Impact of Tobacco Taxation on Rural-Urban Cigarette Consumption in Indonesia

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Abstract

Tobacco taxes in Indonesia have always been increasing over the past period. However, little was known about the impact of increasing tobacco taxes on cigarette consumption in urban and rural communities. Therefore, we examine the impact of implementing tobacco taxation policies in Indonesia on cigarette consumption levels in urban and rural areas. This study uses panel data for the 2007–2022 period from 33 provinces in Indonesia. Data were sourced from the Central Bureau of Statistics of the Republic of Indonesia and the Ministry of Finance of the Republic of Indonesia and were analyzed using the two-stage least squares (2SLS) model and the propensity score matching (PSM) model. Our finding shows that increased tobacco taxes negatively impact cigarette consumption in urban and rural areas. Even so, the decline in cigarette consumption in urban areas is still much lower than the reduction in rural areas.

Keywords	***DOI***	***JEL code***
Tobacco taxation, cigarette consumption, rural, urban, Indonesia	*https://doi.org/10.54694/stat.2023.29*	*C33, E20, E62*

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INTRODUCTION

Tobacco is a commodity that has a strategic role in the economy of Indonesia. This can be seen from the value of state revenues originating from tobacco taxation which tends to grow rapidly. The Indonesian Central Bureau of Statistics shows that state revenues from tobacco taxes in 2022 will touch IDR 224 200 billion or the equivalent of 11.65% of Indonesia's total tax revenues in 2022 (Central Bureau of Statistics, 2023c). The tobacco taxes also contributed around 1.14% of Indonesia's total GDP in 2022. This figure is higher than state revenue from tobacco taxes in 2021 and 2020, which only touched IDR 195 518 billion and IDR 176 309 billion, respectively. In addition, tobacco production in Indonesia is quite high, with the average annual production reaching 256.03 thousand tons. Tobacco produced in Indonesia is mostly used by the tobacco industry and eventually processed into several types of cigarettes, namely clove, and white.

The high production of tobacco and cigarettes in Indonesia has pushed Indonesia to become one of the most cigarette-exporting countries in the world. Indonesia's cigarette commodity export market share (HS code: 2402) in the international market reached 3.60%, slightly lower than the market share of the Dominican Republic, ranked the fourth largest cigarette exporting country globally, which touched 4.40%. (International Trade Centre, 2023). Nonetheless, many studies show that consumption of tobacco in the form of cigarettes can harm public health, which can trigger lung cancer (Singh and Kathiresan, 2015; Zhang et al., 2022), chronic obstructive pulmonary disease (Dai et al., 2022), ischemic heart disease (Holipah, Sulistomo and Maharani, 2020; Lim et al., 2017), and can even increase the risk of mental health disorders (Milic et al., 2020; Taylor and Treur, 2023). Therefore, the marketing of tobacco products in Indonesia is limited and regulated through the Regulation of the Ministry of Finance of the Republic of Indonesia concerning Taxation for Tobacco Products.

It was recorded that from 2007 to 2022, the Ministry of Finance of the Republic of Indonesia issued five modifications to the tobacco taxation policy. Both of the policies are implementing the increase in tobacco taxation. The increase in tobacco taxes alone has had a mixed impact on various sectors of the economy in Indonesia. Based on data from the Central Bureau of Statistics of the Republic of Indonesia shows that the increase in tobacco taxes has led to a decrease in the number of tobacco product industries in Indonesia. The number of tobacco product industries in Indonesia has decreased by an average of 5.23% per year during the 2007–2022 period (Central Bureau of Statistics, 2023b). Hence, the increase in tobacco taxes has reduced labor absorption in the tobacco production and processing sector (Nguyen, Giang and Pham, 2020).

Another study has provided finding about the increasing tobacco tax impacts that reduce tobacco prices at the farm level due to the low demand for tobacco by the tobacco industry (Suprihanti, Harianto, Sinaga and Kustiari, 2018). On the other hand, the price of processed tobacco products such as cigarettes at the consumer level tends to increase due to increased tobacco taxes (Ho, Schafferer, Lee, Yeh and Hsieh, 2018; Zhao, 2022). Several studies have shown that increasing tobacco taxes encourages sustainable and equitable economic growth (Bardach et al., 2022; Bella et al., 2023).

Implementing fiscal policies, especially tobacco taxation policies, may impact rural and urban areas differently. Van den Boogaard and Beach (2023) concluded that implementing tax policies in rural areas tended to be inefficient compared to urban areas due to low tax revenues and high tax collection costs by the government. In particular, people in rural and urban areas have different tax preferences. Rural communities focus more on taxation policies related to their assets, while urban communities pay more attention to taxation policies related to consumption activities (Andersson, 2018). Indonesia itself has both the regional characteristics, rural and urban areas. It is recorded that Indonesia has 98 urban areas and 416 rural areas to date (Central Bureau of Statistics, 2023a). Rural areas are defined as areas dominated by community structures working in the agricultural sector with a relatively low population density (Putri, Russell, O'Sullivan, Meliala and Kippen, 2022), while urban areas are dominated by people working in industrial sectors with high population density (Wang, Ma, Sun and Zhang, 2021).

Previous studies have demonstrated the effects of increasing tobacco taxes in various case studies. However, there were needs for the research linking the impact of the increase in tobacco taxes on cigarette consumption in rural and urban communities. Furthermore, rural and urban areas are known to have many differences, including differences in topography, population density, income level, poverty level, and so on, where these differences have the potential to produce different responses to cigarette consumption when changes in tobacco taxation are implemented. Hence, this research examined the impact of tobacco tax policies on cigarette consumption in rural-urban communities in Indonesia.

1 LITERATURE REVIEW

Many previous studies have proven that the policy of increasing tobacco taxation provided various direct effects on the tobacco product industry and cigarette consumers, including reducing cigarette consumption in society. The results of a recent study conducted by Boachie et al. (2022) show that increasing tobacco taxation and health education can reduce cigarette consumption in the community. In other previous studies, Cheng and Estrada (2020) specifically calculated changes in the elasticity of demand for cigarettes that are affected by increases in cigarette prices. The results can be confirmed that with every increase in the price of cigarettes by 10.00%, the overall demand decreases by 5.60%. In the long term, Friedson, Li, Meckel, Rees and Sacks (2023) proved that the impact of increasing tobacco tax policies would reduce the death rate caused by diseases suffered by smokers. In adolescent smokers, it was found that a $1.00 increase in tobacco taxes was associated with an 8.00% decrease in cigarette consumption as adolescents grew older.

Our analysis begins by exploring previous studies that concluded cultural differences and social interactions in rural and urban communities as the determining factors for cigarette use. Roberts, Teferra, Keller-Hamilton, Patterson and Ferketich (2020) looked into the profile of rural cigarette consumers associated with the presence of male family members who smoked in the household. This indicates that masculinity and smoking culture can spread between generations. Disparities in cigarette consumption that occur in different sociodemographics based on race, ethnicity, poverty status and sexual orientation in the research conducted by Golden, Kong, Lee and Ribisl (2018) are implicated in a recommendation for imposing taxes by adjusting groups that are vulnerable to smoking consumption. These results are supported by the findings of Vallarta-Robledo et al. (2022), who stated that spatially, the environment was associated with cigarette consumption, and behavioral change was associated with smoking independently. Therefore, the first hypothesis to be developed is as follows:

Hypothesis 1: Tobacco taxation in Indonesia can reduce the level of consumption of cigarettes in rural and urban areas.

Despite the fact that several previous studies have shown that the level of cigarette consumption is not only influenced by tobacco taxation but also by other interrelated factors. Aadahl et al. (2021) concluded that a higher unemployment rate could encourage a person to consume more cigarettes. This increase was attributed to the growing volume of leisure time which could be used for smoking (Verkooijen, Nielsenand and Kremers, 2009). In addition, Crespo Cuaresma, Kubala and Petrikova (2018) stated that the increase in cigarette consumption by the public was also triggered by growing income disparities in an area. Another factor that can affect the level of cigarette consumption is the real wage of workers, where an increase in workers' real wages can cause the amount of cigarette consumption to increase (Huang, Liu and You, 2021). Furthermore, the number of incidents of violence that occurred among adolescents and children also encouraged increased cigarette consumption (Kleppang and Skille, 2022; Ouyang et al., 2020). Therefore, we develop the second hypothesis as follows:

Hypothesis 2: Cigarette consumption in rural and urban areas is influenced by unemployment rates, workers' wages, income disparities, and the amount of physical and mental violence that occurs in rural and urban areas.

At the same time, the unemployment rate is simultaneously influenced by various macroeconomic variables. Siregar (2020) shows that an increase in the minimum wage can lead to an increase in the number of the unemployed due to decreased labour demand. In addition, the number of the unemployed is also influenced by economic growth. Economic growth can encourage more opportunities to create new jobs to reduce the number of unemployed (Mushtaq, Ahmed, Fahlevi, Aljuaid and Saniuk, 2022). Furthermore, a person's education level also influences the unemployment rate. The higher the level of education, the greater the attractiveness of becoming a worker compared to someone with a low education level (Tamvada, Shrivastava and Mishra, 2022). Hailu Demeke (2022) also emphasizes that someone uneducated tends to have limitations in obtaining opportunities to get a good job. Based on these studies, we develop a third hypothesis, namely:

Hypothesis 3: Unemployment rates in urban and rural areas are influenced by the provincial minimum wage, economic growth rate, education level, and the percentage of illiterate population.

2 RESEARCH METHOD

2.1 Data source and variables

This study aims to see the impact of tobacco taxation on cigarette consumption in rural and urban communities, and several stages of study have to be completed before evaluating the impact of this policy. We chose our variables based on previous research. Then, we collect annual time series data from the Central Bureau of Statistics of the Republic of Indonesia and the Ministry of Finance of the Republic of Indonesia covering 2007–2021. We also use cross-sectional data from 33 provinces in Indonesia, then the data is organized into panel data.The data used such as real consumption of cigarettes in urban

Table 1 Variable's information

Variables	Description	Measurement	Source
URB	Real cigarette consumption in urban communities	IDR/month/capita	Central Bureau of Statistics of the Republic of Indonesia
RUR	Real cigarette consumption in rural communities	IDR/month/capita	Central Bureau of Statistics of the Republic of Indonesia
UNE	Open unemployment rate	Percent	Central Bureau of Statistics of the Republic of Indonesia
MIN	Provincial minimum wage	IDR	Central Bureau of Statistics of the Republic of Indonesia
GRO	Economic growth	Percent	Central Bureau of Statistics of the Republic of Indonesia
ENR	Pure enrolment rate for high school education	Percent	Central Bureau of Statistics of the Republic of Indonesia
ILL	Percentage of illiterate population	Percent	Central Bureau of Statistics of the Republic of Indonesia
WAG	The average real wage of workers	IDR/hour	Central Bureau of Statistics of the Republic of Indonesia
INE	Gini index	Index	Central Bureau of Statistics of the Republic of Indonesia
VIO	Percentage of population who are victims of violence	Percent	Central Bureau of Statistics of the Republic of Indonesia
R08	Dummy tobacco taxation policy in 2008	1=period of increase in tobacco taxation rates in 2008, 0=others	Ministry of Finance of the Republic of Indonesia
R09	Dummy tobacco taxation policy in 2009	1=period of increase in tobacco taxation rates in 2009, 0=others	Ministry of Finance of the Republic of Indonesia
R12	Dummy tobacco taxation policy in 2012	1=period of increase in tobacco taxation rates in 2012, 0=others	Ministry of Finance of the Republic of Indonesia
R17	Dummy tobacco taxation policy in 2017	1=period of increase in tobacco taxation rates in 2017, 0=others	Ministry of Finance of the Republic of Indonesia

Source: Authors

and rural communities, provincial minimum wage, economic growth, percentage of illiterate population, Gini index, and dummy variables of tobacco taxation policy in 2008, 2009, 2012 and 2017 to see whether there are changes in cigarette consumption after the implementation of the tariff (Table 1).

2.2 Test for Unit Root

The data was then analyzed using Levin Lin and Chu (LLC) test to determine the stationarity level (Levin, Lin and Chu, 2002). Thereafter, using a two-stage least squares (2SLS) model, the stationary variables are analyzed. A unit root test was conducted to determine the level of stationarity of the variables used in this study. Stationarity indicates no change in the data's statistic properties over time. The stationarity test shows that URB, UNE, MIN, GRO, ENR, ILL, INE, and VIO are stationary at level (Table 2). Meanwhile, RUR and WAG are stationary at the first-difference level.

Table 2 Stationarity test

Variable	Urban			Rural		
	Stage	LLC statistic	Prob.	Stage	LLC statistic	Prob.
URB	Level	–2.04	0.02	–	–	–
RUR	–	–	–	1st difference	–12.09	0.00
UNE	Level	–9.11	0.00	Level	–9.17	0.00
MIN	Level	–2.21	0.01	Level	–2.31	0.01
GRO	Level	–6.52	0.00	Level	–6.38	0.00
ENR	Level	–6.61	0.00	Level	–6.55	0.00
ILL	Level	–2.60	0.00	Level	–2.51	0.01
WAG	1st difference	–11.92	0.00	1st difference	–12.22	0.00
INE	Level	–7.43	0.00	Level	–7.67	0.00
VIO	Level	–3.80	0.00	Level	–3.75	0.00

Note: H0: Panels contain unit roots. Ha: Panels are stationary.
Source: Authors analysis, 2023

2.3 Data analysis

2.3.1 Determinants of tobacco consumption and unemployment in urban and rural area

The two-stage least squares (2SLS) model was conducted after the data became stationary. Endogenous variables are often correlated with random variables, and it is possible to solve this problem in each equation using 2SLS (López-Espín, Vidal and Giménez, 2012). This model has two stages, the first stage is to see the factors impacting the unemployment rate, while the second and final stages see the factors affecting tobacco consumption in urban or rural communities. The (1) and (2) Formulas are estimated simultaneously using the 2SLS model. The equation is as follows.

First stage:

$$UNE_t^i = \gamma_0 + \gamma_1 MIN_t^i + \gamma_2 GRO_t^i + \gamma_3 ENR_t^i + \gamma_4 ILL_t^i + \mu\,. \tag{1}$$

Second stage:

$$URB_t^i \; or \; RUR_t^i = \beta_0 + \beta_1 UNE_t^i + \beta_2 WAG_t^i + \beta_3 INE_t^i + \beta_4 VIO_t^i + \beta_5 R08_t^i + \beta_6 R09_t^i + \beta_7 R12_t^i + \beta_8 R17_t^i + \mu\,. \tag{2}$$

Expected estimation mark $\beta_1, \beta_2, \gamma_1, \gamma_4 > 0; \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \gamma_2, \gamma_3 < 0,$

where: *i* represents the cross-section data used in this study that refers to the data from rural and urban areas, while *t* shows the year of observation. The time lag variable was not used in this model. In this research, the time lag variable is not used in the model because it's only used when the policy being implemented is deemed to require a certain amount of time before it can be actively implemented properly. On the other hand, tobacco taxation has been implemented in Indonesia for a long time, so changes in the value of tobacco taxes do not require time lag to be implemented properly (Bella et al., 2023).

At the first stage, the independent variables are provincial minimum wage, economic growth, enrolment rate for high school education, and the percentage of the illiterate population. Meanwhile, the variables to determine impacting factors on tobacco consumption in urban and rural areas are unemployment, the real wage average, Gini index, the percentage of violence victims, and the dummy variables consisting of the implementation of tobacco taxations in 2008, 2009, 2012, and 2017.

2.3.2 Impact evaluation of tobacco taxations on cigarette

The 2SLS model can only determine the difference before and after the policy was implemented in 2008, 2009, 2012, and 2017, but it cannot show how big the difference is. The PSM method is one of the several methods used to determine the impact of Tobacco taxation on cigarette consumption. The propensity score matching (PSM) method is a commonly used method to deal with the problem of sample selection bias (Li, Han and Zhu, 2023). The idea is to balance and make the two situations, before and after the implementation of the tariff policy, comparable. There are several stages, first is to identify the two groups, control and treatment, followed by identifying which outcome would be measured in this study. The last stage was matching the two groups to see the impact of tariffs implementation (Kuss, Blettner, & Börgermann, 2016). The propensity score matching can be calculated through this formula:

$$ATT = E(R_1 \mid I = 1) - E(R_0 \mid I = 0),$$

$$ATT = E\left\{R_1 | I = 1, p\left(Z\right)\right\} - E\{R_0 \mid I = 0, p\left(Z\right)\},$$

here: ATT is the Average Treatment effect of the treated group, which is the impact of implementing the policy, the I symbol shows the indicators of tobacco taxations implementation (I = 0 control, I = 1 treatment), R_0 and R_1 indicate the outcome value of the treatment and control data. Lastly, p(Z) is the propensity score obtained from the dummy variables from each year of the tariff implementation (2008, 2009, 2012 and 2017). The propensity score matching was conducted twice, the first for the urban area and the second for the rural area. After that, we compare the results from the two areas. A balance test is needed to evaluate the conditional independence assumptions. On the other hand, we must also fulfill the overlapping assumptions through the PSM chart to interpret the PSM results properly. Most of the total bias reduction almost reached 100% which means that the impact evaluation result is not biased (Table 3).

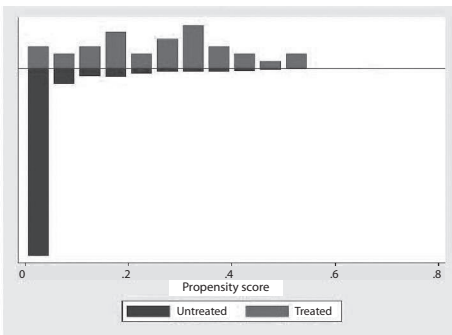
The propensity score distribution shows that most of the data can be matched perfectly except for the distribution of tobacco taxation propensity scores in 2012 (R12) in urban and rural areas that was off support even though it was not dominant, so we can conclude that the matching quality was well maintained in each period of the tobacco taxation implementation (Figure 1).

Table 3 Balancing test for matching based on the propensity score

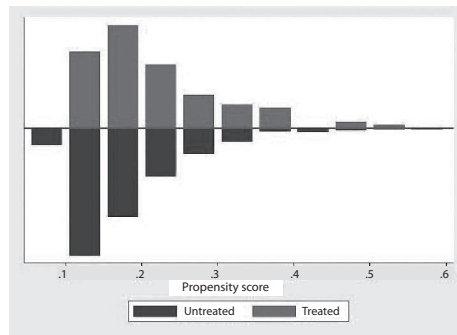
Tobacco excise tariffs period	Pseudo R2 before matching	Pseudo R2 after matching	LR chi2 before matching	LR chi2 after matching	Mean standardized Bias before matching	Mean standardized Bias after matching	Total % |Bias| reduction
Urban							
R08	0.34	0.01	84.64	1.23	87.70	2.10	97.70
R09	0.04	0.00	19.15	0.00	49.50	0.10	99.80
R12	0.11	0.00	69.14	0.20	37.30	4.20	88.90
R17	0.11	0.02	54.45	5.75	66.50	2.00	97.10
Rural							
R08	0.09	0.00	21.63	0.00	89.00	1.50	98.30
R09	0.04	0.00	17.79	0.00	48.60	0.20	99.70
R12	0.04	0.00	22.96	0.16	39.70	2.20	94.50
R17	0.11	0.01	51.96	2.22	68.80	5.10	92.60

Source: Authors analysis, 2023

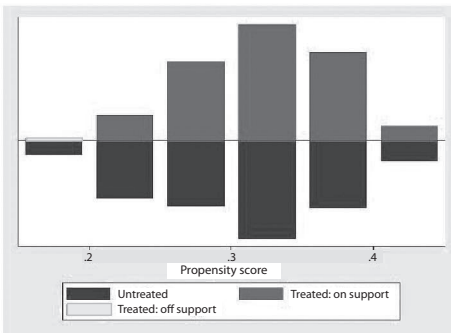
Figure 1 Distribution of tobacco taxation propensity scores



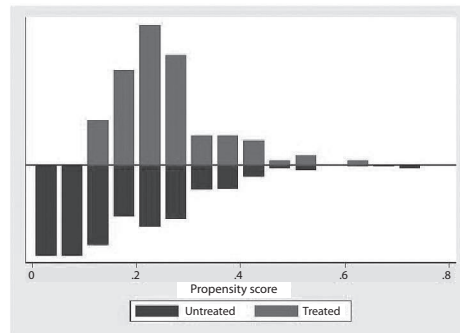
(a) Distribution of tobacco taxation propensity scores in 2008 (R08) in urban areas



(b) Distribution of tobacco taxation propensity scores in 2009 (R09) in urban areas

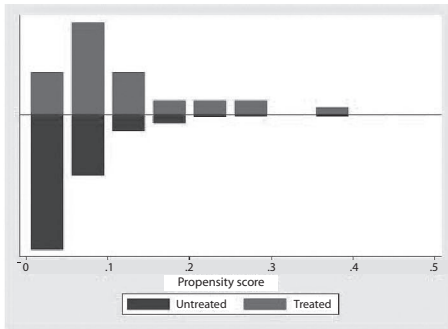


(c) Distribution of tobacco taxation propensity scores in 2012 (R12) in urban areas

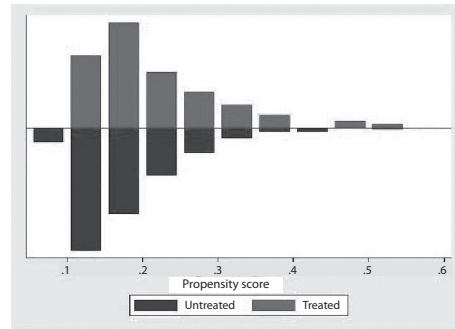


(d) Distribution of tobacco taxation propensity scores in 2017 (R17) in urban areas

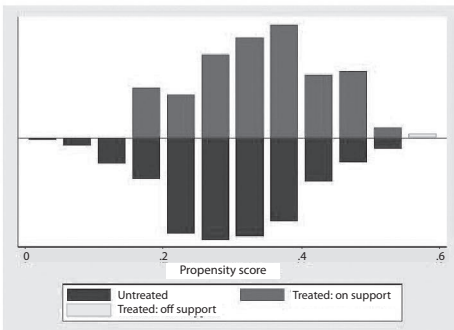
Figure 1 Distribution of tobacco taxation propensity scores (continuation)



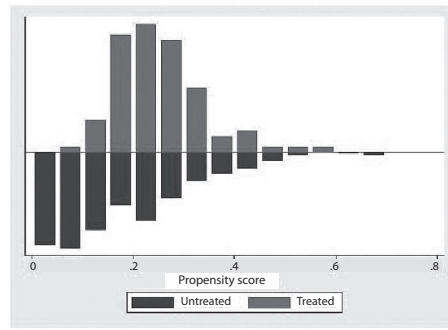
(e) Distribution of tobacco taxation propensity scores in 2008 (R08) in rural areas



(f) Distribution of tobacco taxation propensity scores in 2009 (R09) in rural areas



(g) Distribution of tobacco taxation propensity scores in 2012 (R12) in rural areas



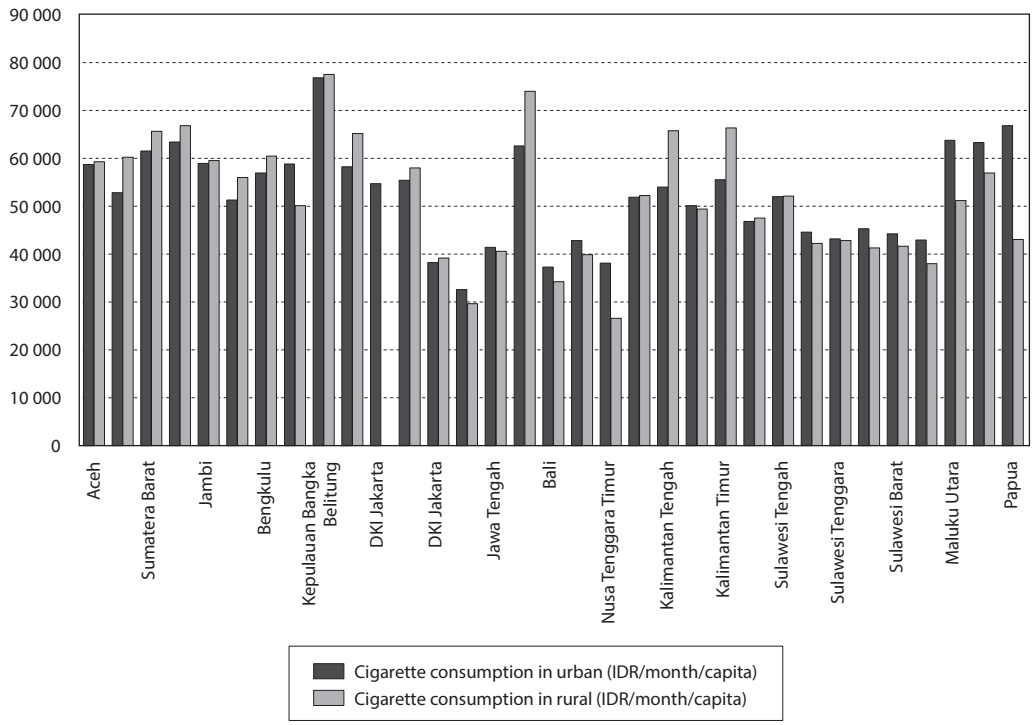
(h) Distribution of tobacco taxation propensity scores in 2017 (R17) in rural areas

Source: Authors analysis, 2023

3 RESULTS

The level of cigarette consumption in rural and urban areas seems to have differences where cigarette consumption in urban areas is higher than in rural areas. The average cigarette consumption in urban areas from 2007 to 2022 reaches IDR 54 647.56/month/capita, while in rural areas the average cigarette consumption is only IDR 51 655.23/month/capita. Furthermore, cigarette consumption in both rural and urban areas shows quite diverse differences at the provincial level (Figure 2). Bangka Belitung Province is recorded to have the highest level of cigarette consumption in rural and urban areas. The level of cigarette consumption in rural areas reached IDR 77 536.75/month/capita followed by IDR 76 821.06/month/capita in the urban areas. The high level of cigarette consumption in Bangka Belitung Province compared to other provinces is caused by the tendency of people to consume cigarettes in every social activity. Social relations are closely related to the level of one's cigarette consumption (Denney, Sharp and Kimbro, 2022; Fithria, Adlim, Jannah and Tahlil, 2021). Someone will tend to consume more cigarettes in a smoker's environment than a non-smoker's (Thomeer, Hernandez, Umberson and Thomas, 2019). Furthermore, the province with the lowest level of cigarette consumption in rural areas is East Nusa Tenggara Province, while in urban areas is the Special Region of Yogyakarta Province where cigarette consumption in each of these provinces is only IDR 26 516.31/month/capita and IDR 32 555.13/month/capita.

Figure 2 Cigarette consumption in urban-rural (IDR/month/capita)



Source: Central Bureau of Statistics of the Republic of Indonesia, 2007–2021

The 2SLS model shows that the equations compiled have met the post-estimation test where this test is a requirement that must be met to use the model properly. Using the 2SLS model requires endogeneity problems in the built model (Prasada and Dhamira, 2022; Prasada, Nugroho and Lakner, 2022). Endogeneity equations can occur when the independent variable is thought to affect a dependent variable, but, at the same time, the independent variable is affected by other independent variables. The post-estimation test shows that the Hausman statistic values for the urban and rural models are 10.07 (prob.=0.00) and 48.66 (prob.=0.00), respectively (Table 4). The probability value of the Hausman statistic is significant at the 1% alpha level, so it can be interpreted that this model has an endogeneity problem, so it fulfills the requirements for using the 2SLS model.

Furthermore, this model is indicated to have strong instrument variables through the Stock & Yogo statistic value of 15.95 (prob.=0.00) for the urban model and 9.08 (prob.=0.00) for the rural model. In addition, the Sargan statistical values for the urban and rural models each show a value of 70.52 (prob.=0.00) and 33.39 (prob.=0.00), meaning that the equation used is included in the overidentified equation category. Therefore, solving this equation must be done using the 2SLS model. Another statistical indicator, namely the Adj.R^2 value in urban and rural models, shows high values, 0.76 and 0.42, respectively. The value of the F statistic also looks significant at the 1% alpha level. Various statistical indicators indicate that selecting the 2SLS model in this study is the right decision because all the requirements for using the model can be fulfilled properly.

Table 4 Determinants of cigarette consumption in Indonesia

Variable	Urban				Rural			
	Coefficient	Std. error	t-statistic	Prob.	Coefficient	Std. error	t-statistic	Prob.
Dependent variable: UNE								
MIN	0.30	0.07	4.10	0.00 ***	0.24	0.08	3.07	0.00 ***
GRO	–0.23	0.04	–5.37	0.00 ***	–0.18	0.05	–3.97	0.00 ***
ENR	0.07	0.06	1.19	0.24 ns	0.07	0.06	1.27	0.21 ns
ILL	–0.05	0.04	–1.24	0.22 ns	–0.04	0.04	–1.01	0.31 ns
Cons.	–0.80	0.13	–6.38	0.00 ***	–0.75	0.13	–5.63	0.00 ***
Adj. R2				0.26				0.25
F statistic				16.58				15.58
F prob.				0.00				0.00
Dependent variable: URB or RUR								
UNE	0.30	0.07	4.04	0.00 ***	0.82	0.15	5.33	0.00 ***
WAG	0.15	0.09	1.73	0.08 *	0.16	0.14	1.14	0.25 ns
INE	–0.23	0.02	–9.98	0.00 ***	–0.03	0.04	–0.74	0.46 ns
VIO	–0.02	0.02	–0.92	0.36 ns	0.08	0.04	1.93	0.05 *
R08	–3.20	0.13	–24.43	0.00 ***	–3.55	0.23	–15.12	0.00 ***
R09	–2.46	0.09	–28.12	0.00 ***	–2.76	0.16	–17.07	0.00 ***
R12	–1.25	0.06	–20.04	0.00 ***	–1.45	0.10	–14.61	0.00 ***
R17	–0.85	0.07	–12.30	0.00 ***	–0.81	0.11	–7.32	0.00 ***
Cons.	1.40	0.06	24.01	0.00 ***	1.56	0.10	15.56	0.00 ***
Adj. R2				0.76				0.42
F statistic				1 630.61				627.76
F prob.				0.00				0.00
Overidentification test				70.52				33.39
Weak instruments test				15.95				9.08
Endogeneity test				10.07				48.66

Note: *** significant at 1% alpha; * significant at 10% alpha; ns not significant.
Source: Authors analysis, 2023

The results of the 2SLS analysis on urban and rural models show that the variable unemployment rate (UNE) is positively influenced by the provincial minimum wage (MIN), meaning that the higher the provincial minimum wage, the higher the unemployment rate will occur, and vice versa. The UNE variable in the urban and rural models is also negatively affected by the economic growth variable (GRO), meaning that the lower the economic growth rate, the higher the unemployment rate will occur.

Furthermore, the UNE variable has a positive effect on the level of cigarette consumption in urban (URB) and rural (RUR) communities. This shows that the higher the unemployment level in urban

and rural areas, the higher the level of public consumption of cigarettes. In the urban model, the average real wage of workers (WAG) also positively affects the cigarette consumption variable, meaning that the higher the real wage of workers, the higher the consumption of cigarettes by people in urban areas, and vice versa. In addition, the Gini index variable (INE), which shows income disparities in urban areas, has a negative effect on urban cigarette consumption, so the higher the income disparity, the lower the cigarette consumption will be. In contrast to the urban model, in the rural model, the VIO variable, which shows the level of population who are victims of violence, has a positive effect on cigarette consumption, meaning that the higher the number of people who are victims of violence, the higher the level of cigarette consumption in rural areas.

Another variable, namely the dummy variable for the implementation of the tobacco tax increase policy in 2008 (R08), 2009 (R09), 2012 (R12), and 2017 (R17) affects the level of cigarette consumption in Indonesia, both in urban and rural areas with negative regression coefficient. The negative regression coefficient indicates that the level of cigarette consumption after implementing the policy is lower than before the policy was implemented. In addition, the results of the impact evaluation analysis using the PSM method show similarities in the decline in cigarette consumption between urban and rural areas (although with different impact sizes). During the implementation of the 2008 increase in tobacco tax, cigarette consumption in urban and rural areas decreased by IDR 5 783.67/month/capita and IDR 9 393.71/month/capita, respectively (Table 5). In the increase in tobacco tax in 2009, consumption of cigarettes in urban and rural areas again decreased by IDR 21 438.58/month/capita and IDR 26 959.85/month/capita, respectively. The decline in this period was the largest decrease in cigarette consumption due to the increased tobacco taxation compared to other periods. Cigarette consumption in urban and rural areas decreased by IDR 4 416.51/month/capita and IDR 12 838.25/month/capita, respectively, when the 2012 tobacco tax increase policy was officially implemented. This decline continued when the increase in tobacco tax was carried out again in 2017, where the increase in tobacco tax reduced cigarette consumption in urban and rural areas by IDR 3 355.02/month/capita and IDR 4 123.43/month/capita, respectively.

Table 5 Impact evaluation results of tobacco taxation policy

Tobacco excise tariffs period	Impact on RCA index (difference after matching)	t-statistics
Urban		
R08	–5 783.76	–8.43 ***
R09	–21 438.58	–7.85 ***
R12	–4 416.51	–2.88 ***
R17	–3 355.02	–4.67 ***
Rural		
R08	–9 393.71	–2.83 ***
R09	–26 959.85	–7.97 ***
R12	–12 838.25	–4.25 ***
R17	–4 123.43	–4.78 ***

Note: *** significant at 1% alpha (t-table = 2.33).
Source: Authors analysis, 2023

4 DISCUSSION

4.1 Factors affecting the unemployment rate

In the urban model, it can be seen that the provincial minimum wage (MIN) has a positive and significant effect on the unemployment rate with a regression coefficient of 0.30. The regression coefficient value indicates that an increase in the provincial minimum wage of 1.00% can increase urban unemployment by 0.30%. The provincial minimum wage is closely related to the ability of a company to provide wages to all its workers. Increased minimum wages (exceeding the market clearing rate) encourage companies to increase the efficiency of their production activities, thereby triggering a reduction in the number of workers (Clemens and Wither, 2019; Dreepaul-Dabee and Tandrayen-Ragoobur, 2023; Kawaguchi and Mori, 2021). The influence of the provincial minimum wage in rural areas is lower than in urban areas. This can be seen from the coefficient of the MIN variable in the rural model which is 0.24 (lower than the UNE regression coefficient in the urban model), meaning that an increase in the provincial minimum wage of 1.00% can increase the numbers of unemployment in rural areas by 0.24%. These results can occur because the informal sector dominates the composition of employment in rural areas, so implementing the provincial minimum wage policy in rural areas has a lower elasticity of the unemployment rate than urban areas (Pérez Pérez, 2020; Siregar, 2020).

Economic growth has a negative and significant effect on unemployment rates in urban and rural areas with regression coefficient values of 0.23 and 0.18, respectively. Higher economic growth encourages an increase in the number of jobs so that the unemployment rate can be reduced (Hjazeen, Seraj and Ozdeser, 2021). The effect of economic growth on the unemployment rate in urban areas is greater than in rural areas. This is due to better connectivity in urban areas in response to rapid economic growth (Tiwasing, Clark and Gkartzios, 2022). Higher economic growth will require increased interconnection between one business unit and another. This encourages business units to develop more quickly and ultimately can encourage increased employment opportunities that can be accessed by the community.

4.2 Factors affecting cigarette consumption

The 2SLS analysis shows that the unemployment rate has a positive and significant effect on the level of cigarette consumption both in urban and rural areas. In the urban model, the UNE coefficient is 0.30, which means that a 1,00% increase in the unemployment rate will increase cigarette consumption by 0.30%. The effect of the unemployment rate in rural areas is bigger than in urban areas. The UNE coefficient in rural areas is 0.82. It can be interpreted that a 1.00% increase in the unemployment rate will increase the cigarette consumption by 0.82% in the rural area. The unemployment rate can trigger an increase or decrease in consumption where higher unemployment forces consumers to lower their expectations of future income levels, so that consumption levels will be lower (Campos and Reggio, 2015). Furthermore, the effect of unemployment on cigarette consumption is bigger in the rural area. This is due to the difficulty in obtaining other alternative jobs in rural areas compared to urban areas, so that when unemployment increases, the decline in future income expectations in rural areas becomes higher than in urban areas (Chen, Huang, Cheng, Tang and Huang, 2023; Nieto Masot, Cárdenas Alonso and Engelmo Moriche, 2020). In addition, an increase in unemployment causes an increase in leisure time which can encourage an increase in cigarette consumption for residents in both urban and rural areas (Aadahl et al., 2021; Verkooijen et al., 2009).

Real wages of workers in urban areas positively and significantly affect cigarette consumption in urban areas. The regression coefficient of this variable is 0.15, meaning that an increase in workers' real wages of 1.00% can increase cigarette consumption in urban areas by 0.15%. Growing real wages increase disposable income (Avram, Brewer, Fisher and Fumagalli, 2022; Ku, Lee, Lee and Han, 2018). Therefore, the higher the real wage of workers, the greater the amount of cigarette consumption. An increase must follow an increase in workers' real wages in public awareness about the dangers of smoking,

so it is expected that an increase in workers' real wages will not impact increasing cigarette consumption. Raising awareness regarding the dangers of smoking can be done by implementing a socialization program on the dangers of smoking, especially for teenagers, mass advertising campaigns in various electronic and print media, mobilizing communities who are activists for the smoking cessation movement, health warnings on tobacco products, and prohibiting smoking in public places (Golechha, 2016).

The income disparity variable (INE) in the urban model has a negative and significant effect on cigarette consumption with a regression coefficient of 0.23, meaning that an increase in income disparity of 1.00% can reduce cigarette consumption in urban areas by 0.23%. Increasing income inequality causes a decrease in people's purchasing power (Crespo Cuaresma et al., 2018). In addition, higher inequality encourages people to be more selective in choosing the products they buy (Shen, Fan and Hu, 2022; Velandia-Morales, Rodríguez-Bailón and Martínez, 2022). Inequality influences consumer behavior, where consumers with high levels of inequality tend to consume products that can improve their social status in society (Velandia-Morales et al., 2022). On the other hand, smoking is considered as an activities carried out by lower class people (Golden et al., 2018). Hence, people with high incomes tend to reduce cigarette consumption. At the same time, people with low income levels cannot afford to buy cigarettes due to increasing purchase prices. Therefore, when income inequality gets bigger, people will prioritize buying their basic needs of goods or services, so that consumption of cigarettes will be lower.

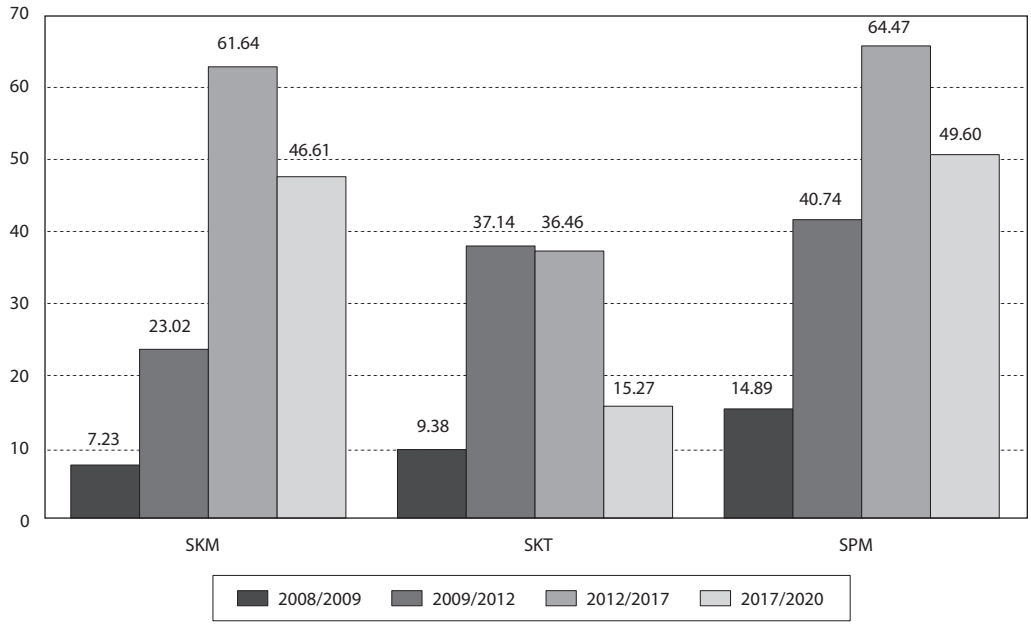
The percentage of population who are victims of violence (VIO) has a positive and significant effect on the level of cigarette consumption in rural areas with a regression coefficient of 0.08. This coefficient means that an increase in the number of victims of violence by 1.00% can increase the amount of cigarette consumption in rural areas by 0.08%. Someone who has experienced physical or sexual violence tends to seek an escape from the problems they are experiencing, so the fastest and easiest alternative to do this is smoking (Lewis, Oberleitner, Morgan, Picciotto and McKee, 2016). Furthermore, negative emotions due to acts of violence experienced by someone can trigger an increase in the frequency of smoking, so the consumption of cigarettes will increase (Spaducci et al., 2020; Y. Wang, Chen, Gong and Yan, 2016). Therefore, to reduce cigarette consumption, appropriate policies are needed to reduce violence in society. Several policies that can be implemented include encouraging the formation of communication that focuses on levels of violence, especially on teenagers and children, media campaigns that highlight preventing acts of violence, and counseling and therapy for mental health support (Araten-Bergman and Bigby, 2023; Pundir, Saran, White, Adona and Subrahmanian, 2019).

4.3 Impact of increasing tobacco taxation on cigarette consumption

Indonesia has a very complex tobacco tax policy where tobacco taxation is differentiated based on several categories at once, namely production volume, production technique (i.e., machine-rolled vs hand-rolled), aroma (i.e., white cigarettes vs clove cigarettes or kretek cigarettes), and retail price (Bella et al., 2023). Tobacco taxation in Indonesia has always been increasing from one period to another. In 2009 there was an increase in tobacco taxation compared to 2008 for the categories of machine-rolled kretek cigarettes (SKM), hand-rolled kretek cigarettes (SKT), and machine-made white cigarettes (SPM) respectively by 7.23%, 9.38% and 14. 89% (Figure 3). Tobacco tax increases continued in 2012, 2017 and 2020 with different percentages of tobacco tax increases.

The gradual increase in tobacco taxation has a direct effect on the level of cigarette consumption in both urban and rural areas. The results of the 2SLS analysis show that the dummy variable of the application of tobacco tax policy in each period (R08, R09, R12, and R17) has a negative sign regression coefficient, meaning that the level of cigarette consumption in the period before the increase in tobacco tax was higher than the period after. This result is also in line with the impact analysis results using the PSM model, where the impact value in each period of increased tobacco tax has a negative value.

Figure 3 The development of tobacco taxation in Indonesia



Source: Ministry of Finance of the Republic of Indonesia, 2007–2021

Impact evaluation analysis using the PSM method shows that the reduction in cigarette consumption rates in rural areas is higher than in urban areas. The increase in tobacco taxation in 2008 led to a decrease in cigarette consumption in rural areas by IDR 9 393.71/month/capita, while tobacco consumption in urban areas decreased by IDR 5 783.76/month/capita (Table 5.). Furthermore, in 2009 the increase in tobacco taxation caused cigarette consumption in urban areas to fall by IDR 21 438.58/month/capita, lower than the decrease in cigarette consumption in rural areas, reaching IDR 26 959.85/month/capita. In 2012, the increase in tobacco taxation led to a decrease in the level of consumption of cigarettes in urban and rural areas by IDR 4 416.51/month/capita and IDR 12 838.25/month/capita, respectively. The decline in cigarette consumption occurred again after the tobacco tax increase policy was implemented in 2017, where the policy pushed cigarette consumption in urban and rural areas to fall by IDR 3 355.02/month/capita and IDR 4 123.43/month/capita, respectively. The impact of increasing tobacco taxation is greater in rural areas due to the high-income gap between urban and rural communities, so the response to reduced cigarette consumption to increased tobacco taxation in rural areas is higher than in urban areas (Liu and Long, 2021; Zhong, Wang, Zhu, Chen and Huang, 2022). These results also indicate that implementing tobacco taxation in urban areas is ineffective compared to rural areas. Differences in the effectiveness of implementing tobacco taxation in urban areas and rural areas are driven by differences in population density, income level, poverty level, and level of public education in each region (Darden, 2021).

The tobacco tax increase policy will be more effective if it is carried out with other interventions such as the anti-smoking campaign (Kalousova et al., 2020; Parks et al., 2021). The anti-smoking campaign acts as a complement that accommodates the behaviour of smokers with various characteristics (Colombo and Galmarini, 2023). Another effort to significantly reduce people's consumption of cigarettes is to provide images of the dangers of consuming cigarettes on packaging (Kim and Khang, 2020). Therefore, a proportional combination of policies between tobacco taxationes and accurate public education

is needed regarding the relative risks that can result from cigarette use (Cummings, Ballin and Sweanor, 2020). Sæbø and Lund (2022) emphasizes that perceptions of the risks of smoking use can be formed by conveying accurate information to the public. The implementation of the tobacco tax increase policy in 2009 appears to have had the greatest impact compared to other tobacco tax increase periods. This was driven by low economic growth due to the global crisis in 2008–2009, causing an increase in tobacco taxation in that period to have a greater impact than in other periods (Nützenadel, 2020; Resosudarmo, Abdurohman, Yusuf and Hartono, 2021; Tambunan, 2019).

Furthermore, it is important for the Indonesian government to reform tobacco taxation policy. The tobacco taxation currently implemented in Indonesia follows a very complex taxation system, where tobacco tax is determined based on various categories, starting from production volume, production technique (i.e., machine-rolled vs. hand-rolled), aroma (i.e., white cigarettes vs. clove cigarettes or kretek cigarettes), and retail price (Bella et al., 2023). This could potentially lead to inefficiencies in the implementation of tobacco taxation. In addition, higher tobacco taxes increase the potential for the phenomenon of untaxed cigarette smuggling to emerge, so supervision regarding the implementation of tobacco taxes needs to be tightened.

CONCLUSION

Tobacco policy improvements have negatively impacted cigarette consumption levels in both urban and rural areas. This indicates that the government's tobacco tax increase policy has successfully reduced cigarette consumption in both areas. The results also show that the decline in cigarette consumption due to the implementation of tobacco taxation in rural areas is greater than in urban areas. Rural and urban areas have different characteristics, both in terms of income level, population density, poverty level, and education level, so they have different responses to changes in tobacco taxes. These results indicate an ineffective implementation of the tobacco tax in urban areas. Therefore, it is necessary to increase the effectiveness of tobacco tax in urban areas by simultaneously implementing other intervention policies complementary to tobacco tax policies. In addition, cigarette consumption in urban and rural areas can be reduced by taking into account the unemployment rate variable, where a lower unemployment rate can reduce the level of public consumption of cigarettes. Furthermore, the unemployment rate can be reduced by carefully considering the increase in the provincial minimum wage every year and implementing policies that can encourage economic growth in both urban and rural areas.

Workers' real wages and income disparity are other variables that need to be considered to reduce cigarette consumption in urban areas. An increase in workers' real wages can encourage an increase in cigarette consumption. Hence, an increase in real wages needs to be balanced by implementing policies that can increase public awareness about the dangers of smoking. In rural areas, reducing cigarette consumption can be reduced by considering the violence in society. Higher levels of violence can lead to increased consumption of cigarettes in rural communities.

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