

ORIGINAL ARTICLE

PRICE ELASTICITY OF DEMAND AND THE IMPACT OF TAXING SUGAR-SWEETENED BEVERAGES IN MALAYSIA

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ABSTRACT

The Malaysian government implemented an excise tax of MYR 0.40 per L on sugar-sweetened beverages in July 2019. Excise tax is imposed on sweetened drinks containing more than 5 g of sugar per 100 ml, flavoured Ultra High Temperature milk-based drinks, and fruit juices with more than 7 g and 12 g of sugar per 100 ml, respectively. We analysed the impact of excise tax on the consumption of SSBs by developing a demand model for SSBs to estimate the elasticity of demand using a two-way fixed-effect model. The tax increased the price of 1 L SSBs by 8.33%, and we estimated it to decrease the consumption of SSBs by 9.25%. The estimated own-price elasticity of demand for SSBs was -1.11 (95% CI: -1.97 to -0.25). Price of SSB is a determinant for SSB demand, but income or the price of milk are not. The estimated excise revenue calculated was MYR 357.61 million. However, industry responses via product reformulation and pass-through rates could reduce revenue and enhance or reduce health impacts.

JEL classification

I1, H51, I12

Keywords: Sugar-sweetened beverages, price elasticity of demand, excise tax, Malaysian government, excise revenue.

INTRODUCTION

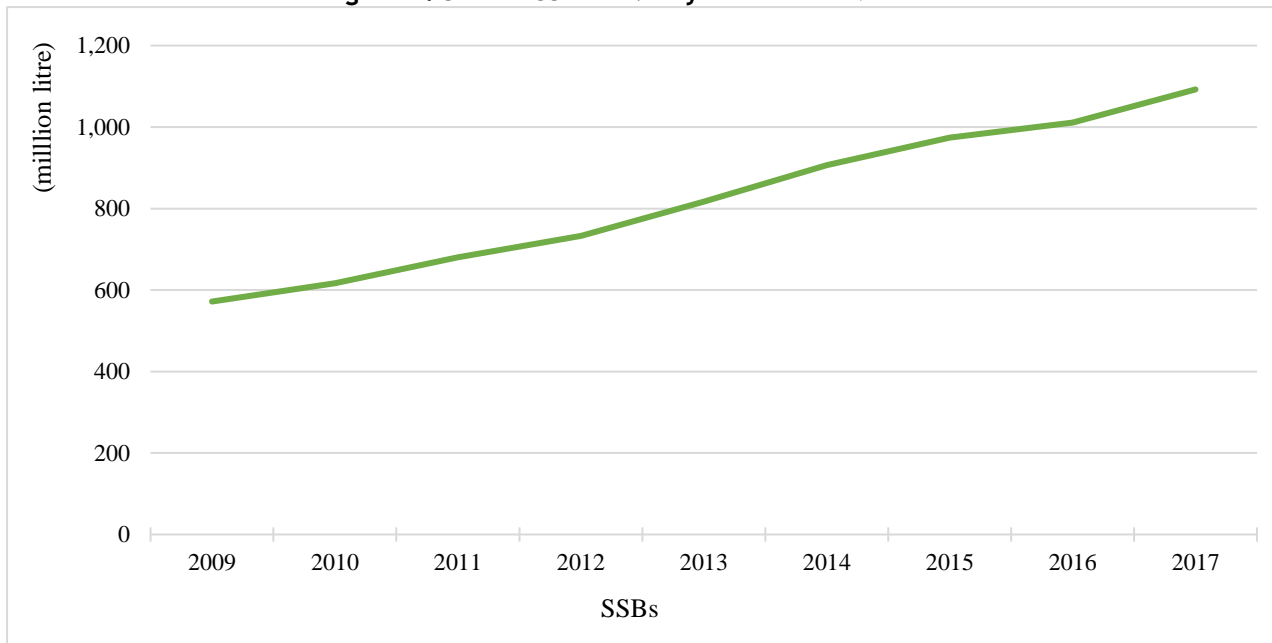
The growing global consumption of sugar-sweetened beverages (SSB) is worrying because these contribute towards obesity and non-communicable diseases (NCD). SSB is any drink with sugar, whether added or natural, such as fruit juice. The link between the intake of SSBs and obesity-related health outcomes is already well established such as a consistent positive association between SSB intake and weight-gain and obesity in both children and adults¹. Besides weight gain and obesity, high consumption of SSBs is also associated with type II diabetes². Today, many individuals are exposed to unhealthy foods and drinks consumption, especially from lower socioeconomic groups who tend to live in areas where SSB are more accessible than healthier food³. The high availability of SSBs also among the reasons that contribute to increase in development of type 2 diabetes and other non-communicable diseases in Malaysia⁴.

The variety in SSB attractive packaging and the aggressive marketing strategies launched by manufacturers can lead to proliferation of purchases and consumption of SSB. On the other hand, the counter strategies undertaken by the authorities such as warning labels, increasing taxes on SSBs, and restricting marketing of SSB can reduce consumption of SSB. The WHO recommends excise tax on SSBs as an effective

fiscal measure to reduce consumption by discouraging the purchase of SSB items. More than 40 countries worldwide have implemented SSB taxes⁵. By discouraging the purchase of SSBs through increased prices, the tax leads to net reductions in calorie intake⁶. It was estimated that a 20% rise in the price of sugary drinks can reduce consumption by around 20% thus preventing diabetes and obesity⁷.

In Malaysia, the consumption of SSB has increased significantly over the past 15 years. Figure 1 shows the increasing trend in SSB sales from 2009 to 2017. More than one-third (36%) of students consume sugary drinks at least once a day. On an average, Malaysians consume approximately 3 kgs of sugar per year in the form of sugary drinks⁸. The sales and consumption of SSBs is rising simultaneously with the increase in obesity in Malaysia. According to the National Health and Morbidity Survey (NHMS) in 2015, the prevalence of obesity (body mass index (BMI) >30) among adults aged 18 years and above increased from 4.4% in 1996 to 14% in 2006, 15.1% in 2011, and 17.7% in 2015¹⁰. The prevalence of overweight (BMI > 25) showed a similar rising trend: 16.6% in 1996, 29.1% in 2006, 29.4% in 2011, and 30.3% in 2015. In the World Population Review 2019, among the ASEAN countries, Malaysia topped the list of obesity prevalence at 15.6%¹.

Figure 1: Sale of SSBs in Malaysia from 2009 to 2017



Source: Euromonitor⁹.

Malaysia not only faces the problem of obesity and overweight issues among adults, but the situation among children is also concerning. According to the NHMS 2015, 11.8% of children below 18 years of age were obese. Based on the latest data, by 2025, around 1.65 million Malaysian school

children are expected to be overweight or obese if no action is taken. Data from the World Health Organization (WHO) suggest that the prevalence of obesity among adults and adolescents in Malaysia increased exponentially from 1975 to 2016 (Figure 2).

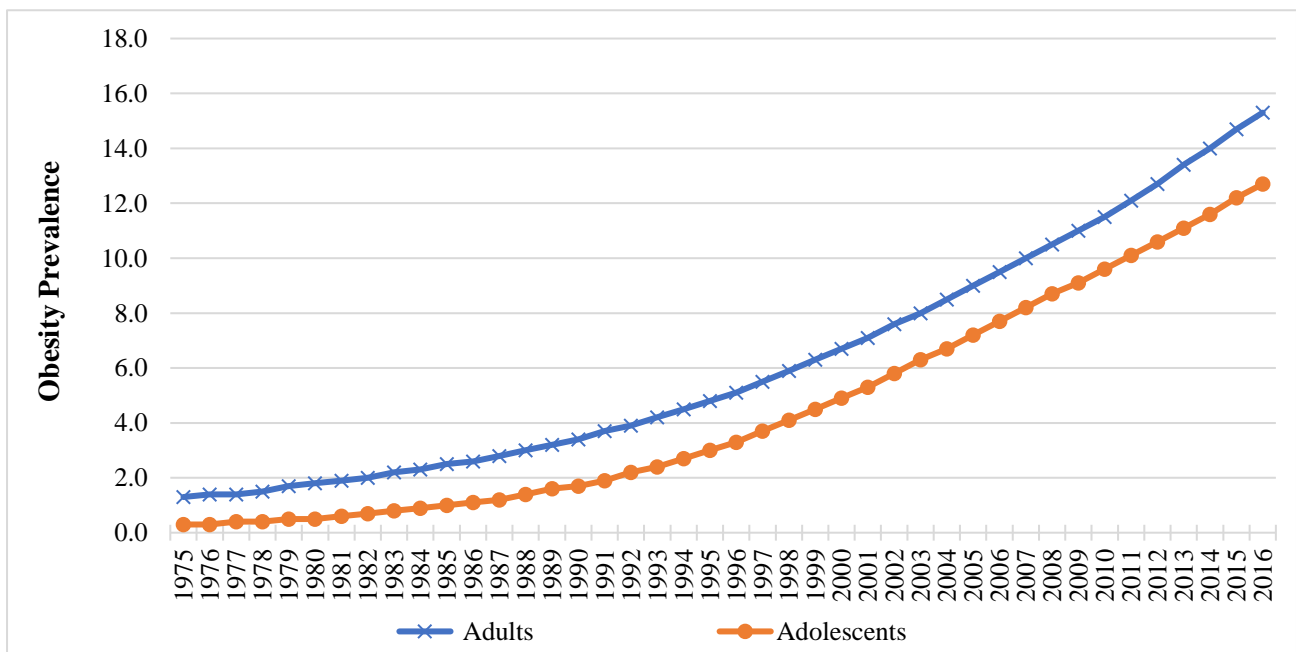


Figure 2: Prevalence of obesity among adults and adolescents in Malaysia

Source: WHO¹²

To deal with obesity and overweight issues, the Malaysian government has introduced 'soft policies' aimed at raising awareness and knowledge through campaigns to promote healthy eating behaviour. In 1996, a health campaign specifically focused on diabetes with a slogan for preventing diabetes. Among the messages to the

audience was the recommendation of lowering sugar intake to prevent diabetes. However, considering the increasing trend in soft drink sales and rising obesity rates in Malaysia, the 'soft policies' approach has had a weak effect at best. Given the mounting evidence of the harmful effects of soft drinks, there is a rationale for the

government to implement hard policies, including changing laws and regulations to curb sugar consumption, and fiscal measures.

On 1 July 2019, the Malaysian government imposed a 'sugar tax' on sweetened beverages in its fight against obesity. An excise duty of MYR 0.40 per litre was imposed on sweetened drinks, including soft drinks containing more than 5 g of sugar per 100 ml, flavoured Ultra-High-Temperature UHT milk-based drinks containing more than 7 g of sugar per 100 ml, and fruit juices with more than 12 g of sugar per 100 ml. The aim was to encourage consumers to reduce the consumption of sweetened beverages. To estimate the potential impact of excise tax on SSB consumption and how much revenue it will generate, information on the elasticity of demand is required. Therefore, this study estimates the price elasticity of demand for SSBs in Malaysia as a first step towards determining the health impact and the projected amount of excise revenue from the Malaysia's sugary tax.

The theory of demand is the most fundamental principle of economics derive from the theory of rational choice. The theory of demand postulates that as the price of a good rises, *ceteris paribus*, an individual will consume less of it. This result from the fact that at the level of consumption given the individual's budget, he will no longer be able to afford the same level of consumption given a constant budget. The extent to which demand for a particular product responds to changes in price can be expressed as own-price elasticity of demand. Own-price elasticity measures the change in demand due to the price change of a particular good (in this study, the price of SSBs). As the relationship between price and demand is inverse in nature, own-price elasticities coefficients' are negative. Goods that are very responsive to price changes are referred to as price elastic. In addition to price, income and price of other goods are other important factors that influence demand for SSB. Income elasticity of demand measures the effect of changes in income on the consumption of goods. It can be positive or negative depending on whether the good is normal or inferior. Cross-price elasticity measures the change in demand for good A (e.g., SSBs) when the price of good B (e.g., milk) changes. The coefficient of cross-price elasticity can either be positive or negative, as it depends on whether the two goods are substitutes or complements.

In Mexico, the price elasticities of demand for soft drinks are between -1.06 and -1.16 ; a 10% increase in price is associated with a decrease in consumption of soft drinks between 10.6% and 11.6%¹³. The poor in Brazil were more price-

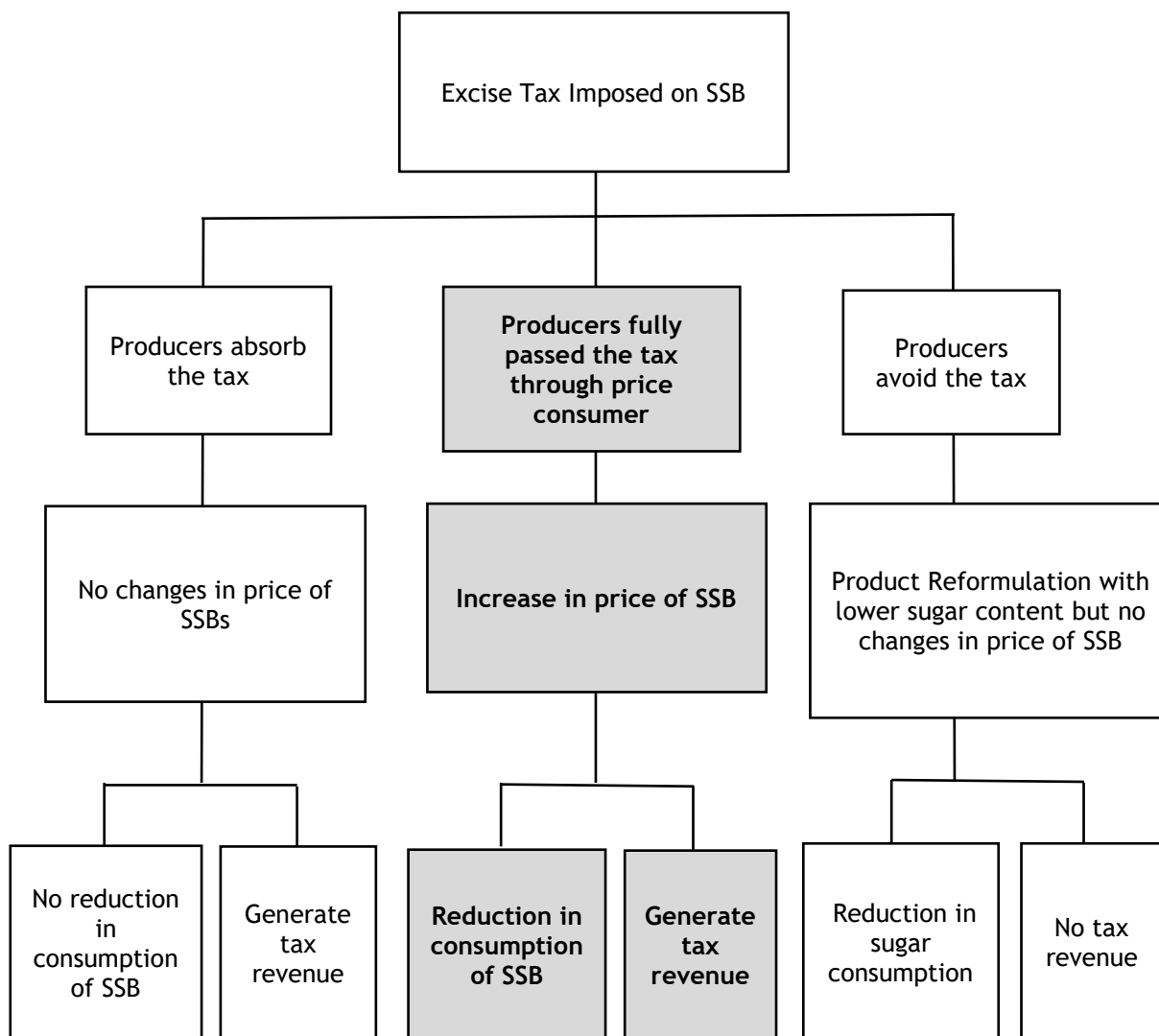
sensitive than the affluent and presented two different own-price elasticities: -1.03 for the poor and -0.63 for the non-poor¹⁴.

Cross-price elasticities show whether two goods act as substitutes or complements to each other. The cross-price elasticities of SSB on milk and plain water estimated in Chile were found to be positive, which showed that milk and plain water were substitute products for SSBs¹⁵. The positive value of income elasticities for SSBs in Ecuador indicated they were normal goods. The coefficient of income elasticity for SSBs was $+0.79$, which means that a 10% increase in real income increased the consumption of SSBs by 7.9%.

In 2016, the World Health Organization recommended a fiscal policy aiming at a minimum of 20% increase in the price of SSBs. A study in South Africa estimated that a twenty percent of SSB tax in South Africa would reduce obesity by 3.8% and 2.4% in adult males and females, respectively¹⁶. In addition to the impact of taxation on consumption and health outcomes, implementing SSB taxation increases revenue for governments and there is evidence that it promotes product reformulation towards reduced sugar content¹⁷. Based on 2014 data, a tax on sugary drinks in China of US\$ 0.16 per litre was estimated to generate US\$ 11.8 billion in revenue¹⁸. In the United States, SSB taxes were estimated to generate approximately US\$ 13 billion in annual tax revenues¹². Revenues generated from taxes could be spent on programmes related to chronic disease prevention or obesity prevention programmes¹⁹.

SSB producers might respond differently to the imposition of taxes. Some producers might absorb the tax or not fully pass it on to the consumer, limiting the effectiveness of the tax to reduce SSB consumption. However, this would be expensive for the producer. The government will still generate revenue from the tax. Others may avoid the tax through product reformulation, wherein the SSB consumption will remain unchanged but sugar consumption goes down, and less revenue will be generated for the government. In the UK, the government introduced the Soft Drinks Industry Levy (SDIL) in April 2018 as a double-tiered levy with different tax rates for drinks over 8 g of sugar per 100 ml and between 5 and 8 g of sugar per 100 ml. Drinks with less than 5 g of sugar per 100 ml incur no additional taxes. The imposition of SDIL encouraged manufacturers to reformulate their products by reducing the sugar content to just below the threshold of 5 g per 100 ml, and more heavily promoted drinks in non-tax categories²⁰. Figure 3 illustrates the pathway effect of the SSB tax on the consumption of SSB and tax revenue.

Figure 3: Pathway effect of SSB tax on consumption of SSB and tax revenue



Source: Norashidah *et al.*

In this study we assumed a 100% pass-on rate of tax to the consumers which is similar to most of the previous SSB tax's studies^{16,21,22}. However to estimate the impact of excise tax on sugary drinks consumption in Malaysia, we need to estimate the price elasticity of demand for SSBs, which is the main objective of this study. The estimated price elasticity of demand of SSBs could be used to estimate the potential of taxing sugary drinks to reduce obesity and overweight in Malaysia.

METHODS

The data used in this study were obtained from three main sources: Euromonitor International, Department of Statistics Malaysia (DOSM), and Ministry of Domestic Trade and Consumer Affairs (MDTCA). Euromonitor International maintains a database on the beverage industry, containing information on the sale of soft drinks and packaged juices sales in Malaysia. From these data, we computed the per capita annual consumption of SSBs (QX) by dividing the total sales of SSBs in volume by the country's population. QX includes sales of both domestically manufactured and imported SSBs (sales of SSBs

were considered as consumption of SSBs since no data were collected separately for consumption). Total population data were obtained from the Department of Statistics Malaysia. Data for the prices of SSB (PX), bottled mineral water (PW), and packed milk (PM) were obtained from the MDTCA. All prices were adjusted for inflation using the consumer price index (CPI) with the base year 2010 to obtain the real prices. Lastly, data for real gross domestic product (GDP) at constant 2010 price (MYR) were obtained from DOSM and divided with the total population as a proxy of income indicator (I).

The data of QX is yearly data; other variables are presented on a quarterly basis. Therefore, in this study, the yearly data of QX were converted into quarterly data by the frequency conversion method, i.e., quadratic-match sum. The time period for this study was from 2013 to 2018 (quarterly data). Only 11 brands were available with complete data on price. These brands represent the most popular soft drink brands in Malaysia.

We utilised panel data analysis to estimate the elasticity of demand for SSBs in Malaysia. Panel

data analysis has become popular among social science researchers because it allows the enclosure of samples for N cross-sectional units. Panel data analysis offers many advantages over time-series and cross-sectional data. First, it generates a large number of observations due to pooling cross-sectional and time series data. This results in a high degree of freedom and tends to reduce multicollinearity problems. In this study, we had 264 points of dataset with N (soft drinks) for 11 brands and T being 24 quarterly periods. Second, it reduces endogeneity problems due to omitted variable bias, measurement error, and simultaneity²³. To avoid heterogeneity bias in a panel data analysis, this study used the least-squares dummy variable (LSDV) model, also known as a two-way fixed effect model, to estimate price effects on soft drinks.

The LSDV model considers dummies for both individual effects and time effects. The model allows the intercept to differ across SSBs and assumed that the individual effect is fixed over time. Also, the LSDV model applied to time effects in the sense that dummy variables are functions of time units. This sense of time dummy shows shifts over time, likewise as changes in diet trend, consumer preferences and taste. The two-way fixed effects model is described as follows:

$$\ln QX_{it} = \alpha_0 + \beta_1 \ln PX_{it} + \beta_2 \ln I_t + \beta_3 \ln PM_t + \beta_4 \ln PW_t + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

Table 1: SSBs Elasticities

	Elasticity	Standard Error	P-value
Own-price elasticity (PX)	-1.11**	0.4367	0.0116
Income elasticity (I)	0.53	1.5941	0.7379
Cross-price elasticity:			
Milk (PM)	0.36	2.3343	0.8788
Mineral Water (PW)	0.82	1.6558	0.6219
R-Squared	0.2016		

** significant at 5% level.

The own-price elasticity of SSB was negative and statistically significant at 5%. The elasticity value was -1.11 (95% CI: -1.97 to -0.25), implying that a 10% increase in the price of SSB would be followed by a decrease of 11.1% in the amount consumed. This shows that the demand for SSBs is elastic. Among all the variables, only the own price of SSBs was significant, implying that price is an important determinant of demand for SSBs in Malaysia. Although other variables were not statistically significant, this does not necessarily mean income and other goods (milk and mineral water) are not important determinants of demand for soft drinks. The current data may not have sufficient statistical information to confirm the effect of income and other goods.

DISCUSSION

To the best of our knowledge, this is the first study to estimate the own price elasticity of

The dependent variable QX_{it} is the quarterly consumption per capita of SSBs. PX_{it} is the price of SSBs in MYR. I_t is GDP per capita, PM_t is the price for packed milk, and PW_t is the price of bottled mineral water. The subscript i denotes the i th drink ($i = 1, \dots, N$) and t denotes the t th year ($t = 1, \dots, T$). μ_i is the individual-specific effect to control for unobserved characteristics of soft drinks, ν_t is the year fixed effect to capture the time trend, and ε_{it} is the error term. Since the model is specified in natural logarithms, the coefficients of the explanatory variables can be interpreted directly as elasticities. β_1 is the price elasticity of demand for soft drinks, β_2 is income elasticity, β_3 & β_4 and are cross price elasticities. The expected sign for β_1 is negative since quantity demanded and own price have a negative relationship. β_2 can be either positive or negative depending on the type of good. It is positive if SSB is a normal good and negative if SSB is an inferior good. Cross-price elasticities (β_3 or β_4) will be positive if the product is a substitute product or a negative sign if a complement product.

RESULTS

Table 1 presents the results for own price elasticity, income, and cross-price elasticities for soft drinks using the two-way fixed effects model.

demand for SSBs in Malaysia. We estimated price elasticity of demand for SSBs in this study at -1.11, which is elastic. This means that an increase in the price of SSBs would largely impact consumption, assuming that other determinants are constant. Malaysia implemented a sugar tax starting 1 July 2019, whereby excise duty of 40 cents per litre is imposed on sweetened drinks, including soft drinks containing more than 5 g of sugar per 100 ml. Excise duty is also imposed on flavoured UHT milk-based drinks and fruit juices or vegetable-based drinks with over 7 g and 12 g of sugar per 100 ml, respectively.

The available evidence from other countries with SSB tax increases indicate that producers tend to fully pass the tax increases onto consumers. Therefore, the 40 cents per litre of excise tax will also increase the average price of 1 litre SSB by 40 cents. The estimated average price for 1 litre SSB in 2018 (the final year for the data used in this

study) was MYR 4.80. The increase of 40 cents per litre due to sugar tax will result in a new average price of 1 litre of SSBs to MYR 5.20. Therefore, the percentage increase in price due to tax is 8.33%. Own price elasticity of demand is the ratio of percentage changes in quantity demanded for SSB to percentage changes in the price of SSB. The estimated price elasticity of demand being -1.11 , the percentage change in price being 8.33%, the expected percentage change in quantity of SSB demanded or consumed will decrease by 9.25%. Since demand for SSBs is elastic, producers bear more of the tax burden than consumers.

To obtain the government's total tax revenue after the imposition of 0.40 cents per liter on July 2019, the tax rate of 0.40 cents must be multiplied by the projected decrease of 9.25% in consumption of SSB or the quantity consumption after tax is around 8.95 million liters. This suggests an estimated tax revenue of around MYR 357.6 million. Even though the experiences of sugar tax elsewhere suggest that consumption of SSBs is likely to decrease due to tax, more time is needed to measure the consumption behaviour, health, and fiscal consequences of Malaysia's sugary tax.

In Malaysia, more than 90% of the existing SSBs are taxable under the specified threshold. In this study we assumed a 100% pass-on rate of tax to the consumers which is similar to most of the previous SSB tax's studies^{16,21,22}. However, some manufacturers and companies of SSBs have come up with solutions to keep the price of their products stable. Nestle Malaysia as the leading company in the local F&B market is absorbing the tax²⁴. Whether this changes consumption is yet unknown. Other companies avoided tax through reformulation (reduction of sugar content). Fraser and Neave Holdings Bhd (F&N) reduced the sugar content to prevent the tax from impacting 70% of their products. The remaining 30% of the products are taxable²⁵. Reformulation of a product means lower tax revenue. However, because it reduces sugar consumption, it does lead to positive results for health and welfare.

The main limitation of this study is its modest sample size. The insufficient data may explain the non-significant results for cross-price elasticities and income elasticity.

CONCLUSION

Our findings indicate that the price elasticity of demand for SSB in Malaysia is elastic. Increases in prices due to higher taxes on SSBs will significantly reduce their consumption. However, the results suggested that the sugar tax of 0.40 cents per litre is insufficient to increase the price of SSBs by 20%, as recommended by the WHO. If the size of tax has a small impact on the industry's profits, they may absorb the tax, in which case there is no reduction in consumption²⁵. Hence, a higher tax should be imposed by the government

to achieve a significant reduction in SSB consumption. To achieve an increase of 20% in the price of SSBs as recommended by the WHO, the excise tax rate must at least be 0.96 cents per litre. With a given elasticity of -1.11 , it can potentially reduce the consumption of SSBs by 22%. The imposition of taxes on other products with higher sugar content (3 in 1 product, cordial, etc.) should also be considered. Taxation should be part of a comprehensive approach to create a healthy food environment. Stricter regulation can reduce the marketing of unhealthy products with higher sugar content. Awareness campaigns on the impact of sugar on health are also needed to promote healthy living. Further research on the impact of SSB tax on obesity could offer better analysis to enhance the effort of government in reducing the obesity and over weight problem in Malaysia.

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