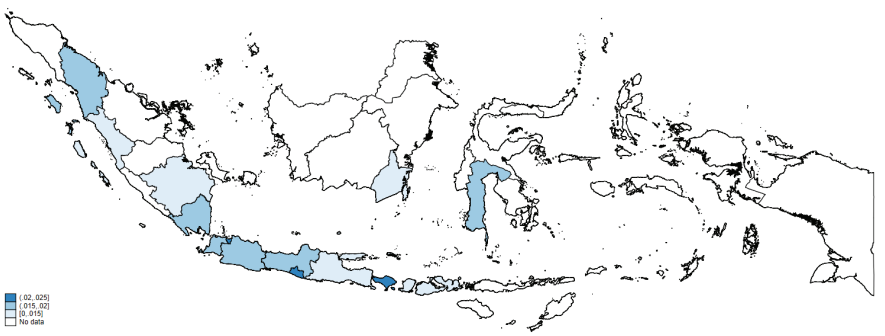

SSB Real Exp. by Real HH Exp. with 95% C.I.
0
10000
20000
30000
40000
1997
2000
2007
2014
0-1 mn.
1-5 mn.
5-10 mn.
>=10 mn.

(d)

4.2. Effect Size and Geographical Distribution

Figure 2 shows the differences in SSB expenditure share among the original IFLS provinces from the latest (5th) wave of IFLS in 2014. As can be seen, households living in provinces in Java and Bali (southern part of Indonesia) spent more on SSBs than their counterparts in Sumatera (western), Kalimantan (central), and Sulawesi (central-eastern) islands. This observation is confirmed after a two-sample *t*-test, which is significant at the 1% level. As mentioned previously, because the significance level under *t*-test statistics increases with the sample size, we used Cohen's *d* and Hedges's *g* to further test our results. The practical significance of the difference is also confirmed by both variables, which generated very similar values of around 0.12, indicating that SSB expenditure share in Java-Bali is 0.12 standard deviations higher than in provinces outside this region. This is not surprising, as food and beverage companies are mostly located in Java Island (Handayani & Kurniawan, 2021), which incidentally is also the most densely populated area in Indonesia. Therefore, Javanese consumers are more likely to spend more on SSBs because they have many available options to choose from.

Figure 2. SSB Expenditure Share by Province in 2014 (IFLS 5)



4.3. Regression Analyses

4.3.1. All food types

Table 5 shows the regression results, which include household characteristics as controls for household expenditure share for each of the food groups. Unexpectedly, the share of Staple Food in real household expenditure is decreasing, suggesting that richer households spend less on this food relative to other consumed goods and services. Current health condition generally has no or positive association with food spending share, whereas households that spend more on Fruits, Fish, and Vegetables tended to be healthier. Several groups also exhibit similar patterns in terms of average household size and age: young and small households tend to spend more on ready-to-consume foods or those that require minimum preparation, such as Dried Foods, Soft drinks, and Other Foods (which include prepared foods). Furthermore, foods that are generally bought in raw forms are usually negatively associated with lower average years of education in the household. From these, we can make a preliminary conclusion that young, small, and educated households tend to purchase more ready-to-consume foods. We summarize these findings in Table 6 below.

Table 5. Regression Results (Dependent Variable: Household Expenditure Share)

	(1) Staple Food	(2) Veg. Fruits	(3) Meat	(4) Fish	(5) Dried Foods	(6) Condiments	(7) Tobacco	(8) Other Beverages	(9) Other Foods	(10) Soft drinks
Age	0.0013***	0.0002***	−0.0010***	0.0004***	−0.0008***	0.0013***	−0.0001	0.0005***	−0.0016***	−0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Real HH expenditure	−0.0014***	−0.0004***	0.0031***	−0.0010***	−0.0001	−0.0018***	−0.0000	−0.0007***	0.0021***	0.0002**
	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0003)	(0.0001)
HH size	0.0118***	0.0033***	0.0014***	0.0043***	−0.0018***	0.0035***	0.0006	−0.0004*	−0.0214***	−0.0022***
	(0.0004)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0002)	(0.0005)	(0.0002)
Years of schooling	−0.0086***	−0.0019***	−0.0006**	−0.0016***	0.0000	−0.0041***	0.0057***	−0.0010***	0.0120***	0.0009***
	(0.0004)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0002)	(0.0005)	(0.0002)
Share of young adults in HH	0.0185***	0.0013	−0.0403***	−0.0097***	0.0002	0.0035*	−0.0268***	0.0065***	0.0388***	0.0074***
	(0.0037)	(0.0020)	(0.0026)	(0.0018)	(0.0019)	(0.0021)	(0.0036)	(0.0017)	(0.0043)	(0.0017)
Healthy	0.0029	0.0044***	0.0002	0.0049***	0.0006	−0.0011	0.0016	0.0027**	−0.0157***	−0.0002
	(0.0032)	(0.0016)	(0.0020)	(0.0015)	(0.0014)	(0.0018)	(0.0027)	(0.0013)	(0.0029)	(0.0010)
Constant	0.1382***	0.0876***	0.1500***	0.0572***	0.1025***	0.1084***	0.0947***	0.0604***	0.2100***	0.0220***
	(0.0055)	(0.0029)	(0.0037)	(0.0026)	(0.0025)	(0.0029)	(0.0048)	(0.0022)	(0.0052)	(0.0018)
Observations	62710	63309	62104	61807	63221	63397	57443	63359	63121	31372
R^2	0.0386	0.0099	0.0261	0.0206	0.0095	0.0372	0.0065	0.0074	0.1428	0.0246

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Summary of Regression Results

	Positive association	Negative association	No association
Age	1, 2, 4, 6, 8	3, 5, 9, 10	7
Real HH Expenditure	3, 9, 10	1, 2, 4, 6, 8	5, 7
Household Size	1, 2, 3, 4, 6	5, 8, 9, 10	7
Years of Schooling	7, 9, 10	1, 2, 3, 4, 6, 8	5
Share of young adults in HH	1, 6, 8, 9, 10	3, 4, 7	2, 5
Healthy	2, 4, 8	9	1, 3, 5, 6, 7, 10

Note: 1-Staple Food, 2-Vegetables and Fruits, 3-Meat and Animal Products, 4-Fish, 5-Dried Foods, 6-Condiments, 7-Tobacco, 8-Other Beverages, 9-Other Foods, 10-Soft drinks.

From Table 6, it can be inferred that all variables, except health conditions, are correlated to the expenditure share of SSBs. The average age of household members has a negative relationship with SSB expenditure, meaning the younger the average age of household members, the more they spend on SSBs/soft drinks. This result differs from that of Daeli and Nurwahyuni (2019), who found that the older population consumed more SSBs, although it must be noted that they used a different data source. The negative relationship between average household age and SSB expenditure share is also found in many types of food, including Meat, Dried Food, and Other Foods. In Section 4.3.2, we will further analyze how SSBs are different from other beverages.

We found that the higher the real household expenditure (i.e., a proxy for income), the larger its impact on SSBs spending, as shown by larger coefficient values. This result is in line with previous studies from Indonesia (Bourke & Veerman, 2018; Daeli & Nurwahyuni, 2019). Meat and Other Foods also show exactly similar patterns. This indicates that the consumption of these food items is positively and strongly associated with household income.

Household size, however, has a negative relationship with SSB expenditure share, indicating that smaller households spend more on SSBs. This negative relationship is also found in Dried Foods, Other Beverages,

and Other Foods. Meanwhile, a household's average years of schooling has a positive relationship with SSB expenditure share, indicating that more educated household members spend more on SSBs. This positive relationship is also found in Tobacco and Other Foods.

Overall, these results indicate that the nutrition transition in Indonesia is in progress, with younger-member and higher-income households spending more on SSBs and beverages in general. Increasing consumption of Dried Foods, SSBs, and Other Foods, including prepared foods, among younger and smaller households indicates that there is a changing lifestyle to a more "urbanized style" during that period. More educated and higher-income households also spend more on ready-to-consume foods and beverages, including SSBs.

4.3.2. Beverages and granulated sugar

Table 7 shows the estimation results after we ran the same model for different types of beverages and granulated sugar. Spending for SSBs/soft drinks shares similar characteristics with some other beverages. For example, SSB tends to be consumed by those with higher education, similar to Cocoa and Drinking Water (e.g., bottled water). However, it is also unique, as its spending share increases with household income (as proxied by expenditure), which is a feature not observed in other beverages.

Table 7. Regression Results for Different Types of Beverages and Granulated Sugar (Dependent Variable: Household Expenditure Share)

	(1) Granulated Sugar	(2) Coffee	(3) Tea	(4) Cocoa	(5) Soft drinks	(6) Alcoholic. Bev.	(7) Drinking Water
Age	0.0004***	0.0003***	0.0001***	−0.0002***	−0.0002***	−0.0001	−0.0002***
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0003)	(0.0000)
Real HH expenditure	−0.0011***	−0.0003***	−0.0003***	0.0003***	0.0002**	0.0021***	0.0005***
	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0006)	(0.0001)
HH size	0.0010***	−0.0005***	−0.0003**	−0.0013***	−0.0022***	−0.0061***	−0.0037***
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0012)	(0.0002)
Years of schooling	−0.0025***	−0.0008***	−0.0008***	0.0012***	0.0009***	−0.0025*	0.0032***
	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0014)	(0.0002)
Share of young adults in HH	0.0113***	0.0018	0.0038***	−0.0015	0.0074***	0.0326***	−0.0099***
	(0.0013)	(0.0011)	(0.0006)	(0.0016)	(0.0017)	(0.0118)	(0.0016)
Healthy	0.0038***	0.0005	−0.0017**	−0.0017	−0.0002	0.0052	−0.0080***
	(0.0011)	(0.0012)	(0.0008)	(0.0013)	(0.0010)	(0.0056)	(0.0013)
Constant	0.0300***	0.0178***	0.0132***	0.0132***	0.0220***	0.0478***	0.0290***
	(0.0016)	(0.0013)	(0.0014)	(0.0020)	(0.0018)	(0.0117)	(0.0021)
Observations	58326	50991	53653	10627	31372	2905	34470
R^2	0.0250	0.0055	0.0046	0.0327	0.0246	0.0211	0.0701

Notes: Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

4.4. Robustness Analysis

In this section, we further check our findings by re-estimating the model using a balanced panel and subsamples of households living in either

urban or rural districts. Table 8 shows the main result remains consistent: small and young households spend more on SSBs. Having more young adults is also positively associated with spending share for SSBs. The main difference from the previous results lies in the effect of education in which positive association is only significant in the rural subsample. Furthermore, real household expenditure is only relevant in the urban subsample, although its level of significance is only at 10%. Again, we could not find any association between SSB spending share and existing health conditions.

Table 8. Robustness Checks Regression Results (Dependent Variable: Household Expenditure Share for SSBs)

	(1)	(2)	(3)
Age	−0.0002***	−0.0002***	−0.0002***
	(0.0000)	(0.0001)	(0.0001)
Real HH expenditure	0.0002*	0.0001*	0.0001
	(0.0001)	(0.0001)	(0.0002)
HH size	−0.0022***	−0.0015***	−0.0029***
	(0.0002)	(0.0002)	(0.0003)
Years of schooling	0.0008***	0.0004	0.0013***
	(0.0002)	(0.0003)	(0.0002)
Share of young adults in HH	0.0072***	0.0064***	0.0068***
	(0.0017)	(0.0022)	(0.0026)
Healthy	−0.0001	−0.0010	0.0013
	(0.0010)	(0.0015)	(0.0014)
Constant	0.0217***	0.0220***	0.0220***
	(0.0019)	(0.0024)	(0.0029)
Observations	29634	14719	15550
R^2	0.0242	0.0125	0.0370
Sample	Balanced panel	Urban	Rural

Notes: Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

5. Conclusion

This study seeks to analyze the patterns of SSB consumption in Indonesia and their determinants. From the four latest waves of IFLS, we found that the expenditure share for SSBs ranges from 0.8%–1.5% of total food expenditures, which is comparatively small relative to expenditures spent on other types of food. Furthermore, SSB expenditure share in Java-Bali is higher than in provinces outside Java-Bali. We also found that the average age of household members, real household expenditure, household size, and household average years of schooling are determinants of SSB consumption. This result is consistent when we re-estimate the model using a balanced panel and after dividing the observations into subsamples based on whether the households lived in urban or rural districts.

Given that our results indicate higher-income households spend more on SSB, it is necessary to apply fiscal measures, such as SSB tax, to reduce this spending. A recent initiative by the Ministry of Finance to implement an SSB tax is a good starting point. During an audience with the House of Representatives in Jakarta in February 2020, the Ministry of Finance proposed that packaged sweet tea be subject to a tax of IDR 1,500 (11 US cents), while carbonated drinks, energy drinks, concentrated coffee, and similar drinks be subject to a tax of IDR 2,500 (BBC News, 2020; Kusumasari, 2020).

Moreover, the government should ensure the price stability and availability of healthy foods, such as vegetables, fruits, and fish. Finally, as real SSB expenditure is increasing with the number of young members and adolescents in the household, it is also necessary to conduct social campaigns at school or through social media (Oddo, Maehara, & Rah, 2019). These policy interventions play an important role in changing consumer preferences from SSBs to healthy food and drinks. In addition, as the expenditure share of SSBs is higher in Java-Bali, interventions to change consumption patterns among the public should focus on this region first.

As with other studies, our work has limitations. First, as our study is based on IFLS data, it does not provide detailed information on who (the individual) consumes SSBs in one household and what kind of SSBs are consumed. Therefore, we encourage future researchers who will study the consumption patterns of SSBs to incorporate other datasets, such as the multiple-year Susenas data. Another suggestion for further research is by conducting similar analyses on other food categories with additional socioeconomic determinants. This would provide more scientific evidence for future policymaking by the government of Indonesia. The study can also be extended to estimate the potential economic burdens of diseases resulting from the overconsumption of SSBs (see, e.g., Finkelstein, Chay, & Bajpai, 2014). Finally, researchers may be interested in determining the consumption patterns linked to other types of beverages, such as alcohol, and how they are related to health problems (in this journal: Komonpaisarn, 2016).

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