PRICE ELASTICITY OF DEMAND FOR CIGARETTE ITEMS: EVIDENCE FROM SOUTH KALIMANTAN PROVINCE OF INDONESIA

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Abstract

Smoking can affect health conditions that can lead to many adverse impacts in a wider scope. The government of Indonesia has applied some excise tax regulations on tobacco products to control the consumption of cigarette items. With very limited studies in Indonesia about the price elasticity of demand for tobacco products, this paper aims to fill the gaps in the demand for cigarette items in Indonesia. By using a new approach to calculate the price elasticity of demands which is AIDS and QUAIDS with the ILLS approach, this paper found significant findings. It is found that only the filtered clove cigarettes that inelastic to the price increases. The government should carefully apply the excise tax regulation based on the cigarette items.

Keywords: *Elasticity, cigarette, demand system, South Kalimantan, Indonesia*

JEL Classification: *D12, E61, J68, Q48, R22*

INTRODUCTION

A cigarette contains around 4,000 chemical materials, and 69 of those have a carcinogenic impact. Thus, cigarette consumption can affect human health. Further, smoking not only affects the smoker but also the person or people who inhale the smoke. Smoking is also addictive which makes the effort to eliminate smoking activity becoming harder (Indonesian Central Bureau of Statistics (BPS), 2019).

Smoking affects health, and the health issue relates to many things. From a macro perspective, the health issue can affect the life expectancy rate as a factor to construct the Human Development Index (HDI). It also affects the expenditure of a household through a crowding-out effect (more expenditure for medicine and also less expenditure for other nutritious goods); therefore, it could affect the poverty rate (John et al., 2019). Smoking could also affect the third goal of the Sustainable Development Goals (SDGs) which is Good Health and Well-being. With many concerns about the adverse impacts of smoking, the government should take action to minimize such impacts.

According to BPS (2019), for the age of 15 and above, the percentage of smokers in Indonesia from 2017 to 2019 were 29.25%, 32.20%, and 29.03% respectively. From those numbers, the highest proportion came from the rural area, male, not holding a college degree, middle quintile of income group, and west area of Indonesia. The percentage of the smoker from 2017 to 2019 was fluctuating. The recent decline of the percentage of smokers in 2019 could be the impact of the excise

tax of the tobacco products that applied in 2019. The Indonesian Minister of Finance had applied the Ministerial Regulation Number 152/PMK.010/2019 that amended the Ministerial Regulation Number 146/PMK.010/2017 and Ministerial Regulation Number 156/PMK.010/2018 about the application of excise tax for tobacco products. In 2020, the Ministerial Regulation is updated by applying the Ministerial Regulation Number 198/PMK.010/2020. This new regulation not only managed the excise tax of tobacco products but also regulated the retail prices.

With all the efforts by the government of Indonesia to regulate the excise tax and pricing of tobacco products, it is essential to know how the households respond to the price changes. The examination of the households' consumption behavior can be a significant input for the government in formulating future policy regarding tobacco products in Indonesia. This paper aims to measure the price elasticity of demand (hereafter, PED) for the cigarette items in Indonesia by using a case study in South Kalimantan province. This paper employs the new approach in calculating elasticity which is the Almost-Ideal Demand System Iterated Linear Least Square (AIDS-ILLS) comprising of common and quadratic specifications. This introduction will be followed by a literature review, research method, result and discussion, and conclusions.

LITERATURE REVIEW

The studies of the demand for tobacco products particularly on the elasticity of demand have been conducted around the world. Table 1 summarizes the research that involving the calculation of the price elasticity of demand for tobacco products or cigarette items in the world.

Table 1 Selected Studies of Price Elasticity of Demand for Tobacco Products

Author	Country	Method	Year	PED
Hidayat & Thabrany (2008)	Indonesia	Generalized Methods of Moments (GMM)	1993-2000	-0.35 and -0.39 (short run and long run)
Adioetomo et al. (2005)	Indonesia	Two-part demand model	1999	-0.61
Rasyid (2019)	Indonesia	OLS, 2SLS, and Fixed Effect Model	2014	-0.40 to -0.70
Adeniji (2019)	Nigeria	Quadratic Almost-Ideal Demand System	2009-2010	-0.62
Lance et al. (2004)	China and Russia	Two-part demand model	1993-1997 (China); 1996, 1998, 2000 (Russia)	-0.082 (China) and -0.132 (Russia)

Gjika et al. (2020)	Albania	Almost-Ideal Demand System (AIDS)	2012	-0.57
Chelwa & Van Walbeek (2019)	Uganda	Linear Approximation AIDS	2005 and 2009	-0.26 to -0.33
Nargis et al. (2014)	Bangladesh	Two-part demand model	2009-2010	-0.49
Reed et al. (2013)	United Kingdom	Engle-Granger two-step cointegration	2001-2011	-0.35 to -0.78
Choi (2016)	Korea	Heckman's two-stage estimation	1998-2011	-0.425
Gligorić (2020)	Bosnia and Herzegovina	Deaton demand model	2011 and 2015	-1.366
Tauras et al. (2016)	United States of America	Generalized Linear Model (GLM)	1991-2012	-0.34 (for lower price cigarettes) and -1.70 (for a higher price)
Yeh et al. (2017)	28 European Countries	Threshold Regression Model	2005-2014	-1.227

Source: Author's compilation.

Table 1 exhibits the differences in terms of the magnitude of the PED of tobacco products around the world. The PED is called inelastic when having the value under zero (i.e., -0.49) and is called elastic when having a value above zero (i.e., -1.366). In the case of Indonesia, a recent study conducted by Rasyid (2019) mentioned the possibility of different PED across cigarette items in Indonesia. But, still, his result showed that PED for the cigarette items in Indonesia is price inelastic (similar with previous studies in Indonesia). However, Tauras et al. (2016) showed that the higher prices of cigarette items have higher elasticity (price elastic). There is still a gap in PED study for cigarette items or tobacco products in Indonesia especially in measuring PED for each cigarette item. Therefore, the main aim of this paper is to measure PED for cigarette items in Indonesia by using more recent data and a new approach. The Almost-Ideal Demand System Iterated Linear Least Square (AIDS-ILLS) approach will be employed to calculate PED in Indonesia by using Indonesian National Social and Economic Survey (SUSENAS) 2020 of South Kalimantan data. The AIDS-ILLS approach in this paper covers quadratic (QUAIDS) and common (AIDS) specifications for comprehensiveness.

RESEARCH METHOD

Data

This paper mainly uses SUSENAS core and consumption modules from March 2020 wave data. South Kalimantan province is chosen as the locus of study based on the data availability. The number of samples is 8,072 households. The variables employed in this paper are a monthly total expenditure in rupiah, weekly expenditure of cigarette items in rupiah (filtered clove cigarettes, non-filtered clove cigarettes, white cigarettes, and others), household size, dummy variable of rural or urban areas, dummy variable of income groups, age of household's head, dummy variable of education of household's head, and dummy variable of the gender of the household's head. The data of prices of the cigarette items use the unit value approach (the value of expenditure divided by quantity consumed).[1] A household that does not consume cigarette items has zero value of consumption; thus, such a household has a missing price unit of cigarette items. To overcome this issue, the value of the missing price unit will use the nearest household price data (similar strategy was applied by (Murjani, 2020).

Econometrics Modelling

Lecocq & Robin (2015) stated that the common AIDS (Deaton & Muellbauer, 1980) and QUAIDS (Banks et al., 1997) model can suffer the endogeneity problem. To solve this issue, they used an Instrumental Variable (IV) which is total income in the demand model. In this paper, total expenditure is used as a proxy for the total income. Instrumental regression in the first stage regression produces a residual vector that will be inserted in the demand model. The Quadratic AIDS-ILLS model based on Lecocq & Robin (2015) approach can be written in the specification as follow:

$$w_i^h = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j^h + \beta_i \ln\left[\frac{M^h}{a(P^h)}\right] + \frac{\lambda_i}{b(P^h)}\left(\ln\left[\frac{M^h}{a(P^h)}\right]\right)^2 + \rho_i \hat{v}^h + u_i^h \qquad (1)$$

Where,

w_i^h	:	Budget share of the i th cigarette item obtained from the expenditure of the i th cigarette item divided by total cigarette item expenditures
$\alpha_i, \beta_i, \gamma_{ij}, \rho_i, \lambda_i$	:	Parameters in the demand system. When $\lambda_i = 0$, QUAIDS becomes AIDS.
p_j^h	:	Price of the j th cigarette item faced by household h.
M^h	:	Total expenditure of cigarette items of household h in the demand system.
P^h	:	Price index that defined as $Ln\, a(P^h) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln p_i^h + 0.5 \sum_i \sum_j \gamma_{ij} \ln p_i^h \ln p_j^h.$ $\qquad b(P^h) = \prod_{i=1}^{n} p_i^{\beta_i}.$
$\hat{v}^h$	:	Residual vector from the IV regression.

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[1] The unit of quantity consumed for all cigarette items are expressed in stick or piece, except for tobacco products and others (so-called others in this paper) are in ounce.

u_i^h :   error terms.

Some regressors are injected into Equation (1) through α_i which is:

$$\alpha_i = \alpha_i^* + \sum_{k=1}^{m} \alpha_{ik}^* d_k \qquad (2)$$

Where,

α_i^* : The intercept of the ith cigarette item.
α_{ik}^* : The coefficient of the ith cigarette item for k^{th} demographic variable.
d_k : The value of kth demographic variable.

The demographic variables that used are household size, dummy variable of urban or rural areas of the household' lives, dummy variable of income groups (bottom 40% or top 60%), age of household's head, dummy variable of education of household's head (holding a college degree or not), and dummy variable of the gender of the household's head (male or female).

QUAIDS model imposes some restrictions in Equation (1) such as:

Adding up: $\sum_{i=1}^{n} \alpha_i = 1, \sum_{i=1}^{n} \beta_i = 0, \sum_{i=1}^{n} \gamma_{ij} = 0, \sum_{i=1}^{n} \lambda_i = 0$
Homogeneity: $\sum_{j=1}^{n} \gamma_{ij} = 0$
Symmetry: $\gamma_{ij} = \gamma_{ji}$

The elasticity of demand is derived from Equation (1) such as:

$$\mu_i = \frac{\partial w_i}{\partial ln M_i} = \beta_i + \frac{2\lambda_i}{b(P)} ln \left[\frac{M^h}{a(P)} \right] \qquad (3)$$

$$\mu_{ij} = \frac{\partial w_i}{\partial ln p_j} = \gamma_{ij} - \mu_i \{\alpha_j + \sum_k \gamma_{jk} ln p_k\} - \frac{\lambda_i \beta_j}{b(P)} \left(ln \left[\frac{M^h}{a(P)} \right] \right) \qquad (4)$$

The price elasticity of demand (PED) for Marshallian (uncompensated) is:

$$e_{ij}^u = \frac{\mu_{ij}}{w_i} - \delta_{ij} \qquad (5)$$

To calculate PED for AIDS model, simply put $\lambda_i = 0$ (λ_i is the quadratic specification in the QUAIDS model, when the specification is equal to zero, the QUAIDS model becomes the AIDS model).

RESULT AND DISCUSSION

AIDS-ILLS Elasticities Estimation

Table 2 provides the PED for four cigarette items in South Kalimantan province by using common AIDS specification (Common AIDS-ILLS). The PED is also divided into groups such as income, urban/rural, and education.

Table 2 PED of Four Cigarette Items in South Kalimantan using Common AIDS-ILLS Specification

Cigarette Items	Total	Income Groups		Urban/rural		Education	
		Bottom 40%	Top 60%	Urban	Rural	Non-College Degree	College Degree
Filtered clove	-0.759	-0.761	-0.757	-0.768	-0.753	-0.758	-0.761
Non-filtered clove	-1.529	-1.521	-1.533	-1.685	-1.458	-1.522	-1.637
White	-2.373	-2.443	-2.338	-2.247	-2.464	-2.356	-2.622
Others	-1.856	-1.786	-1.989	-2.025	-1.778	-1.815	-3.240

Source: Author's estimation.

In general, by using the Common AIDS-ILLS approach, uncompensated PED for cigarette items has two different elasticities that can be examined from Table 2. Filtered clove cigarettes have inelastic PED which is -0.759. On the other hand, the PEDs for non-filtered clove cigarettes, white cigarettes, and other cigarettes are -1.529, -2.373. and -1.856 respectively. The PEDs for cigarette items other than the filtered clove are price elastic. The increasing prices for the filtered clove cigarettes will be followed by decreasing amount of consumption of such cigarettes but less reactive (i.e., 10% increase of the filtered clove cigarettes will be responded by decreasing consumption level of such cigarettes by 7.59%). For other cigarette items such as non-filtered clove, white, and other cigarettes, the increasing prices will be followed by decreasing consumption more reactively. For non-filtered clove cigarettes, for instance, a 10% increase of the prices will be followed by decreasing level of consumption by 15.29%. For the government, if the purpose of increasing the prices of cigarettes is to reduce the consumption level, then higher prices for the filtered clove cigarettes will give a smaller impact compared to the rest of cigarette items.

If the uncompensated PED is analyzed by income groups, the bottom 40% households of income groups have more elastic (bigger in absolute value) PED for filtered clove and white cigarettes. The top 60% of the income group has a more elastic PED for non-filtered clove and other cigarettes. This result indicates that the poorer households are much more sensitive to the price changes of the filtered clove and white cigarettes compared to the wealthier households (even though the margin of the PED between the two groups is not so wide). For the urban/rural groups, the urban area has a more elastic PED for filtered clove, non-filtered clove, and other cigarettes. The rural area has a higher PED for white cigarettes only. Lastly, based on education groups, the households that obtain a college degree (for the household's head) have more elastic PED for all kinds of cigarette items.

QUAIDS-ILLS Elasticities Estimation

The estimation result for PED by using QUAIDS specification (Quadratic AIDS-ILLS) can be seen in Table 3.

Table 3 PED of Four Cigarette Items in South Kalimantan using Quadratic AIDS-ILLS Specification

Cigarette Items	Total	Income Groups		Urban/rural		Education	
		Bottom 40%	Top 60%	Urban	Rural	Non-College Degree	College Degree
Filtered clove	-0.776	-0.778	-0.775	-0.785	-0.770	-0.776	-0.779
Non-filtered clove	-1.452	-1.450	-1.453	-1.586	-1.391	-1.446	-1.537
White	-2.061	-2.156	-2.016	-1.934	-2.159	-2.045	-2.311
Others	-1.939	-1.869	-1.980	-2.129	-1.851	-1.884	-4.736

Source: Author's estimation.

The PED values in Table 3 are generally similar to the result in Table 2, showing that only the filtered clove cigarettes are price inelastic. Similarly, the income groups, urban/rural areas, and education levels in Table 3 have the same conclusion as Table 2 in terms of which group has a higher magnitude of elasticity. All in all, it can be said that QUAIDS provides a different value of PED with the same classification of elasticity (either elastic or inelastic). Overall, this paper found a similar conclusion with Tauras et al. (2016) inferring that the difference of cigarette items (as well as a different level of prices) could affect the price elasticity of demand (PED). By using South Kalimantan data, this paper found that the PEDs for cigarette items are different. Only the filtered clove cigarettes have inelastic PED whereas the rest of the cigarette items are price elastic.

CONCLUSIONS

Different results of the price elasticity of demand for tobacco products/cigarette items from around the world have become the primary motivation for this study. Further, very limited studies of the demand system for tobacco products in Indonesia opened more opportunities to fill the gaps by using more recent data and another approach. This paper examined the price elasticity of demand for cigarette items in the South Kalimantan province of Indonesia by employing AIDS and QUAIDS models with the ILLS approach.

This paper found some distinctive findings in Indonesia. One, the PEDs for cigarettes, after being differentiated, having a different value of elasticities. Only the filtered clove cigarettes have inelastic PED; the non-filtered clove, white, and other cigarettes have elastic PED. Two, only the college degree group consistently has

higher PED compared to the non-college degree group for all kinds of cigarette items. Three, AIDS and QUAIDS specifications gave similar results/conclusions about the PED classification.

As for recommendations, if the government wants to push down the tobacco products' consumption, the price changes should be carefully applied for the cigarette items that have elastic PED such as the un-filtered clove cigarettes, white cigarettes, and other tobacco products (other than the filtered clove cigarettes). Increasing the prices of the filtered clove cigarettes also gives the decreasing level of consumption but at a smaller level. This paper has limitations in terms of the number of samples used. So, it can be improved by using more samples that represent a wider area or even covering the whole of Indonesia.

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