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The association between the health promotion levy and employment in South Africa: an interrupted time series analysis

Chengetai Dare[1*], Micheal Kofi Boachie[1], Susan Goldstein[1] and Evelyn Thsehla[1]

Abstract

Background The production and consumption of sugar-sweetened beverages (SSBs) have been increasing over the past years, globally. However, there is overwhelming evidence linking SSBs to the rising prevalence in obesity and its comorbidities. In South Africa, the prevalence of overweight and obesity is high and is among the highest in Sub-Saharan Africa. In response to rising prevalence in obesity and its comorbidities, on 1 April 2018 the South African government introduced an SSB tax, known as the Health Promotion Levy (HPL). However, the levy has been opposed by the sugar industry, claiming that it leads to jobs losses. Against this backdrop, this study seeks to investigate the association between the HPL and employment in the sugar industry.

Methods We employed single-group interrupted time series analyses using the Quarterly Labour Force Survey data from Statistics South Africa.

Results Our results show that the HPL has not been associated with job losses (or generation) in the sugar-related industries in South Africa. These findings are consistent with the findings on the effects of SSB taxes on employment in other jurisdictions.

Conclusions Considering that the HPL does not impede employment, and the overwhelming evidence on the effectiveness of SSB taxes, together with the relatively low tax burden, it is imperative that the government raises the HPL from the current 8% of the retail price to the WHO-recommended 20% threshold. The government should also consider expanding the HPL to fruit juices. Such strategies are important in encouraging people to reduce the intake of SSBs, while enabling the government to raise additional revenue for the fiscus.

Keywords Health Promotion Levy, Employment, SSB tax, Sugar industry, South Africa, Obesity, Non-communicable diseases

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Background

The consumption of sugar-sweetened beverages (SSBs) have been increasing over the past years, globally [1]. However, there is overwhelming evidence linking SSBs to the rising prevalence in obesity and its comorbidities (such as diabetes, hypertension, stroke, cardiovascular diseases, dental caries, and many forms of cancer) [2–4]. The global prevalence of obesity nearly tripled since 1975 and is expected to increase further in the coming decades [5]. The highest prevalence rates have been recorded in in low- and middle-income countries (LMICs) [1, 5].

Non-communicable diseases (NCDs) account for over 70% of deaths globally, about 40% of which is attributable to dietary factors. In response to the rising incidence of obesity and a variety of diet-related NCDs, especially considering that SSBs are among the leading sources of free sugar intake in many countries, there has been growing interest in implementing SSB taxes to curb consumption [6, 7]. SSB taxes are regarded as a cost-effective measure which can be used to prevent or slow the growing burden of NCDs [8]. This is happening as the growing affordability of SSBs, especially in LMICs, threatens to worsen existing global health inequalities [7].

In South Africa, the prevalence of overweight and obesity is high and is among the highest in Sub-Saharan Africa. In 2016, 31% of adult males, 67% of adult females, and 13% of children under five years old were either overweight or obese [9, 10], posing a significant challenge to the healthcare system. This impacts heavily and negatively on income due to decreased productivity [11, 12]. The economic impact of obesity and its comorbidities on the South African economy is estimated at ZAR30 billion, in 2020 [13].

In response to rising prevalence in obesity and its comorbidities, in 2016 the South African government announced the introduction of an SSB tax based on sugar content, as recommended by the World Health Organisation (WHO). The announcement was followed by a white paper, evidence reviewing and making recommendations for a sugar-based tax to be levied at ZAR0.028 per gram of sugar, resulting in a tax burden of approximately 20% of the per-litre price of the most popular SSB [14]. After extensive consultation with the sugar industry, beverage manufacturers, civic society groups, and public health advocates, there were substantial concessions made to both the sugar and beverage industries. The tax was formally implemented on 1 April 2018 referred to as the Health Promotion Levy (HPL). The levy is limited to non-alcoholic sugary drinks, excluding fruit juice. It is levied at a rate of ZAR0.0221 per gram of sugar above a threshold of 4 g of sugar per 100 ml. Thus, the effective tax burden was reduced to about 10% from the 20% initially proposed.

Despite the concessions made, policymakers continue to face substantial opposition to the levy. The primary argument, which has also been raised against tobacco and alcoholic beverages taxes, is that the tax has led (and will continue to lead to) job losses, particularly in the industries involved in the production, distribution, and sale of these products [15, 16]. This argument by the industry led the government to suspend till 2025 its intention to increase the levy rate, reduce the threshold to below 4 g per 100 ml, and expand the tax to fruit juice. However, evidence from independent research globally show no significant changes in employment associated with SSB taxes e.g., in Mexico [17], Peru [18], San Fransisco [19], and Illinois and California [20]. Considering the persistent argument by the sugar and beverage industry (amid high unemployment rate), and limited evidence on the employment impact of the SSB tax, this study seeks to investigate the association between the HPL and employment in sugar-related industries in South Africa. This knowledge is important especially for policymakers as they consider reviewing the HPL. Given that South Africa's economic and market conditions are largely similar to those of Mexico and Peru, we expect the HPL to have weak or no association with employment.

Methods

Data

We use the Quarterly Labour Force Survey (QLFS) data [21] to evaluate the relationship between the HPL and employment levels in South Africa. The QLFS is conducted by Statistics South Africa (Stats SA). The survey is household-based and collects information on labour market activities in all sectors of the economy. It is nationally representative. The information is collected from individuals aged 15 years or older from all nine South African provinces. The survey uses a two-stage stratified sampling technique. Demographic and socioeconomic characteristics (such as race, age, gender, and level of education) are also gathered. The QLFS has been conducted every year (quarterly) since the first quarter (q1) of 2008. The most recent available survey data (at the time of writing) cover the first quarter of 2023. In this study we exclude the periods pre-2009q2 and post-2020q2 to exclude the effects of the 2008/09 global financial crisis and the coronavirus disease that occurred in 2020 (COVID-19) with its associated restrictions. South Africa recorded its first COVID-19 case on 5 March 2020. The government declared a National State of Disaster on 15 March 2020. The COVID-19 regulations were repealed on 22 June 2022. As such, this study uses data for the period 2009q2–2020q2.

Sugar-related industries are classified into three categories: agriculture, manufacturing, and wholesale and retail. These categories are to some extent proxies. The

Table 1 Number of employees by industry and gender, 2009–2020

	Male		Female		Total	
	N	**Percentage of total sample**	***N***	**Percentage of total sample**	***N***	**Percentage of total sample**
Agriculture	5 005 681	2	3 169 426	1.3	8 175 107	3.3
Manufacturing	830 088	0.3	578 546	0.2	1 408 634	0.6
Wholesale & Retail	4 829 602	1.9	5 760 306	2.3	10 589 908	4.2
Non-sugar industry	131 002 948	52.1	100 365 162	40.00	231 368 110	92.00
Total	**141 668 319**	**56.3**	**109 873 440**	**43.7**	**251 541 759**	**100**

Table 2 Number of employees by industry and province, 2009–2020

		Western Cape	**Eastern Cape**	**Northern Cape**	**Free State**	**KwaZulu-Natal**	**North West**	**Gauteng**	**Mpumalanga**	**Limpopo**	**Total**
Agriculture	N	2 012 334	603 700	654 009	804 934	1 106 784	452 775	528 238	955 859	1 056 475	8 175 108
	Percentage of total sample	0.8	0.24	0.26	0.32	0.44	0.18	0.21	0.38	0.42	3.25
Manufacturing	N	377 313	108 163	30 185	45 278	133 317	62 885	402 467	52 824	181 110	1 393 542
	Percentage of total sample	0.15	0.04	0.01	0.02	0.05	0.03	0.16	0.02	0.07	0.55
Wholesale & retail	N	1 987 180	1 031 321	211 295	628 854	1 534 405	679 163	3 270 043	679 163	553 392	10 574 816
	Percentage of total sample	0.79	0.41	0.08	0.25	0.61	0.27	1.30	0.27	0.22	4.20
Non-sugar industry	N	32 021 266	20 877 966	4 080 007	12 048 850	40 447 915	13 407 175	76 921 470	16 123 827	15 469 818	231 398 294
	Percentage of total sample	12.73	8.30	1.62	4.79	16.08	5.33	30.58	6.41	6.15	91.99
Total	**N**	**36 398 093**	**22 621 150**	**4 975 496**	**13 527 916**	**43 222 421**	**14 601 998**	**81 122 218**	**17 811 673**	**17 260 795**	**251 541 760**
	Percentage of total sample	**14.48**	**8.98**	**1.98**	**5.38**	**17.19**	**5.81**	**32.25**	**7.07**	**6.86**	**100.00**

agricultural industry covers growing of crops, horticulture and mixed (crop and animal) farming. The manufacturing category covers only those that produce beverages, while the wholesale and retail category is comprised of the following (as captured in the QLFS): wholesale trade in agricultural raw materials, livestock, food, beverages and tobacco; retail trade in food, beverages and tobacco in specialised stores; restaurants, bars and canteens; and shebeen. All other (sub-)industries were classified as non-sugar related. Tables 1 and 2 respectively show the distribution of aggregate employment levels for each industry, by gender and province for the period 2009–2020.

Empirical estimation

To assess the association between the HPL and employment we employ a single-group panel interrupted time series (ITS) analysis, (also known as segmented analysis). The segmented ITS study design is a quasi-experimental research technique with potentially significant degree of internal validity in cases where multiple observations on the variable of interest exist for pre- and post-intervention periods. The approach (or its variants) is increasingly being used for the evaluation of public health interventions and are particularly suited to interventions introduced at a population level [17, 22–25].

The outcome of interest is the logarithm of the aggregate employment by province in the sugar-related industries measured quarterly from 2009q2 to 2020q2. As such, we transformed the data to reflect the employment levels by quarter and province.

The regression model used in this study follows an approach used in by Guerrero-López et al. [17] and Boachie et al. [25] for similar purpose. The model is specified as follows:

$$ln\left(Y_{it}\right) = \beta_0 + \beta_1 T + \beta_2 X_{it} + \beta_3 T X_{it} + \beta_p P + \varepsilon_t$$

where Y_{it} is the number of employees for industry *i*, at time (quarter) *t*. T is the time elapsed since the start of the study (2009q2), X_{it} is a dummy variable representing the HPL intervention; it takes the value of 0 for the pre-intervention (HPL) period, and 1 for the post-HPL period. TX_{it} is an interaction term of the time trend and the HPL, and is the main variable of interest. β_0 represents the baseline level of the employment at T=0, β_1 represents the underlying pre-HPL trend (i.e., the change in employment level associated with a single unit increase in time before the HPL). β_2 indicates the immediate level (or intercept) change following the introduction of the HPL and β_3 represents the change in the slope of the trend due to the HPL, compared with the pre-HPL trend. P accounts for provincial fixed effects.

We run regressions for the overall sugar-related industry, and for each sugar-related industry. The primary regression model is a pooled ordinary least-squares (OLS) linear regression. For robustness checks, we run two more different regressions: generalised-least squares (GLS) and random-effects (RE) regression models. The pooled OLS assumes that there are no significant unobserved individual characteristics that could affect the relationship between variables, while GLS allows estimation in the presence of first-order autoregressive while accounting for autocorrelation and heteroskedasticity. Random-effects model assumes that unobserved individual characteristics are random and uncorrelated with the explanatory variables. All analyses are done with STATA V.18.

Results

Overall, there were 396 observations for the nine provinces (i.e., 44 quarterly observations for each of the nine provinces). Figure 1 shows the trend of the aggregated number of employees in separate sugar-related industries, while Fig. 2 shows the employment trend for the overall sugar-related industry, for the period 2009q2–2020q2. Thus, Fig. 2 depicts the aggregate of the industry-specific employment levels depicted in Fig. 1.

From both Figs. 1 and 2, the HPL appears to have had no significant impact on employment levels in the sugar-related industry. The extent to which these covariates impacted on employment is established through regression analyses. The regression results are shown in Table 3. The results from all the regression models are largely similar. Results from the pooled OLS and RE models are identical.

Table 3 shows that across all the sugar-related industries, both β_2 (the coefficient of the HPL) and β_3 (the coefficient of the interactive term of HPL and time) are not significant. The trend of employment varies across provinces. For instance, compared to the Eastern Cape province, Western Cape, KwaZulu Natal, Gauteng and Limpopo provinces registered higher overall employment levels, while Northern Cape, Free State, North West and

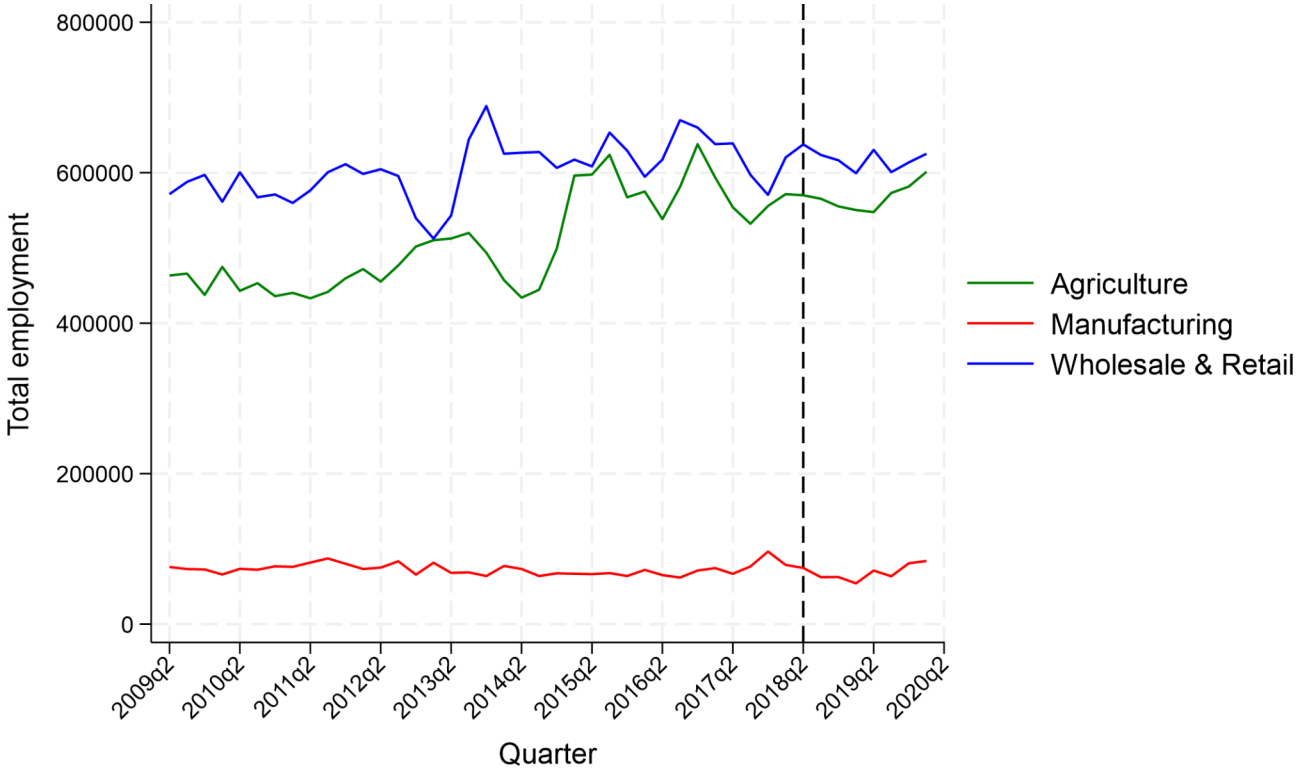


Fig. 1 Industry-specific employment levels

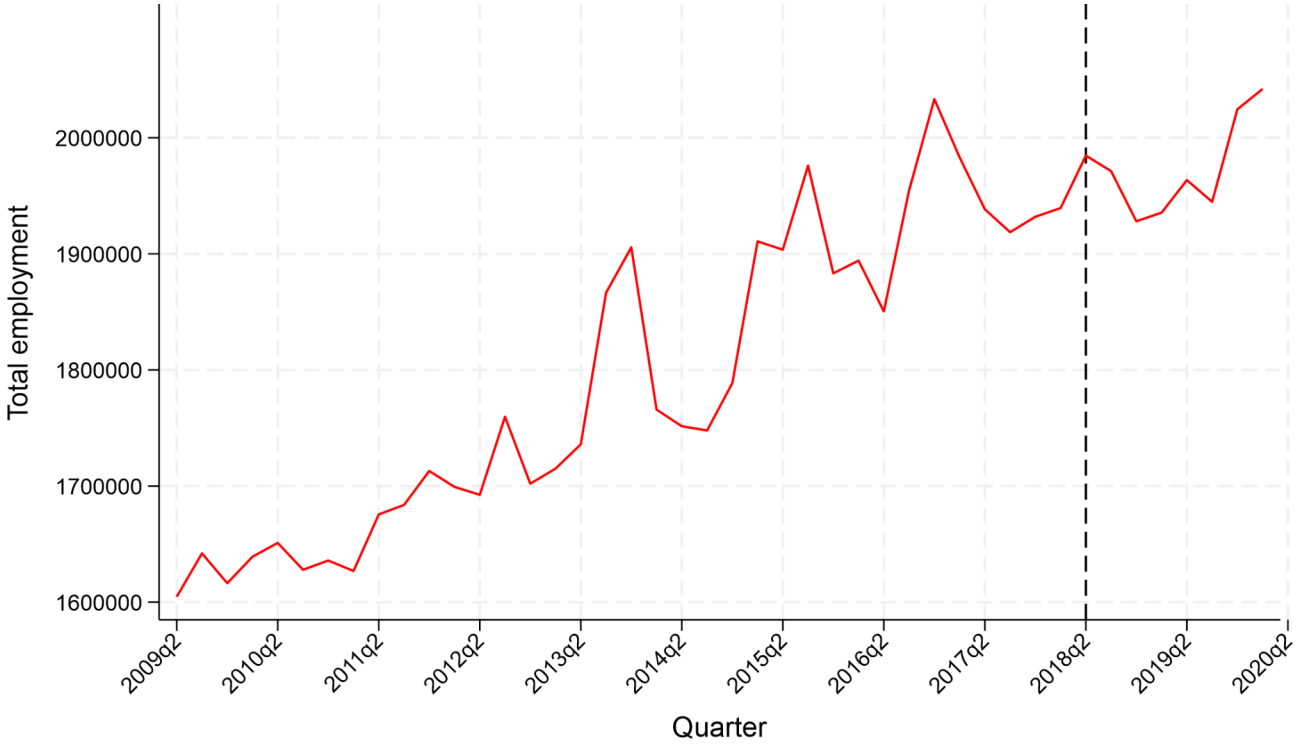


Fig. 2 Overall employment level in the sugar-related industry

Mpumalanga recorded less. The provincial level performance in the overall economy compares favourably with those registered in the manufacturing sector. In the agricultural sector, Northern Cape and Gauteng performed worse than Eastern Cape, while Western Cape KwaZulu Natal and Gauteng performed better than the Eastern Cape in the wholesale and retail sector.

Discussion

We employed single-group interrupted time series analyses to investigate the association between the HPL and employment levels in sugar-related industries (including agriculture, beverage manufacturing, and commercial establishments that sell food and beverages). We used the Quarterly Labour Force Survey data from Statistics South Africa, the national statistical agency.

Our results show statistically insignificant association between the HPL and employment in the sugar-related industries in South Africa. However, the employment levels vary across provinces. This is expected especially considering the variations in size and performances provincial economies in South Africa. For instance, Gauteng is the biggest provincial economy, contributing about 33% to the national economy. KwaZulu Natal and Western Cape respectively contribute about 16% and 14% to the national economy, while Northern Cape is the smallest provincial economy, contributing about 2% to the national economy.

The findings that the association between HPL and employment is statistically insignificant compare favourably with findings from other peer-reviewed non-industry-funded studies on the employment impact of SSB taxes. For instance, our results are consistent with the findings on the effects of SSB taxes on employment in Peru [18], San Francisco [19], Philadelphia [26], and California and Illinois [20]. In all these studies, SSBs taxes were found to have no significant impact on employment levels. However, the key difference is that our study is the first to look at the subject in Africa.

The lack of effects of the SSB tax (the HPL) on employment can be attributed to at least four reasons [18–20]. First, multiproduct firms in affected industries may internally reallocate their labour force to products unaffected by these policies. Second, beverages have non-nutritive sweetener options that allow producers to quickly reformulate, as research has shown in South Africa [2, 27] and Portugal [28]. Reformulation allows producers to avoid the tax and retain most consumer preferences [18, 27]. As a result, they have no need to reduce employment (or change wages) [18]. Third, if the demand for the affected products does not decline (or declines slightly) after the implementation of the HPL, the industry finds no incentive to adjust employment levels. Fourth, consumers may substitute untaxed for the taxed products from the same producers. The increase in the demand for unaffected

Table 3 Regression results

	Agriculture			Manufacturing			Wholesale and retail			Overall economy		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
	OLS	GLS	RE	OLS	GLS	RE	OLS	GLS	RE	OLS	GLS	RE
Time	0.005***	0.005**	0.005***	-0.008***	-0.009***	-0.008***	0.003***	0.002*	0.003***	0.005***	0.005***	0.005***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HPL	-0.037	-0.003	-0.037	-0.110	-0.053	-0.110	0.024	0.043	0.024	-0.004	0.016	-0.004
	(0.055)	(0.063)	(0.055)	(0.109)	(0.126)	(0.109)	(0.036)	(0.042)	(0.036)	(0.027)	(0.031)	(0.027)
HPL*Time	-0.013	-0.014	-0.013	0.037	0.028	0.037	-0.010	-0.012	-0.010	-0.009	-0.010	-0.009
	(0.012)	(0.014)	(0.012)	(0.023)	(0.027)	(0.023)	(0.008)	(0.010)	(0.008)	(0.006)	(0.007)	(0.006)
Western Cape	1.345***	1.346***	1.345***	1.532***	1.531***	1.532***	0.687***	0.687***	0.687***	0.821***	0.821***	0.821***
	(0.048)	(0.084)	(0.048)	(0.094)	(0.138)	(0.094)	(0.032)	(0.054)	(0.032)	(0.024)	(0.041)	(0.024)
Northern Cape	-0.193***	-0.185**	-0.193***	-1.731***	-1.752***	-1.731***	-1.622***	-1.617***	-1.622***	-1.111***	-1.104***	-1.111***
	(0.048)	(0.084)	(0.048)	(0.095)	(0.138)	(0.095)	(0.032)	(0.054)	(0.032)	(0.024)	(0.041)	(0.024)
Free State	0.198***	0.196**	0.198***	-0.821***	-0.824***	-0.821***	-0.485***	-0.492***	-0.485***	-0.334***	-0.337***	-0.334***
	(0.048)	(0.084)	(0.048)	(0.094)	(0.138)	(0.094)	(0.032)	(0.054)	(0.032)	(0.024)	(0.041)	(0.024)
KwaZulu-Natal	0.548***	0.541***	0.548***	0.221**	0.212	0.221**	0.393***	0.398***	0.393***	0.632***	0.632***	0.632***
	(0.048)	(0.084)	(0.048)	(0.094)	(0.138)	(0.094)	(0.032)	(0.054)	(0.032)	(0.024)	(0.041)	(0.024)
North West	-0.338***	-0.347***	-0.338***	-0.842***	-0.879***	-0.842***	-0.467***	-0.464***	-0.467***	-0.542***	-0.547***	-0.542***
	(0.048)	(0.084)	(0.048)	(0.098)	(0.141)	(0.098)	(0.032)	(0.054)	(0.032)	(0.024)	(0.041)	(0.024)
Gauteng	-0.444***	-0.464***	-0.444***	1.350***	1.353***	1.350***	1.178***	1.179***	1.178***	1.026***	1.022***	1.026***
	(0.048)	(0.084)	(0.048)	(0.094)	(0.138)	(0.094)	(0.032)	(0.054)	(0.032)	(0.024)	(0.041)	(0.024)
Mpumalanga	0.507***	0.496***	0.507***	-0.657***	-0.663***	-0.657***	-0.462***	-0.458***	-0.462***	-0.060**	-0.063	-0.060**
	(0.048)	(0.084)	(0.048)	(0.094)	(0.138)	(0.094)	(0.032)	(0.054)	(0.032)	(0.024)	(0.041)	(0.024)
Limpopo	0.843***	0.830***	0.843***	0.461***	0.462***	0.461***	-0.449***	-0.448***	-0.449***	0.084***	0.078*	0.084***
	(0.048)	(0.084)	(0.048)	(0.094)	(0.138)	(0.094)	(0.032)	(0.054)	(0.032)	(0.024)	(0.041)	(0.024)
Constant	10.393***	10.409***	10.393***	8.683***	8.702***	8.683***	10.906***	10.908***	10.906***	11.846***	11.855***	11.846***
	(0.041)	(0.070)	(0.041)	(0.079)	(0.115)	(0.079)	(0.027)	(0.045)	(0.027)	(0.020)	(0.033)	(0.020)
Observations	396	396	396	385	385	385	396	396	396	396	396	396

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.10$

products may offset the decline in demand for affected products [2, 18].

To reduce the intake of SSBs, the government should consider raising the HPL from the current 8% of the retail price to the minimum 20% recommended by the World Health Organisation [29]. Given the statistically insignificant association between the HPL and employment in the sugar-related industries, the government should also consider lifting the 2023 moratorium on extending the HPL to fruit juices. Increasing the HPL and expanding it to fruit juices are important in reducing overweight and obesity and the associated comorbidities and mortalities, while enabling the government to raise additional revenue for the fiscus [30].

Although this study provides useful information for devising suitable SSB tax policy measures, there is one limitation to consider. The sugar-related industries are broadly defined, which may include other activities that are unrelated to the sugar industry. As such, the dependent variable could be subject to measurement error with an unknown bias.

Conclusions

Contrary to the sugar-related industry claims of employment losses due to the HPL, we found statistically insignificant association between the levy and employment levels based on the QLFS. Considering that the HPL does not significantly impede employment, and the overwhelming evidence on the effectiveness of SSB taxes in reducing consumption, together with the relatively low tax burden, it is imperative that the government consider raising the HPL from the current 8% of the retail price to the WHO-recommended 20% threshold. The government should also consider expanding the HPL to fruit juices. Such strategies are important in encouraging people to reduce the intake of SSBs, while enabling the government to raise additional revenue for the fiscus. Thus, primary prevention of NCDs such as type 2 diabetes and cardiovascular diseases can be implemented without harm to employment.

Abbreviations

SSB	Sugar-sweetened beverage
HPL	Health Promotion Levy
LMICs	Low- and middle-income countries
NCDs	Non-communicable diseases
WHO	World Health Organisation
QLFS	Quarterly Labour Force Survey
OLS	Ordinary least-squares regression
GLS	Generalised-least squares regression
RE	Random-effects regression

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Author contributions

CD, MKB and ET conceptualised the study. CD and MKB conducted the data analysis. CD, MKB, SG and ET contributed to the drafting and revision of the manuscript.

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Data availability

Data are publicly available on https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/?page=1&sort_by=title&sort_order=asc&ps=15.

Declarations

Ethics approval and consent to participate

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research. The data used anonymised before use, and a waiver of informed consent were approved by the Human Research Ethics Committee at the University of Witwatersrand (HRECNMW24/03/04).

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

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