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Price Smoothing Behavior of Cigarette Firms in Indonesia

Amin Dwinta Putra[1*], Vid Adrison[2]
[1,2]Faculty of Economics and Business, University of Indonesia, Indonesia
E-mail: [1]amindwinta@gmail.com, [2]vadrison@yahoo.com
[*]**Corresponding author**

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ABSTRACT

Research Originality: This research analyzes the price-smoothing behaviors of cigarette firms across various cigarette types, firm classifications, and government policies by using quarterly data at the brand level.

Research Objectives: This research aims to identify the price-smoothing tendencies of cigarette firms in Indonesia by analyzing the change in market retail price across various cigarette types and firm classifications and the impact of government policies.

Research Methods: This research used quarterly market retail price survey data covering all cigarette brands available in Indonesia from March 2014 to June 2021. The System Generalized Method of Moments (System GMM) was identified as the optimal estimation method.

Empirical Results: The results showed that cigarette firms in Indonesia employed price-smoothing strategies in response to implementing the tariff increase policy. Notably, substantial price increases tend to occur in December, immediately following the announcement of the tariff increase policy. Removing one of the ceiling price criteria has led to an increase in the average price of cigarettes within the specified criteria. The implementation of a minimum price had no significant impact on price changes.

Implications: This study's findings suggest that to address the issue of rising smoking prevalence, the government should consider implementing a more substantial tariff increase to counteract the impact of price-smoothing.

Keywords:

cigarette retail prices; time intervals; quarterly period, price smoothing.

How to Cite:

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INTRODUCTION

Smoking prevalence among the Indonesian population is increasingly alarming. Although the Government has increased tobacco excise taxes annually, Indonesia still ranks high globally for smoking prevalence. In 2018, 62.9% of males and 4.8% of females aged 15 and older were smokers (World Health Organization, 2020). Among youth aged 10-18, in particular, there is an upward trend, with rates increasing from 7,2% in 2013 to 7,4% in 2023 (Amalia et al., 2024). These figures underscore the challenges posed by smoking prevalence in the nation.

The cigarette tax (in this paper referring to excise) -as in the case of the Indonesian Government- is a powerful instrument to regulate cigarette consumption and reduce smoking prevalence, ultimately leading to improved public health (Chaloupka et al., 2011; International Agency for Research on Cancer, 2011; World Health Organization, 2020). However, the efficacy of this tool largely depends on the extent to which the tax increase is reflected in changes to the retail prices of cigarettes (Linegar & Van Walbeek, 2018), as well as the degree to which these increases are passed from firms and retailers to consumers, thereby affecting consumer demand levels (Nargis et al., 2020). The extent to which cigarette firms pass on tax increases to consumers is influenced by the strategies adopted by these firms in response to tax increases. These strategies focus on mitigating the potential impact of higher tobacco taxes, which threaten the profitability of cigarette firms (Ross et al., 2017).

One of the strategies employed by cigarette firms involves a timing approach to mitigate the impact of increased tax rates. This strategy, commonly referred to as "price smoothing" or "cushioning," entails a gradual, incremental adjustment of prices over several months (Ross et al., 2017). Instead of a significant change, this strategy involves small, gradual price adjustments following tax increases (Hiscock et al., 2018; Partos et al., 2020). The primary objective is to attenuate the tangible impacts of the tobacco excise tax increase (Bayly et al., 2021), thereby preventing the potential cessation of consumer smoking habits (Hiscock et al., 2018; Sheikh et al., 2021). This approach has shown a relatively smaller impact on reducing the demand for cigarettes compared to a one-off increase in cigarette prices to the ceiling (International Agency for Research on Cancer, 2011). A gradual price increment allows sufficient time for consumers to acclimate to the impact of the excise tax increase.

However, the literature on price smoothing remains scarce, mainly limited to discussions in general systematic reviews (Hiscock et al., 2018; Partos et al., 2020; Ross et al., 2017; Sheikh et al., 2021). Recent exceptions include studies in Australia and Mexico (Bayly et al., 2021; Saenz-de-Miera et al., 2024). The first study was based on the two largest Australian supermarket chains and found that significant tobacco retailers in Australia are gradually raising prices (cushioning) on factory-made cigarettes and roll-your-own tobacco products at least one month before the scheduled tax increase. Further research with a larger sample of products, stores, and types of cigarettes is needed to confirm these findings. The second study found that the tobacco industry employed two pricing strategies in response to Mexico's 2020 tax increase: price smoothing and moderate

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overshifting. However, this study only examines pricing strategies during recent excise tax adjustments. Research covering a more extended period of annual tax increases may be needed. Considering these research gaps, this study focuses on Indonesia, a country with a high prevalence of smoking and a complex tobacco tax system consisting of various cigarette types and firm classifications.

Indonesia has a complex tobacco excise system that determines tariffs based on four categories: (1) production volume; (2) production method (i.e., by hand or using machines); (3) flavor (i.e., with a clove, known as *kretek,* or without clove; and (4) reference price limit (Harga Jual Eceran, HJE) (Prasetyo & Adrison, 2020), see Appendix 1. The regulations categorize those four[1] as types of tobacco products, firm classification (based on type and production volume), and HJE limits. The specific tariff rates and categories are determined through a Minister of Finance Regulation (Peraturan Menteri Keuangan, PMK) and usually announced towards the end of the year, between October and December, with implementation scheduled for early January or February of the following year. This timing allows cigarette firms to implement price-smoothing strategies (Bayly et al., 2021), during the period of policy announcement to the commencement of the new tariff rates.

Excise rates for hand-made cigarettes are lower than those for machine-made cigarettes, with higher rates for cigarettes containing filters. These categories collectively define different types of cigarettes. However, this study focused on three specific categories: machine-made clove cigarettes (Sigaret Kretek Mesin/SKM), machine-made non-clove cigarettes (Sigaret Putih Mesin/SPM), and hand-made clove cigarettes (Sigaret Kretek Tangan/SKT).

The firms are classified according to the type of cigarettes produced and production volume. Each group is subject to a production limit. If production exceeds the permitted limit, the firm is obliged to move up to a higher class (group). Cigarette firms are classified into three hierarchical groups: I, II, and III. Firms in the higher groups are subject to more significant production limits, which result in higher tariffs. In addition, each group of firms is also given a different limit of the reference price, known as Harga Jual Eceran (HJE). The reference price represents the allowable price range for each cigarette stick and serves as the basis for the Government's calculation of excise taxes. The reference price is set through a Minister of Finance Regulation. Notably, firms in higher groups benefit from more generous HJE limits, but higher excise rates offset this benefit. Within Indonesia's regulatory framework, in addition to the reference price, there are two other important price components: (1) the tag (banderol) price and (2) the market retail price. The tag price is the value stated on the excise tax band attached to each pack of cigarettes. The tag price is calculated by multiplying the reference price set by the firm by the number of cigarette sticks in a pack. It should be noted that the tag price, determined by the firm, may differ from the Government's reference price per individual cigarette stick.

[1] Article 5 point (2) Minister of Finance Regulation Number 192/PMK.010/2021.

It should be underlined that the tag price should not exceed the reference price limit set for each cigarette. In practice, the market retail price, referred to as the Market Transaction Price (Harga Transaksi Pasar, HTP), represents the retail price of cigarettes at the retailer level. However, discrepancies may arise between the market retail price and the tag price. In this context, the Government of Indonesia is responsible for setting and overseeing pricing policies, including monitoring retail prices of the cigarette market. This monitoring is critical due to the significant variations in market retail prices across different cigarette brands, each displaying a tag (banderol) price on its packaging. To maintain price stability and fairness in the market, the Government sets both a ceiling price and a minimum price, which serve as the upper and lower limits for the market retail price of cigarettes.

Before 2015, market retail price monitoring focused on two criteria for the ceiling price (see Appendix 1). These two criteria were: (1) the market retail price of a cigarette brand was not allowed to exceed the reference price limit per stick of the above tier and/or (2) for brands whose excise tax rate is at the highest reference price per stick for each group, the market retail price may not exceed 5% of the tag price. Between 2015 and 2021, two important policies were implemented regarding monitoring market retail prices. The first was the elimination of one of the two ceiling price criteria that had been set previously. The second was the introduction of minimum prices.

The Minister of Finance Regulation No. 198/PMK.010/2015, effective as of November 6, 2015, removed one of the two ceiling price criteria. As a result, brands with excise tariffs with the highest reference price per stick for each group were allowed to have a retail price exceeding 5% of the tag (banderol) price. Consequently, ceiling price monitoring ensures that the market retail price of a cigarette brand does not exceed the reference price limit per stick of the above tier.

Following the Minister of Finance Regulation No. 146/PMK.010/2017, which became effective on October 25, 2017, the Government has established a minimum market retail price requirement. This regulation mandates that the market retail price for a brand should not be less than 85% of the tag price. Prior to the issuance of this regulation, no minimum market retail price was set, thus allowing firms to sell their cigarettes at any price below the tag price without restriction. Therefore, since October 25, 2017, market retail price monitoring has been conducted with a focus on two specific aspects: (1) market retail prices that exceed the reference price limit per stick or gram of the above tier or (2) market retail prices that are less than 85% of the tag price.

This study aims to identify instances of price smoothing within the Indonesian cigarette market by analyzing market retail price fluctuations. These fluctuations are observed from the announcement of tobacco tax (excise) tariff changes to the effective date of the new tariffs in the following year. To track market retail price changes over the specified intervals, this study uses the period between policy announcements and the quarterly periods of the current year as a proxy.

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According to the authors, this is the first study investigating price smoothing behaviors in Indonesia. It is distinct from previous research by employing brand-level data with nationwide coverage over an extended period. It covers various cigarette types, firm classifications, and government policies regarding cigarette prices in Indonesia. These policies include the elimination of one of the two ceiling price criteria in 2015 and the introduction of minimum pricing in 2017.

METHODS

Our study is based on a comprehensive analysis of quarterly market retail price (hereafter referred to as retail price) data for all cigarette brands available between March 2014 and June 2021. The data was obtained from the Directorate General of Customs and Excise, Ministry of Finance. The analysis specifically focused on the three largest categories of cigarettes produced in Indonesia (Zheng et al., 2018). These categories are machine-made clove cigarettes (referred to as SKM), machine-made non-clove cigarettes (referred to as SPM), and hand-made clove cigarettes (referred to as SKT).

The data set consists of the retail prices per stick, applicable tax (excise) rates, the types of cigarettes, the group or class of producers or firms, and information on whether a brand is at the highest reference price within its category. In addition, data from the Minister of Finance Regulation on tobacco tax rates from 2013 to 2020 is used to ascertain the time interval between the announcement of the tariff policy and the survey period.

A total of 245,852 rows of survey data from various cigarette brands were collected during the specified survey period. The average retail price for each brand and period was calculated, and panel data were generated. The retail price data for each of the same cigarette brands were aggregated on a per-survey-period basis. Given that (1) the retail price of each brand may vary by region, (2) a single brand of cigarette in the market may have an excise stamp design with a different tag (banderol) price and tax rates, we calculated the average retail price per cigarette brand across the same survey period. Due to the fluctuations in retail prices within the same survey period, it was necessary to calculate the time interval data from the enactment of the Minister of Finance Regulation stipulating excise tax rates, until the end of the survey period (March 31, June 30, September 30, or December 31). This approach is taken to capture the distribution of these changes.

It is assumed that in the absence of an announcement regarding the tax rates policy for the upcoming year within the specified survey period, the firm will refrain from speculation. As a result, the retail price of cigarettes was still determined based on the previous tax rates. Changes in retail prices were observed quarterly, with a particular focus on price adjustments occurring at the end of the year (t-1) before the tax increase (pre-emptive), during the tax increase (contemporaneous), and after the tax increase (delayed). Given that the tax increase is effective in early January or February, while the data used is quarterly price data (December, March, June, September), the price smoothing analysis employs price changes in December (pre-emptive) and in March, June, and September (delayed).

To determine the impact of tax rate changes and the time interval since the announcement of the new rate policy on price movements, we regress price changes as a function of these variables on the price survey period. Using dynamic panel data regression estimation (The Generalized Method of Moments), we test the consistency of the parameters by performing several stepwise regressions from restricted to unrestricted specifications for the brand's price in period t by the following equation:

$$\begin{aligned} ln\,(AvgPrice_{it}) = {} & \beta_0 + \beta_1 ln\,(AvgTax_{it}) + \beta_2 Interval_t + \beta_3 DQ1_t \; x \; Interval_t + \\ & \beta_4 DQ2_t \; x \; Interval_t + \beta_5 DQ3_t \; x \; Interval_t + \beta_6 DSKM_i \; x \; Interval_t + \\ & \beta_7 DSPM_i \; x \; Interval_t + \beta_8 DGol1_i \; x \; Interval_t + \beta_9 DGol2_i \; x \; Interval_t + \\ & \beta_{10} DTop105_{it} + \beta_{11} DNonTop_{it} + \beta_{12} D85_t + \beta_{13} ln\,(AvgPrice_{it-1}) + \delta_t + \\ & \alpha_i + \varepsilon_{it} \end{aligned} \quad (1)$$

In the initial step, the explanatory variables consist of the average applicable tax per stick of brand i at t period (in natural logarithm), $AvgTax$; the time interval (in days) between the announcement of the new tax rate and the survey end date of t period, denoted as $Interval$; and interaction terms between $Interval$ and quarterly period dummy. This baseline specification investigates the effect of the cigarette tax changes and length of time interval across different quarters. Since there are four quarterly periods -March (Q1), June (Q2), September (Q3), and December (Q4)- we use three dummy variables for the quarterly period (DQ1,DQ2,DQ3) with Q4 as the reference group. In this case, the coefficient for $Interval$ represents the effect without interaction.

In the second step, we add interaction terms between the interval and the cigarette type dummy variables to account for the potential differences in retail prices across different cigarette types and quarters. There are three types of cigarettes considered: machine-made clove cigarettes (SKM), machine-made non-clove cigarettes (SPM), and hand-made clove cigarettes (SKT). Two dummy variables (DSKM,DSPM) are used to categorize cigarette types, with SKT as the reference group. In this case, the coefficient for the $Interval$ represents the effect without interaction.

In the third step, we add interaction terms between the interval and the firm classifications dummy variables to account for the potential variation in retail prices across different firm classes over various quarters. There are three firm classifications: class I (Gol1), class II (Gol2), and class III (Gol3). Two dummy variables are employed for each firm class ($DGol1$ and $DGol2$), indicating that the reference group is Gol3, representing a pure coefficient on $Interval$ without interaction.

Furthermore, in the final step, three additional dummies are employed to capture the impact of price policy changes. The three dummies are: (1) $DTop105$ is a dummy variable interacting with cigarette brand i that is in the top tier in its classification, with a dummy marking the periods before and after the implementation of PMK No.198/PMK.010/2015. This dummy interaction is used to determine the effect of the policy of eliminating one of the ceiling price criteria for cigarette brands that occupy the top position of the reference price limit per cigarette in their category. (2) DNonTop is used to determine the spillover effect on the retail price of cigarette brands that do not occupy

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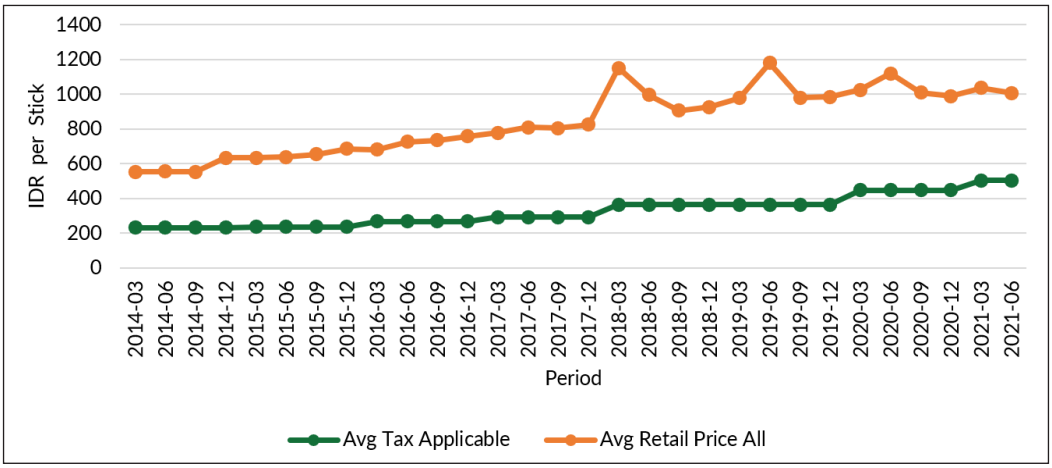
the top tier of the reference price limit per cigarette in their category. (3) *D*85 is used to examine the impact of the minimum price implementation policy in 2018.

RESULTS AND DISCUSSION

The statistical significance and magnitude of change in the average retail price over distinct time intervals can be used to identify price smoothing behavior. A sudden, sharp price increase occurring in a single step or a substantial rise distributed incrementally across multiple stages may indicate price smoothing. On the other hand, if the average retail price shows significant fluctuations up and down over a period, these patterns do not indicate price smoothing.

As illustrated in Figure 1, the descriptive statistical analysis shows that between 2014 and 2017, the retail prices followed a gradual upward trend. A notable shift was observed from 2017 to 2018, indicating a substantial increase in retail prices. Notably, the period from late 2018 to early 2019 did not show any significant retail price increases and no concurrent changes in tax rates or reference prices. Considering that strong market demand and the absence of excise tax increases affect product costs, cigarette firms subsequently increased their market transaction prices in the second quarter of 2019. However, in keeping with the previous year's pattern, this increase was followed by a marked decline in reference prices from the second to the third quarter of 2019.

Figure 1. Average Tax Tariff Applicable and Average Retail Price (HTP) Between Survey Periods



Source: Authors' calculation from the dataset

It is essential to perform an econometric test and analyze the statistical significance by estimating statistical software to reach a conclusion regarding the existence of price smoothing behavior. Therefore, we performed multiple regression analyses for equation (1) using STATA, with the results presented in Table 1. The first column shows the application of Pooled Least Squares (PLS) estimation for the base model, excluding price policy as a control variable but including the time trends. The second column applies the PLS estimation method, incorporating both price policy and time trend variables into

the model. Furthermore, our analysis uses the fixed effect model (FEM), as illustrated in the third and fourth columns of the table.

Table 1. Regression Results

Regression	PLS		FEM		Diff. GMM	Sys. GMM
Specification	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Variable	**lnAvgPrice**	**lnAvgPrice**	**lnAvgPrice**	**lnAvgPrice**	**lnAvgPrice**	**lnAvgPrice**
lnAvgTax	0.0812***	0.100***	0.180***	0.198***	0.286***	0.407***
	(0.00644)	(0.00692)	(0.0367)	(0.0339)	(0.0650)	(0.0539)
Interval	0.000339***	0.000305***	0.000358***	0.000322***	0.000332***	0.000383***
	(0.0000877)	(0.0000889)	(0.0000690)	(0.0000693)	(0.0000869)	(0.0000968)
DQ1_Int	0.00000153	-0.0000173	-0.0000588	-0.0000548	**-0.0000596**	**-0.000115***
	(0.0000547)	(0.0000544)	(0.0000434)	(0.0000442)	(0.0000510)	(0.0000513)
DQ2_Int	-0.000165**	-0.000185**	-0.000170***	-0.000157**	-0.000168**	-0.000247***
	(0.0000623)	(0.0000623)	(0.0000506)	(0.0000516)	(0.0000585)	(0.0000590)
DQ3_Int	-0.000201**	-0.000222***	-0.000181***	-0.000163**	-0.000184**	-0.000260***
	(0.0000663)	(0.0000667)	(0.0000538)	(0.0000547)	(0.0000606)	(0.0000613)
DSKM_Int	-0.000160***	-0.000234***	-0.0000191	-0.0000313	-0.0000604	-0.0000235
	(0.0000210)	(0.0000226)	(0.0000210)	(0.0000210)	(0.0000880)	(0.000108)
DSPM_Int	-0.000118***	-0.000204***	-0.0000237	-0.0000341	**-0.000112**	**-0.000321***
	(0.0000231)	(0.0000244)	(0.0000250)	(0.0000251)	(0.000121)	(0.000157)
DGol1_Int	0.0000727*	0.000172***	-0.000120***	-0.000100**	-0.0000300	0.0000336
	(0.0000337)	(0.0000368)	(0.0000333)	(0.0000345)	(0.000104)	(0.000125)
DGol2_Int	-0.00000988	0.000145***	-0.000123***	-0.000103**	-0.0000747	-0.0000640
	(0.0000284)	(0.0000329)	(0.0000329)	(0.0000343)	(0.000106)	(0.000127)
DTop105		0.00565		0.0179***	0.0519***	0.0408***
		(0.00456)		(0.00526)	(0.00991)	(0.00949)
DNonTop		-0.0392***		-0.0456**	-0.136**	-0.147**
		(0.00521)		(0.0162)	(0.0519)	(0.0460)
D85		-0.00307		-0.0132**	-0.00840	-0.00520
		(0.00521)		(0.00465)	(0.00507)	(0.00501)
t	0.00161***	0.00230***	0.0150***	0.0148***	0.0106***	0.00926***
	(0.000222)	(0.000364)	(0.000946)	(0.000914)	(0.00109)	(0.000981)
L.lnAvgPrice	0.834***	0.787***	0.108***	0.0991***	**0.162****	0.130**
	(0.00955)	(0.0118)	(0.0249)	(0.0250)	(0.0578)	(0.0485)
_cons	0.624***	0.827***	4.708***	4.681***		3.394***
	(0.0459)	(0.0558)	(0.258)	(0.249)		(0.247)
N	7674	7674	7674	7674	6162	7674

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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The panel FEM addresses the problem of unobserved heterogeneity that may exist in the estimation model. However, due to the correlation between the dependent variable ($AvgPrice_{it}$) and the previous lagged dependent variable ($AvgPrice_{it-1}$), the estimation results with FEM are biased. This correlation arises because cigarette firms set cigarette prices across periods by considering the previous period's price, reflecting forward-looking behavior with consumer rational addiction. Additionally, this is also caused by the policy prohibiting the tag price of a firm's new brand from being lower than the tag price of similar cigarette products it owns. To address this correlation problem, models (2) and (4) are estimated using the GMM dynamic panel model.

Initially, the retail price ($AvgPrice_{it}$) was regressed as a basic function of ($AvgTax_{it}$) and $Interval_t$, with interactions for dummy variables differences between quarter periods, types of cigarettes, and firm classification, while controlling for time trends. Then, the price policy variables (dummy $DTOP105_t$, $DNonTop_t$, and $D85_t$) were added to the regression. This regression process was performed using both PLS and FEM estimation methods.

The results from regression specifications (1), (2), (3), and (4) indicate that the lagged dependent variable ($AvgPrice_{it-1}$) is consistently positive and significant. Therefore, the lagged dependent variable should be included in the model specifications. Since the specification uses a lagged dependent variable, the estimation technique is no longer suitable for a static panel model, so it is more appropriate to use the GMM dynamic panel model for the unrestricted model specifications (2) and (4). The GMM technique results are presented in specification (5) for the difference GMM and specification (6) for the system GMM estimation.

Based on the results from the difference GMM and the system GMM estimations, the coefficient of the lagged dependent variable ($AvgPrice_{it-1}$) remains consistent and significant, so it is appropriate to use GMM dynamic panel estimation. The coefficients for $AvgTax_{it}$ and $Interval_t$ also show significant interaction in both types of GMM estimation. However, there is a difference in the interaction terms $DQ1_t \; x \; Interval_t$ and $DSPM_t \; x \; Interval_t$ between the difference GMM and the system GMM results. To determine the most appropriate model, the coefficients of the lagged dependent variable ($AvgPrice_{it-1}$) from the difference GMM is compared with previous PLS (as an upper limit) and FEM (as a lower limit) estimates.

The lagged dependent variable ($AvgPrice_{it-1}$) coefficient estimated by the difference GMM is 0.162, which lies between 0.787 for the PLS estimation (specification 2) and 0.0991 for the FEM estimation (specification 4). These results indicate that the selected GMM model passes the unbiased test. As a rule of thumb, if the difference of GMM estimation results is closer to or lower than the FEM estimation results, then the system GMM estimation results of the system should be appropriate, as it provides slightly better results. Since 0.162 is closer to 0.0991, the system GMM estimation results (specification 6) are chosen.

In addition to passing the unbiased test, the difference GMM and the system GMM estimations has also passed the instrument validity and consistency tests. The Hansen test of overidentifying restrictions, used to test the validity of the instruments, shows a probability value greater than 5%. Meanwhile, the instrument consistency test, conducted using the Arellano-Bond test for zero autocorrelation in first-differenced errors with a probability value of greater than 5% at the second order, confirms that the error term is not correlated with AR order 2 (no autocorrelation).

The estimation results using the system GMM (specification 6) show that the coefficient $AvgTax_{it}$ is positive and significant, indicating the correlation between increases in average excise tax and average retail price. These results align with the previous research (Linegar & Van Walbeek, 2018; Prasetyo & Adrison, 2020) and the majority of other literature shows that tax increases lead to higher cigarette prices (Chaloupka et al., 2000). When taxes rise, firms increase costs that are ultimately passed on to consumers. The difference lies in the degree of shifting of the tax charged to consumers, whether under-shifting, full-shifting, or over-shifting.

Initially, we assumed the average retail price (Market Transaction Price, HTP) across different periods, types of cigarettes, and firm classification (groups) correlated with the time interval between the tax increase announcement and the survey period. To test this hypothesis, we created an interaction variable between $Interval_t$ and the quarterly survey period (Q) dummy, $Interval_t$ and the cigarette type dummy, as well as $Interval_t$ with the firm classification dummy as the control variable.

The results show that the $Interval_t$, used as the reference (along with its interactions between the $Interval_t$ and the Q4 survey period, the type of SKT cigarettes, and class III firms), is significant. The time interval is relevant to retail price changes in Q4 and for SKT cigarettes and class III firms. In addition to Q4 retail price changes, the time interval is also relevant to price changes in the Q1, Q2, and Q3 periods as shown by the significant coefficients for $DQ1_t \; x \; Interval_t$, $DQ2_t \; x \; Interval_t$, and $DQ3_t \; x \; Interval_t$. Based on the estimated coefficients, the impact of changes in time intervals on the average price for each Q period can be calculated and summarized in Table 2.

Table 2. Impact of Changes in Time Intervals on the Average Price Between Periods

Variable	Coefficient	Significance	Period	Total Coefficient	Impact of Change
$Interval_t$ (reference)	0.000383	Significant	Q4	0.000383	0.0383%
$DQ1_t \; x \; Interval_t$	-0.000115	Significant	Q1	0.000268	0.0268%
$DQ2_t \; x \; Interval_t$	-0.000247	Significant	Q2	0.000136	0.0136%
$DQ3_t \; x \; Interval_t$	-0.000260	Significant	Q3	0.000123	0.0123%

Note: Q, Quarterly Survey Period

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The coefficient of the $Interval_t$ and its interaction with $DQ1_t$, $DQ2_t$, and $DQ3_t$ are significant, indicating that the length of time since the announcement of the tax increase correlates with the average retail price in the survey periods Q4, Q1, Q2, and Q3. The negative coefficient on the interaction of $Interval_t$ with Q1, Q2, and Q3 indicating the average price increase in these three periods is lower than in Q4, which serves as the reference. This decreasing coefficient indicates the price smoothing for SKT cigarettes and class III firms, representing the key finding of this study.

The average price increase in Q4 of the previous year was substantial but not sudden. The rise in Q4 last year is followed by a further increase in Q1, Q2, and Q3 of the following year through a decreasing magnitude (indicating a declining slope). Thus, since the announcement of the excise tax policy at the end of the year, cigarette firms have gradually increased their average prices (price smoothing). The longer the interval between the policy announcement and the survey period, the smaller the impact on average price changes. Cigarette firms engage in price smoothing to reduce the impact of tax increases.

There is a difference in consumer response between a sudden and a gradual price increase. A substantial body of research shows that many smokers are highly responsive to changes in cigarette prices, demonstrating a marked price sensitivity (Hyland et al., 2005). As a result, sharp and substantial hikes in cigarette prices are often associated with a greater likelihood of smokers quitting (Chaloupka et al., 2000; Forster & Jones, 2001; Lee, 2008; Ross et al., 2011; Ross et al., 2011; Tauras & Chaloupka, 1999). In contrast, consumers generally show less sensitivity to lower price increments (Li et al., 2017). This observed behavior informs firms' strategies, gradually motivating them to raise prices (Bayly et al., 2021; Hiscock et al., 2018; Linegar & Van Walbeek, 2018; Partos et al., 2020). By implementing gradual price adjustments, firms take advantage of consumers' reduced sensitivity to minor price changes, allowing them to raise prices gradually without causing a significant demand reduction.

When firms raised cigarette prices following the announcement of the new tariffs, they could secure additional profits until the new tariffs officially took effect. However, such price hikes prompted consumers to reduce their demand in response to the price increases (Ross et al., 2017). It should be noted that this demand reduction was less pronounced than what would occur if firms implemented price increases in a single step on the effective date of the new tariffs. As a result, firms prefer a gradual approach to raising prices in subsequent periods.

The identification of price smoothing as the key finding of this study is in line with observations indicating that tax increases can be passed on to consumers over several months (Linegar & Van Walbeek, 2018). This transmission occurs in anticipation of the tax increase (pre-emptive), during the tax increase (contemporary), and following the tax increase (delayed price adjustments). More significant nominal price increases for cigarettes are expected to predominantly appear around the month when the tax increase takes effect.

Cigarette firms tend to smooth the incremental price changes throughout the year. This behavior aligns with the concept of rational addiction (Becker & Murphy, 1988), which suggests that the intertemporal relationship between current cigarette consumption and its impact on future consumption encourages cigarette firms to adopt a forward-looking approach (Gordon & Sun, 2015; Rogeberg, 2020). In this context, cigarette firms seek to identify optimal pricing strategies that maintain demand over time. Firms anticipate future events by influencing current consumption (Showalter, 1999). Rather than abruptly increasing prices to the equilibrium level following tax hikes, firms choose a gradual price adjustment strategy. This measured approach prevents consumers from reducing their current and future cigarette consumption. By doing so, firms can safeguard long-term profitability in the tobacco industry, prioritizing sustained revenue streams over short-term gains from immediate price increases aligned with tax hikes.

However, this price smoothing behavior in Indonesia contrasts with findings in Australia. In Australia, cigarette prices showed marked fluctuations, especially after a regular tax increase in March and undergoing significant changes in the two months following a more extensive tax hike in September (Bayly et al., 2021). The results of this study suggest a different pattern: significant price changes occurred immediately following a tax increase announcement. After the tax increase took effect in the first quarter and subsequent periods, Indonesian firms continued to raise prices, albeit at a smaller percentage increase, indicating a more gradual and sustained approach to pricing adjustments.

This study's results also indicate that the coefficient for the interaction variable between $Interval_t$ and the $DSKM_i$ is not statistically significant. This shows that SKM cigarettes did not experience significant changes in the average retail price in each period, relative to SKT. In contrast, the interaction between $Interval_t$ and the $DSPM_i$ shows a significant negative coefficient, indicating a correlation between time intervals and changes in the average retail price of SPM, albeit with a lower marginal effect when compared to SKT. This observation is reasonable given that SPM is subject to a higher reference price limit and tax rates compared to SKT and SKM. The higher reference price limit inherently implies a higher minimum price for SPM. Consequently, this means that SPM targets consumers with relatively higher incomes who demonstrate loyalty to a particular type of cigarette. In response to this distinct market positioning, cigarette firms adjusted SPM prices by a smaller incremental increase compared to SKT. As a result, the average price of SPM increased gradually throughout the year. This strategic pricing approach aligns with the consumer profile associated with SPM, appealing to higher-income individuals who are committed to this particular cigarette type.

The insignificance of SKM but the significance of SPM may be attributed to differences in excise tax rates. Between 2014 and 2021, annual increases in excise tariffs for both SKM and SPM cigarettes were consistent in Indonesia. Although both are high-end cigarettes, SKM is subject to a slightly lower excise tax rate than SPM.

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Consequently, the price changes due to tax changes experienced by SKM are not as high as those experienced by SPM. Therefore, firms have not changed their prices drastically, as shown by the insignificant estimation results. In contrast, SPM, which is subject to higher taxes, results in price changes that force firms to engage in price smoothing. However, because SPM is a high-end cigarette, the degree of price smoothing is smoother than SKT. The firms commonly increase prices differently among the segmented brands. The firms prefer under-shifting cheap brands but over-shifting premium brands to keep up with the excise tax increases (Marsh et al., 2016). Higher deviation for the higher-priced brands allows the firm to earn a larger profit margin from the high-end cigarette brands. Meanwhile, the deviation in the low-priced cigarette segment is smaller. The lower relative price of the firm intends to expand demand for cheaper brands by compensating for the profits of exclusive brands (Nargis et al., 2020). This is because higher prices have been observed to significantly reduce consumption of economy and mid-priced cigarettes, while demand for premium cigarettes remains highly price inelastic (Atuk & Özmen, 2017).

Similar results also occur in the firm classification. The average price changes for firms class I and II do not show statistically significant changes compared to firms class III. This may be because firms class I and II firms are the upper classes that have great power and loyal consumers for their products. Although they are subject to higher taxes than firms class III, they do not engage in price smoothing for their premium products.

When examining the influence of government policies, we observe that the coefficient $DTop105_{it}$ is positive and statistically significant. This dummy variable represents an interaction between cigarette brands that occupy the highest reference price position in their classification and the period after Minister of Finance Regulation No.198/PMK.010/2015 enactment on November 6, 2015. The coefficient value of 0.0408 indicates that, the retail prices of cigarette brands that occupy the highest reference price within their class are, on average, higher after eliminating one of the criteria governing the ceiling price limit. This criterion had previously restricted cigarette brands with the highest reference price not to exceed 5% of their tag price. These results prove that the government's policy, by eliminating this criterion, effectively increased the average retail prices of cigarette brands occupying the highest reference price positions within their respective classification. Thus, cigarette firms gained greater flexibility in pricing their products, even though the products were priced higher than their price tags. This newfound flexibility eliminates concerns regarding the maximum retail transaction price limit, which was previously capped at 105% of the tag price.

One remaining ceiling price criterion stipulates that the retail price of a cigarette brand must not exceed the reference price limit per stick of the above tier in the same class (group). This condition primarily impacts cigarette brands that are not positioned at the highest price tier in their respective class. Our estimation shows that the dummy variable $DNonTop_{it}$ is statistically significant and has a negative coefficient of -0.147. This

finding indicates that, the average retail price of cigarettes that are not in the highest reference price tier of their class is lower than that of cigarettes in the top reference price tier. Cigarette brands below the highest tier tend to carefully manage their transaction prices to ensure they do not exceed the reference price of the above tier. This strategic approach aims to avoid triggering adjustments (i.e., reference price increases), as this could potentially lead to a higher tax rate if the reference price limits of the upper tier are breached. Furthermore, this strategy enables firms to remain competitive with lower-class cigarette brands but at the highest reference price in their class. As a result, this condition contributes to a significant difference in the average retail prices between brands not located at the highest reference price tier and those positioned at the highest reference price but in the lower class.

The findings of this study show that the implementation of a minimum price does not result in a significant impact on price changes. This may be attributed to the fact that the minimum price set by the government does not exceed the pre-existing market price, as in Malaysia (Liber et al., 2015). This assumption aligns with previous studies indicating that firms keep prices close to the minimum level that consumers can afford. For SKT, the firms keep prices close to the minimum price to maintain a large market share, offsetting this with higher taxes and profit margins from sales of the less price-elastic SPM cigarette types (Adrison & Dauchy, 2023). To effectively address this behavior, it is crucial to set a minimum price for cigarettes at or above the price consumers currently report paying. This could serve as an effective strategy to reduce tobacco use (Golden et al., 2016).

This study is limited to analyzing changes in the average retail price of cigarette brands for a quarterly period (March, June, September, and December) from 2014 to June 2021. Due to the limitations of data availability, we do not account for the sales volume of a cigarette brand, which may vary across regions in Indonesia and be concentrated in specific areas. Our analysis focuses solely on SKM, SPM, and SKT cigarette brands, as these types are the most widely produced in Indonesia. The largest market share during 2011-2017 was SKM, followed by SKT and SPM (Zheng et al., 2018).

This study also did not control for geographic differences and characteristics between regions in Indonesia. Each region may have a different price range due to variations in cost structure components. However, this condition can be minimized by the implementation of a national upper and lower limit price policy. Cigarette brands that violate the price policy in most monitored areas would be subject to tariff adjustments and firm profile reviews.

CONCLUSION

Cigarette firms in Indonesia have adopted a price smoothing strategy by gradually increasing the retail price. The cigarette firms prevent drastic declines in consumer consumption by progressively raising prices. This pricing approach has been consistently observed in the previous year's last quarter (Q4) and the following quarters of Q1,

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Q2, and Q3. During Q4, cigarette firms promptly adjusted their prices upon receiving confirmation of the upcoming year's tax policy. However, the marginal effect observed in Q4 of the previous year diminishes significantly in the following quarters of Q1, Q2, and Q3 of the following year. This pattern underscores the deliberate and systematic nature of the price smoothing strategy employed by cigarette firms for hand-made clove cigarettes, machine-made non-clove cigarettes (SPM), and lower-class firms. Meanwhile, machine-made clove cigarettes (SKM) and higher-class firms did not show significant price smoothing behavior.

The Government's decision to eliminate one of the ceiling price criteria at the end of 2015 has had a tangible impact on the average price of cigarettes. Shortly after the policy was implemented, the average price of cigarettes at the highest reference price within their respective classification (class) increased, resulting in higher prices than before the policy change. In contrast, cigarette brands that do not occupy the highest reference price position in their class tend to have lower average retail prices than those positioned at the top reference price in their class. This price difference reflects the effects of the policy on the pricing dynamics of cigarettes in different tiers, with brands at the highest reference price experiencing notable price increases compared to brands at lower tiers. Meanwhile, implementing a minimum price had no significant impact on price fluctuations.

The main focus of this study is related to the function of excise tax rates as an instrument to limit cigarette consumption. A key challenge in reducing smoking prevalence in Indonesia is the absence of a consistent policy for increasing tobacco excise tax. Each regulation's tariff increase is insignificant, around 10% to 12%. These conditions encourage the complexity of Indonesia's excise policy, making it less effective in reducing cigarette consumption. Cigarette firms' price smoothing behavior makes the condition even more ineffective. To overcome the problem of increasing cigarette prevalence, the Government should implement higher tariff increases to reduce the impact of price smoothing.

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