excise report

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This report presents our analysis on mainly estimating elasticity and forecasting future excise and revenue for DGCE. We find that the elasticity of demand to be vary between -0.5 to -1.1. We also find a strong case for tax-price pass-through for SKM and SPM tobacco type. Our findings corroborates most literature on the Indonesian tobacco use. Unfortunately data limits how much and how robust the analysis can get. In particular, we find very little value of analysis on electric cigarettes, which maindly due to only one year datapoint available for study.

Introduction

Nicotine is addictive and harmful. Controlling tobacco use via taxation requires understanding of demand elasticity of the good (Hidayat and Thabrany 2011). ADBI was tasked to help Min o Finance to calculate the elasticity of cigarette excise.

The study become even more important since the introduction of electric cigarettes. It can be argued that e-cigs create a substitute to the cigarettes, and may be an introduction to more traditional tobacco cigarettes (Binns, Lee, and Low 2018). DGCE was starting to collect data (and excise) for e-cigarettes since 2020.

We must answer this following question: How much is the cross-price substitution between traditional cigarettes?

While all of these questions are extremely important, we find the answer to not be straightforward. Few literatures actually looking at this. But the main problem is the lack of good quality data in answering those questions, particularly on e-cigarettes.

Literatures

We rely on three papers for our desk investigation which is summarized in Table 1.

Hidayat and Thabrany (2011) investigates whether smokers in general are myopic or rational addicts. They utilise 2SLS and GMM along with IFLS data with 1783 total observations to conduct their study. According to this consumer-side study, the price elasticity of demand for traditional tobacco is around -0.38 to -0.57. They also controls for income with total expenditure as the proxy.

Djutaharta et al. (2021) look at the impact of cigarette prices to household nutrient intake. Collecting various household surveys in 2014, they are able to observe a cross-section 285,400 households. They use unit value as the price which is sourced from PODES, one of the household survey. While their goal is not to look at elasticity, they find that 1% increase in cigarette prices lead to an increase of budget share for cigarettes by 0.0737 percentage point.

Prasetyo and Adrison (2020) utilise transactional data on the firm level, 2005-2017, with total 32,711 observations (around 2,500 firms per year). They get the data from DGCE. They look at the tax-price pass through, which is the impact of changes in tax to the firms' pricing strategy. They also examine the pass-through effect on three types of traditional cigarettes, namely SKT, SKM and SPM. They find that an increase of 1% of tax rate leads to an increase of prices by around 0.15, 0.36 and 0.77 for SKT, SKM and SPM respectively.

Table 1: literature summary

paper	finding	data	obs year	N
Hidayat and Thabrany (2011)	elasticity (-0.38 to -0.57)	IFLS	1993,1997,2000	1783
Djutaharta et al. (2021)	budget share	Susenas, PODES, RISKESDAS	2014	285,400
Prasetyo and Adrison (2020)	tax-price passtrough	firm transactions from DGCE	2005-2017	32,711

For objectives, this report bear similarity with Hidayat and Thabrany (2011) the most, albeit it is indeed important to see a tax-price pass-through a la Prasetyo and Adrison (2020). We do have a production data of different types of cigarettes, but our data lack firm level richness as Prasetyo and Adrison (2020)[1]. Generally we do not look at the question posed by Djutaharta et al. (2021), but This is still an important question to adhere by DGCE. The reason is because using excise as an instrument to reduce smoking may lead to a reduction of a household's nutrient intake.

Prasetyo and Adrison (2020) offers various insight to the cigarettes market in Indonesia. The industry is highly oligopolistic and often offers low price of cigarettes to avoid paying progressive exicse. This leads to higher number of smokers[2]. Low potential revenue,thus may be outweighed by the higher cost of treatment of tobacco-related diseases.

On the last note, none of those are looking at electric cigarettes.

On Method, we generally use Zellner (1963) which developed Seemingly Unrelated Regression (SUR) which is widely used for cross-price elasticity calculation.

Data

This paper relies solely on data sourced by DGCE. The data contains information on both traditional and e-cigarettes, albeit on different details. We will first discuss about the traditional cigarettes and then proceed to e-cigarettes.

Traditional cigarette data

According to Peraturan Menteri Keuangan (PMK) 192/PMK.010/2021 Tentang TARIF CUKAI HASILTEMBAKAU BERUPA SIGARET, CERUTU, ROKOK DAUN ATAU

[1]interestingly, they also sourced the data from DGCE.
[2]adult male smokers increase in share from 60.6% in 2000 to 76.1%

KLOBOT, DAN TEMBAKAU IRIS, There are three types (jenis) of cigarette in Indonesia:

1. Sigaret Kretek Mesin (SKM) is a cloved cigarette which utilises machinery in most of its production. This accounts for 70.5% of total number of cigarette production in our dataset.
2. Sigaret Putih Mesin (SPM) is an uncloved cigarette which utilises machinery in most of its production. This accounts for 4.68% of total number of cigarette production in our dataset.
3. Sigaret Kretek Tangan (SKT) is a cloved cigarette which utilises no machinery at all in its production. This accounts for 24.8% of total number of cigarette production in our dataset. Included in this type is Sigaret Putih Tangan (SPT) which is the uncloved version of SKT, but we generally includes it here because they have the exact same tax structure.

Actually there are other types of cigarettes but these three are the most important and we only have dataset on these three.

For excise purpose, these three types are divided further into categories (golongan) based on how much a single firm produces each category. i.e., the tax structure tries to be progressive in that it put larger firm (e.g., producing so much annualy) on a higher tax brackett. Table 1 shows these categories and I put example from PMK 192/PMK.010/2021 (of course this table evolves as new PMK is produced)

THere are two types of prices in our dataset: 1. Harga Jual Eceran (HJE) is a price used by the government to set how much is the excise per cigarette. 2. Harga Transaksi Pasar (HTP) is a price paid by the consumer. This price is crucial but we have very little data point for this (i.e., many missing obs because MOF does not conduct survey every month)

Table 1. example from the PMK 192/PMK.010/2021

type/category	Quantity produced	HJE (kIDR)	tariff (kIDR)	AVE(%)
SKM1	> 3 billion cigarettes	1.95	.985	50.51
SKM2	<= 3 billion cigarettes	1.14	.6	52.63
SPM1	> 3 billion cigarettes	2.005	1.065	53.12
SPM2	<= 3 billion cigarettes	1.135	.635	55.94
SKT1a	> 2 billion cigarettes	>1.635	.44	26.91
SKT1b	> 2 billion cigarettes	>1.135	.345	30.4

type/category	Quantity produced	HJE (kIDR)	tariff (kIDR)	AVE(%)
SKT2	(0.5 < x < 2) billion cigarettes	>600	.205	34.2
SKT3	<= 0.5 billion cigarettes	>505	.115	22.77

From table 1 we can see that handrolled types are taxed lower. This trend continues in the future iterations of the PMK, in fact.

variables in this dataset is constructed such that V_{ij} be a variable where $i \in \{l, q, t, r, p\}$ and $j \in \{skm1, skm2, spm1, spm2, skt1a, skt1b, skt2, skt3\}$. l=HJE, q=production quantity, t=specific rate, r=total revenue, p=HTP. members of j is just type/category but lowercase.

We also have mo=month which is the time index for the dataset which spans from Jan 2014 to Dec 2023.

Therefore, variable names in mydataset should look like this:

> mo lskm1 lskm2 lspm1 lspm2 lskt1a lskt1b lskt2 lskt3 qskm1 qskm2 qspm1 qspm2 qskt1a qskt1b qskt2 qskt3 tskm1 tskm2 tspm1 tspm2 tskt1a tskt1b tskt2 tskt3 rskm1 rskm2 rspm1 rspm2 rskt1a rskt1b rskt2 rskt3 pskm1 pskm2 pspm1 pspm2 pskt1a pskt1b pskt2 pskt3

WHO suggests any tax rate below 70% is deemed too small to reduce smoking (Prasetyo and Adrison 2020).

Since the market price data is quite limited, I created some weighted-aggregate variables which is variable names without number. For example, I create:

$$pskm = \frac{pskm1 \times qskm1 + pskm2 \times qskm2}{qskm1 + qskm2}$$

some prices (both legal and market) and tariff moves together and highly correlated. This is very apparent in SKT, where SKT1a,SKT1b, and SKT2 moves together.

Visualization

Data is visualized. I arrange the visualization using a typical pattern. Each variable is visualized 4 times. The first three are each category in each three types (SKM, SKT, and SPM).

For example, top-left panel is SKM1 and SKM2, top right is SPM1 and SPM2, and the bottom-left panel is SKT1a, SKT1b, SKT2 and SKT3. The bottom-right shows either the aggregate or the weighted average of SKM, SPM, and SKT.

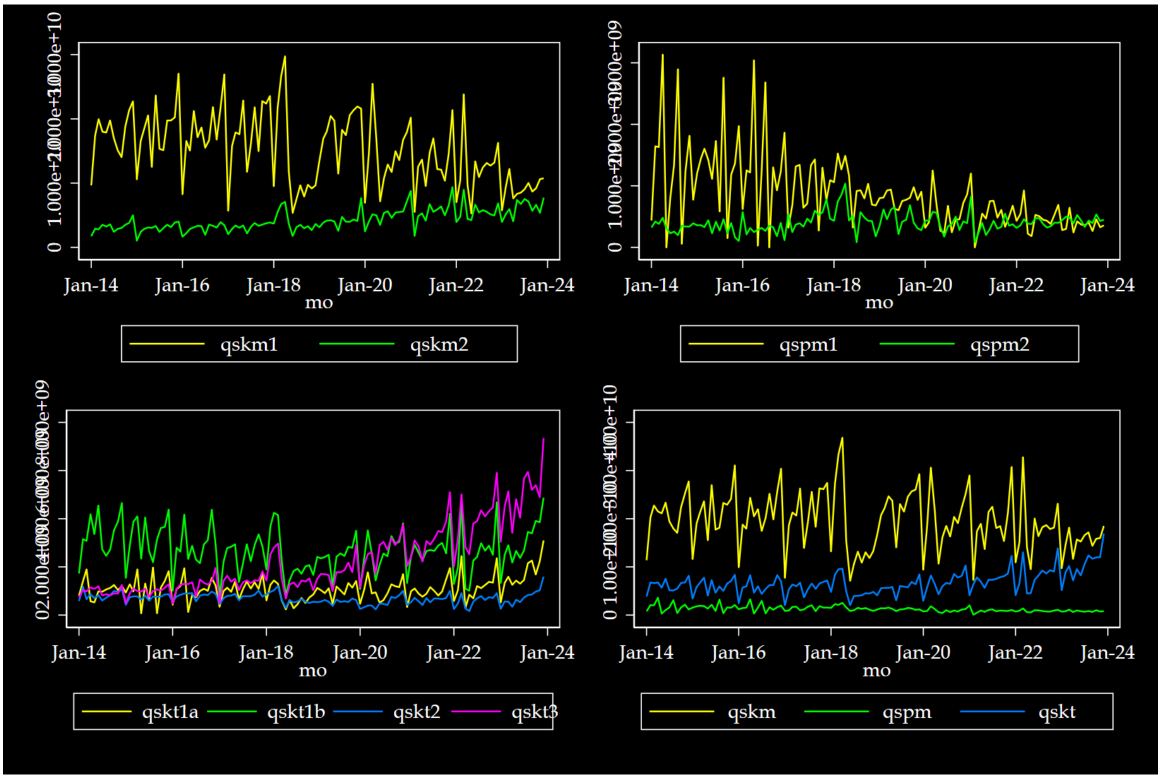

Figure 1: Quantity demand for excise ribbon

Figure 1 represents the quantity demand of excise ribbon, which is measured by stick. We can see some trend. The SKM1 seems to be gradually reduced, with a clear downtrend starting on mid-2018. Meanwhile, SKM2 gradually rises, suggesting a possible bunching, where large firms distribute its production to many smaller firms to get SKM2 tariff brackett.

Similar trend can be seen in SPM, which shows clear convergence where the more expensive one dwindles down. On aggregate, we can see clear reduction in this type. Lastly, we can see clear winner from SKT, which is the SKT3. Again, cutoff point is around mid-2018.

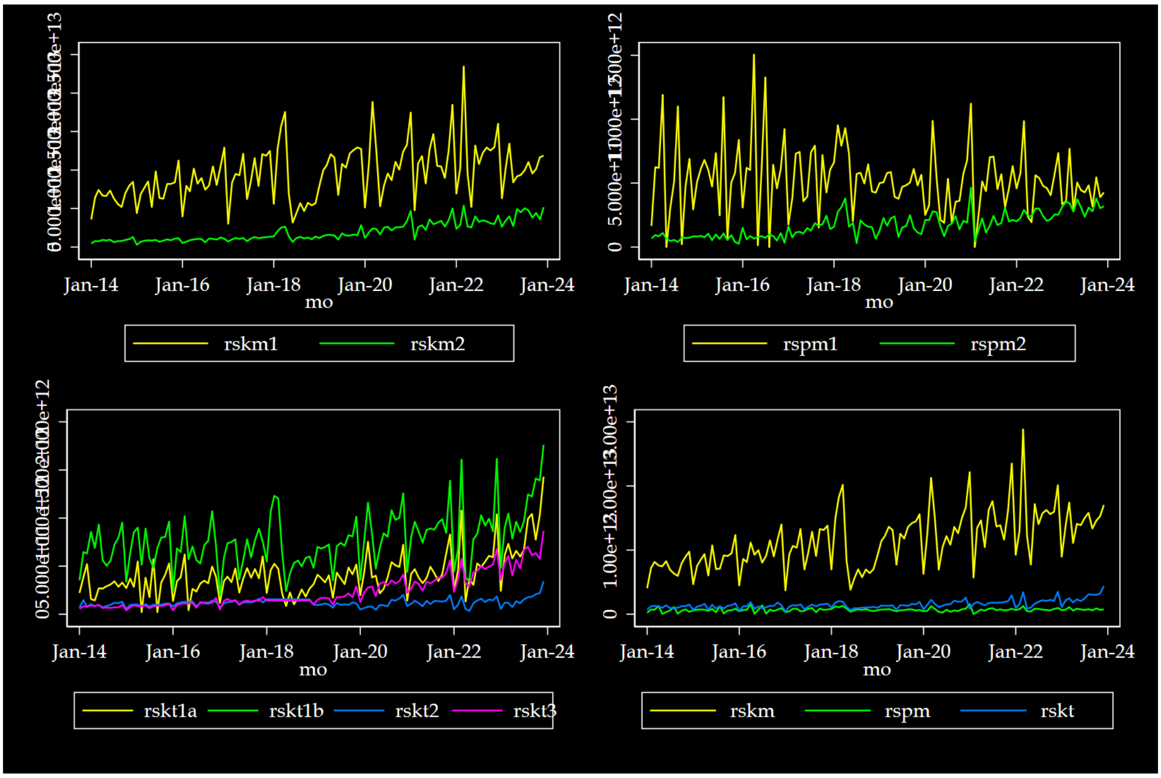

Figure 2: Tariff Revenue

We can infer similar similar situation from Figure 2, which shows revenue generated from such excise. We do still see upward trend amid increasing tariff overall. However, the stagnation from SPM isn't matched by the increase in SKT's revenue.

Figure 3 shows the legal price, HJE. This is the price set by the customs as a tariff reference. The HJE changes only few times in a year, which explains the various flat line.

We see a noticable reduction of HJE for SKT2 and SKT3 in June 2018. The same cannot be said for the rest of the cigarette types. In June 2020, we see another noticable spike especially in the machine cigarettes. We don't see the same thing in SKT, however.

Figure 4 shows the market price surveyed by the customs. Here we have many missing observation (months without a dot) because the customs do not conduct monthly survey. We do see a noticable divergence of price in January 2020 between machine-made and hand-made cigarettes (bottom-right).

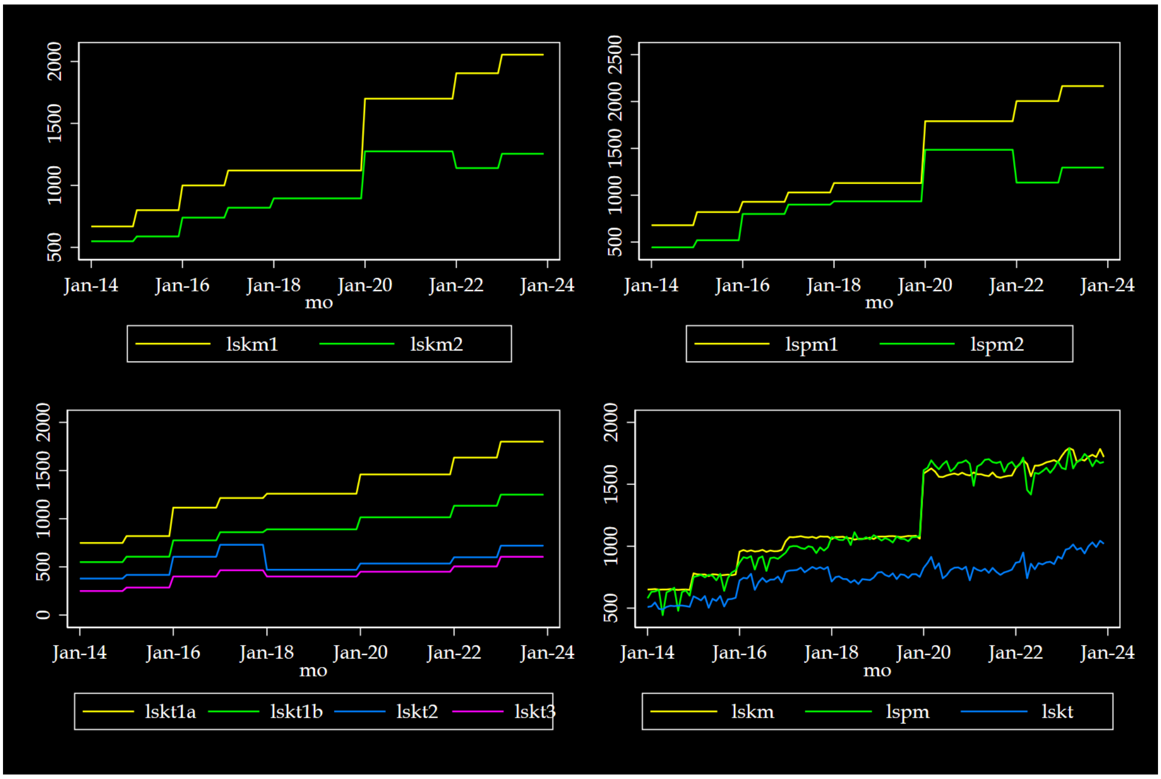

Figure 3: Legal price per stick (HJE)

Figure 4: Market price per stick

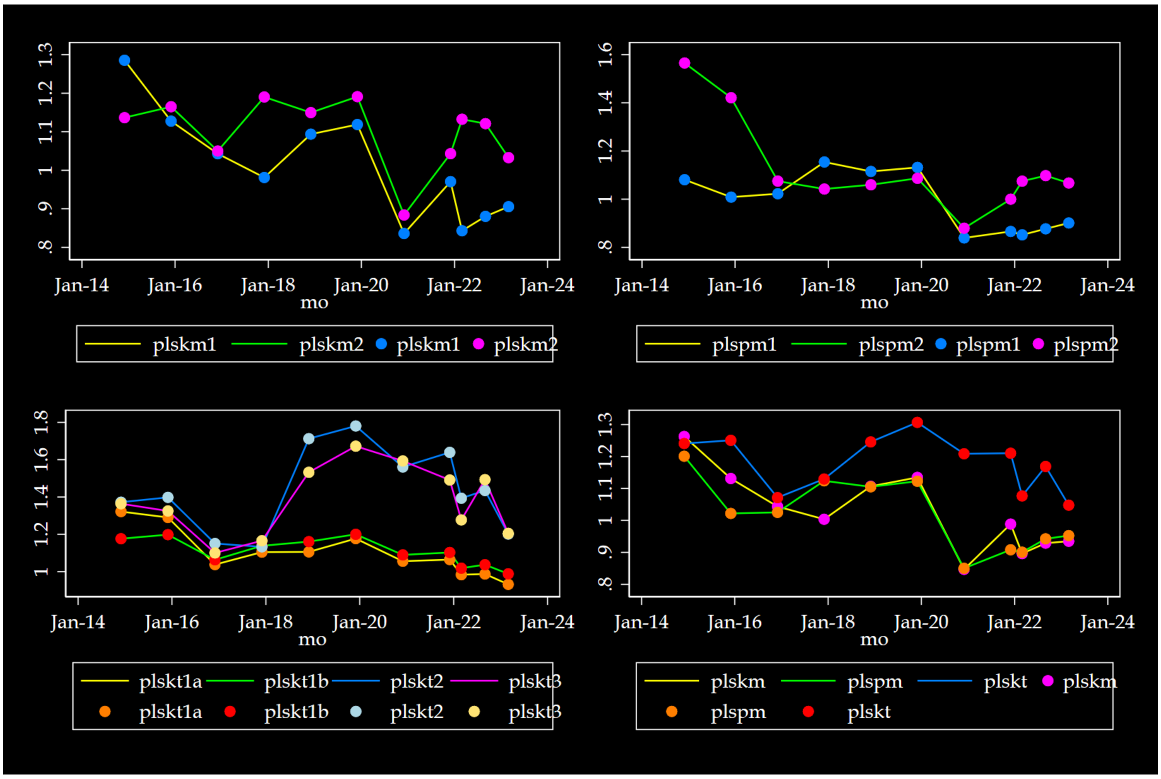

Figure 5: Ratio between market price and legal price

Figure 5 shows a ratio between market price and legal price. A high HTP/HJE ratio may suggests a degree of market power or high demand. More importantly, if the HTP/HJE ratio generally reasonably flat, then we can use HJE (which observation completes) as a proxy for HTP (which contain missing observations.

Unfortunately, this ratio varies considerably for all observations.Generally, HTP/HJE ratio is lower for machine-made cigarettes compared to hand-made ones, even reaching below 1 after January 2020. This ratio is driven mainly by the two lowest brackett, SKT2 and SKT3 (lower-left).

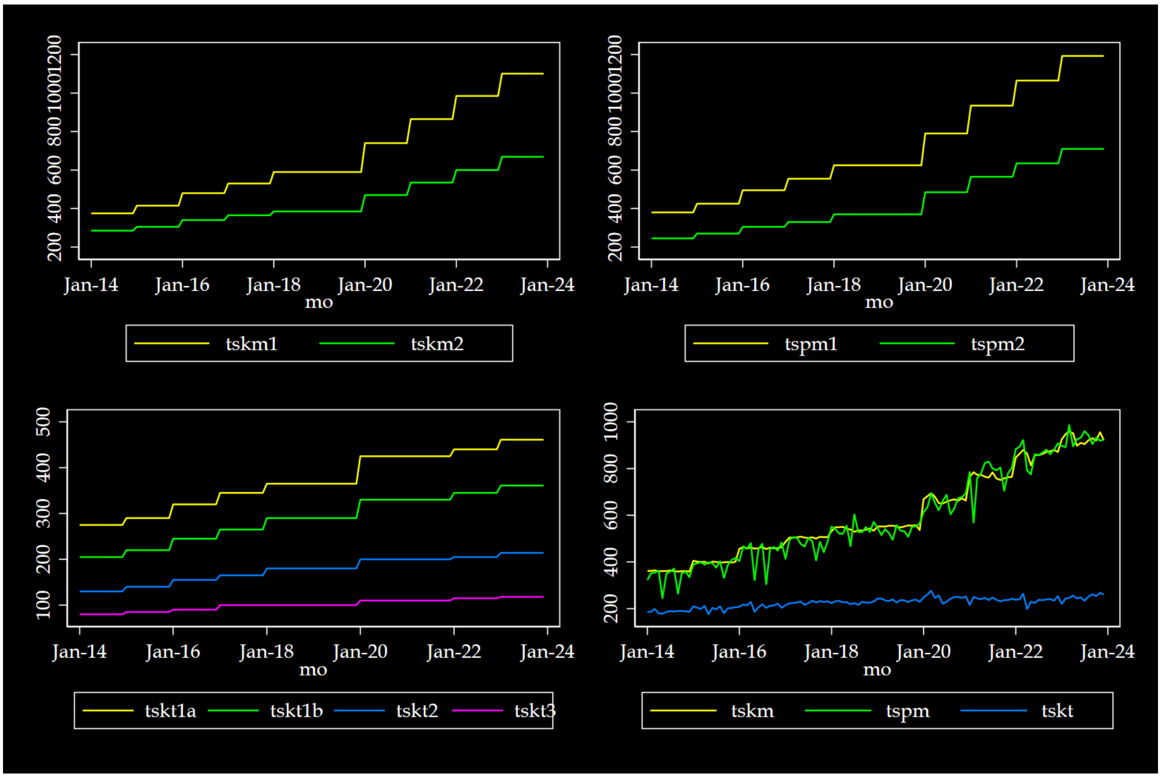

Figure 6: Excise tariff per stick

Meanwhile, Figure 6 shows tariff charged per stick. We can see a pattern resembling the HJE since the tariff is enacted based on HJE. While some SKT got HJE reduction, tariff remains increasing in trend.

Figure 7 shows an ad-valorem equivalence (AVE) of the stick, i.e., tariff/HJE ratio. From this graph, we can see that the AVE changes drastically in January 2018, confirming the possible correlation with noticeable changes in quantity demand in Figure 1. Additionally, we see a divergence of AVE between machine-made and hand-made in the 2020s onwards.

We know that the SKM is by far the driver of revenue for the customs. However, its demand is being caught-up by hand-made cigarette, the SKT. Additionally, the SKM demand seems to switch from SKM1 to SKM2 as well. We note at least two important timing, which is the year 2018 and 2020 where we see a noticeable changes in SKM1, SKM2, and SKT.

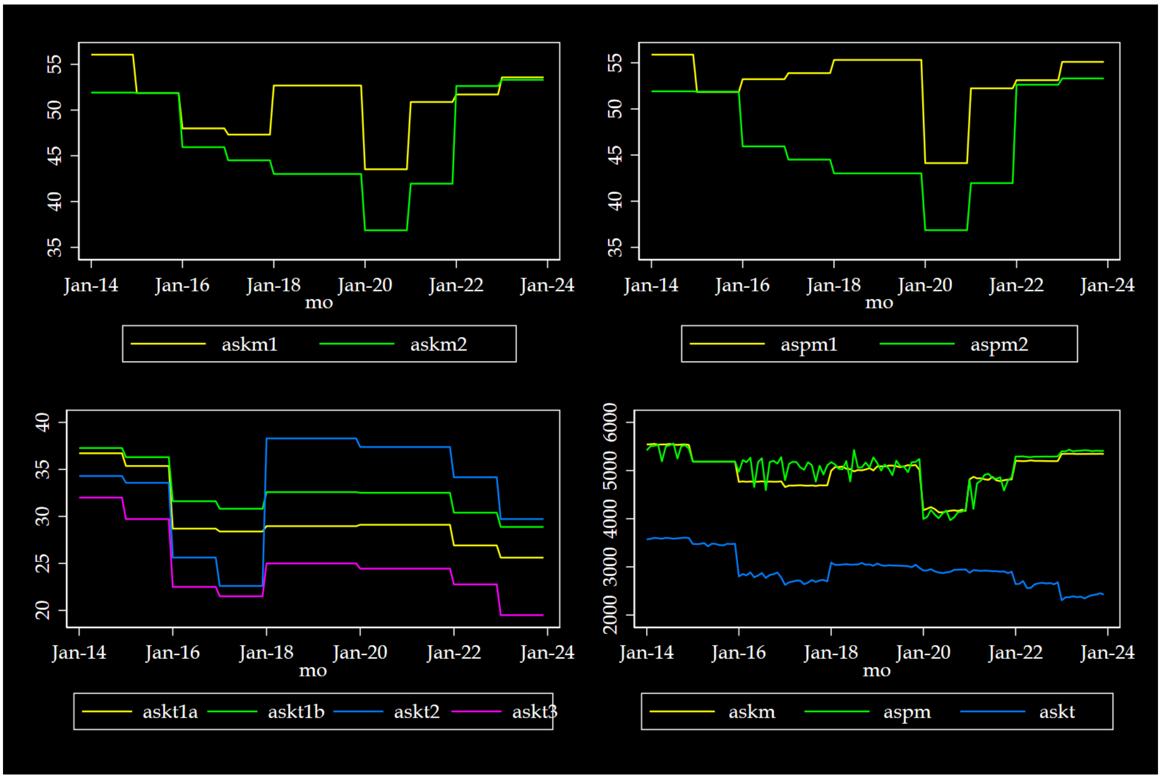

Figure 7: Ad-valorem equivalence per stick

At this point, we has little choice but to run elasticity regression

Elasticity estimation

Here we describe our method in getting elasticities. We generally use SUR regression, as discussed above.

Let a standard downward-sloping demand function:

$$Q_i = AP_i^{-\varepsilon} Y^{\gamma} \prod_{j \in -i} P_j^{\varepsilon_j}$$

which can be approximately log-linearized

$$q_i = a - \varepsilon p_i + \gamma y_i + \sum_{j \in -i} \varepsilon_j p_j \pm \epsilon_i$$

where a lowercase is the log version of its uppercase counterparts. We can, thus, econometrically estimated the above equation with a regression.

We assume an iid ϵ_{it} for now and uses own-price elasticity since we lack information on the price of electric cigs. The parameter ε is the own-price elasticity of demand, which we expect to be negative, while γ is the income elasticity of demand which is assumed to be positive. We expect the most important ε_j, the cross-price elasticity variable, to have positive number.

Results

It is important to note that prices (both HTP and HJE) as well as specific tariff rate are highly correlated with each other. Only quantity demand and AVE tariff are not correlated strongly with each other. Here I present these results, but various other regression tables are available in the file accompanying this report.

Demand elasticity

Table 3 shows the results from $\log Q = f(ave)$ regression. lgni is log of GDP per capita, as a proxy for income. AVE of SPM2 is omitted by Stata.

A percentage point increase in SKM1's AVE correlates with the reduction with 15% of its quantity demand. There is no cross-ave elasticity detected in this regression. For SKM2, however, we can see that AVE for SKM1 increases its quantity demand by 12.7%, suggesting a strong substitution between SKM1 and SKM2. For SKT, only SKT3 has a significant cross-AVE elasticity with SKM1.

Table 3: table 2. Q vs AVE

VARIABLES	(1) lqskm1	(2) lqskm2	(3) lqspm1	(4) lqspm2	(5) lqskt1a	(6) lqskt1b	(7) lqskt2	(8) lqskt3
askm1	-0.150*	0.127*	-0.883**	-0.143	0.184	0.120	0.0519	0.253***
	(0.0893)	(0.0738)	(0.354)	(0.103)	(0.152)	(0.0926)	(0.0862)	(0.0739)
askm2	0.0195	-0.0365**	0.156*	-0.0219	-0.0519	-0.0111	-0.00967	-0.0460***
	(0.0208)	(0.0171)	(0.0823)	(0.0240)	(0.0352)	(0.0215)	(0.0200)	(0.0172)
aspm1	0.119*	-0.102*	0.710**	0.143*	-0.135	-0.0945	-0.00886	-0.220***
	(0.0709)	(0.0586)	(0.281)	(0.0819)	(0.120)	(0.0735)	(0.0684)	(0.0586)
o.aspm2	-	-	-	-	-	-	-	-
askt1a	-0.215	-0.200	1.919*	0.900***	-0.0675	-0.362	-0.333	-0.342*
	(0.251)	(0.207)	(0.993)	(0.289)	(0.425)	(0.260)	(0.242)	(0.207)
askt1b	0.556	0.218	-1.787	-1.470***	-0.0333	0.759**	0.740**	0.292
	(0.338)	(0.279)	(1.342)	(0.391)	(0.574)	(0.351)	(0.326)	(0.280)
askt2	-0.0312	-0.0753*	0.527**	0.151**	-0.107	-0.106*	-0.0985*	-0.121***
	(0.0545)	(0.0450)	(0.216)	(0.0630)	(0.0925)	(0.0565)	(0.0526)	(0.0451)
askt3	-0.0131	0.0960	-0.615	0.0712	0.130	-0.0669	-0.0764	0.128
	(0.111)	(0.0918)	(0.441)	(0.128)	(0.189)	(0.115)	(0.107)	(0.0919)
lgni	1.713**	2.438***	-2.120	-1.181	1.642	1.950**	1.768**	3.210***
	(0.743)	(0.613)	(2.945)	(0.858)	(1.260)	(0.770)	(0.716)	(0.614)
Constant	-14.16	-17.63	53.10	53.74***	-2.202	-19.13	-18.96	-27.93**
	(14.75)	(12.19)	(58.51)	(17.04)	(25.03)	(15.30)	(14.23)	(12.20)
Observations	120	120	120	120	120	120	120	120
R-squared	0.297	0.514	0.081	0.172	0.117	0.162	0.249	0.802

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In Table 4, we see the results from $\log Q = f(htp)$ regression, which shows our actual price elasticity. Since we have plenty missing observation in HTP, I had to aggregate some prices and omit SPM, arguing that SPM is not as important as the other two. As can be seen, we have only 11 observations with around 5-6 regressors each. Not ideal.

Unlike with AVE, here, income percapita shows negative correlation with quantity demand, which is surprising. More importantly, our price elasticity don't seem to get along with theory, where own-price is mostly positive. Lack of degree of freedom seems to be very important in this regression, unfortunately.

Table 5 is the relationship of $\log Revenue = g(ave)$. Income per capita, shows a positive correlation like with quantity demand, a good start. Unfortunately I cannot get anything significant with the revenue of SKM1, the main contributor to revenue. For SKT, again, SKT3 shows strong correlations with many other AVE but itself.

Lastly, Table 6 shows the relationship between HTP and HJE. This regression suppose to show us how the legal price translates to actual market price. As before, we have only 11 observations due to missing HTP observations so we use some aggregated prices.

a percent increase in HJE for SKM1 translated to 0.673% in the increase of its market price. This number is only 0.312% for SKM2. Only SKT1a and SKT1b has significant coefficient for its own price. SKT2 is driven by SKT aggregated price, while SKT3 actually correlates positively with SKM aggregated price.

Table 4: table 3. Q vs HTP

VARIABLES	(1) lqskm1	(2) lqskm2	(3) lqskt1a	(4) lqskt1b	(5) lqskt2	(6) lqskt3
lpskt1a			11.18***	10.79***	7.934***	7.301***
			(4.017)	(2.036)	(2.732)	(2.369)
lpskt1b			-7.024**	-9.228***	-11.50***	-8.035***
			(3.552)	(1.797)	(2.387)	(2.098)
lpskt2			1.366	0.651	2.807***	1.523*
			(1.431)	(0.722)	(0.942)	(0.848)
lpskt3			-2.481**	-0.871*	0.387	-0.0243
			(1.041)	(0.528)	(0.714)	(0.613)
lpskm			1.621	1.810**	3.188***	2.985***
			(1.671)	(0.837)	(1.061)	(0.993)
lgni	-1.561	-3.333*	-2.337	-2.202***	-2.580***	-0.463
	(2.355)	(1.929)	(1.581)	(0.789)	(0.973)	(0.943)
lpskm1	-1.401	1.762				
	(2.073)	(1.788)				
lpskm2	3.853*	3.024				
	(2.015)	(1.868)				
lpskt	-3.547*	-2.739				
	(1.949)	(1.746)				
Constant	56.40**	61.39***	21.62	31.53***	40.35***	0.616
	(27.00)	(22.14)	(22.04)	(11.05)	(14.02)	(13.10)
Observations	11	11	11	11	11	11
R-squared	0.270	0.588	0.671	0.878	0.828	0.962

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: table 4. Revenue vs AVE

VARIABLES	(1) lrskm1	(2) lrskm2	(3) lrspm1	(4) lrspm2	(5) lrskt1a	(6) lrskt1b	(7) lrskt2	(8) lrskt3
askm1	-0.0542	0.234***	-0.785**	-0.0287	0.217	0.138	0.00800	0.250***
	(0.0887)	(0.0755)	(0.353)	(0.104)	(0.151)	(0.0919)	(0.0840)	(0.0653)
askm2	0.00633	-0.0535***	0.142*	-0.0432*	-0.0633*	-0.0199	-0.0128	-0.0547***
	(0.0206)	(0.0175)	(0.0821)	(0.0241)	(0.0351)	(0.0214)	(0.0195)	(0.0152)
aspm1	0.0288	-0.200***	0.618**	0.0369	-0.169	-0.115	0.0328	-0.224***
	(0.0704)	(0.0599)	(0.280)	(0.0821)	(0.120)	(0.0730)	(0.0667)	(0.0518)
o.aspm2	-	-	-	-	-	-	-	-
askt1a	-0.240	-0.231	1.905*	0.902***	-0.0275	-0.295	-0.123	-0.253
	(0.249)	(0.212)	(0.991)	(0.290)	(0.424)	(0.258)	(0.236)	(0.183)
askt1b	0.481	0.131	-1.884	-1.626***	-0.161	0.604*	0.420	0.141
	(0.336)	(0.286)	(1.338)	(0.392)	(0.572)	(0.348)	(0.318)	(0.247)
askt2	-0.0459	-0.0983**	0.513**	0.138**	-0.104	-0.0920	-0.0334	-0.115***
	(0.0541)	(0.0461)	(0.216)	(0.0632)	(0.0923)	(0.0561)	(0.0513)	(0.0399)
askt3	0.00545	0.136	-0.593	0.111	0.148	-0.0616	-0.116	0.149*
	(0.110)	(0.0939)	(0.440)	(0.129)	(0.188)	(0.114)	(0.105)	(0.0813)
lgni	2.692***	3.304***	-1.073	-0.109	1.995	2.268***	1.687**	3.896***
	(0.737)	(0.627)	(2.937)	(0.861)	(1.257)	(0.764)	(0.698)	(0.543)
Constant	-19.79	-21.54*	46.77	47.68***	1.084	-15.53	-9.331	-32.12***
	(14.64)	(12.46)	(58.35)	(17.09)	(24.96)	(15.18)	(13.88)	(10.79)
Observations	120	120	120	120	120	120	120	120
R-squared	0.246	0.807	0.059	0.631	0.253	0.225	0.190	0.887

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusion

In this report, we tried to find a demand elasticity. We can see from line chart that the demand for SKM is decreasing quite fast since 2018, while SKT picks up the slack. The SKM decrease is driven mainly by SKM1, which is produced by large firms. SKM2 rises, suggesting a possible bunching. Meanwhile, The SKT is increasing, with SKT3 (which is produced by the smallest firms) leading the charge.

The lack of HTP data is a major problem in our analysis. We can see that the price elasticity is not as expected, with most of the own-price elasticity being positive. This is likely due to the lack of degree of freedom. Our second-best approach is exploiting AVE, which is the ratio between specific tariff and HJE, a reference price set by the government. While HJE seems to be flat, we did find some evidence that there is a strong relationship between HJE and HTP. We do get somewhat expected data from AVE regression, but a better quality data would certainly improve the analysis.

References

Binns, Colin, Mi Kyung Lee, and Wah Yun Low. 2018. "Children and e-Cigarettes: A New Threat to Health." *Asia Pacific Journal of Public Health* 30 (4): 315–20. https://doi.org/10.1177/1010539518783808.

Table 6: table 5. HTP vs HJE

VARIABLES	(1) lpskm1	(2) lpskm2	(3) lpskt1a	(4) lpskt1b	(5) lpskt2	(6) lpskt3
llskm1	0.673***	0.231				
	(0.155)	(0.197)				
llskm2	0.0937	0.312*				
	(0.143)	(0.187)				
llskt	-0.154	0.409	-0.00444	0.0639	0.886***	0.368
	(0.221)	(0.268)	(0.211)	(0.209)	(0.315)	(0.819)
llskt1a			0.518***			
			(0.160)			
llskm			0.0937	-0.101	-0.00905	0.501*
			(0.118)	(0.117)	(0.158)	(0.276)
llskt1b				0.880***		
				(0.162)		
llskt2					-0.0447	
					(0.100)	
llskt3						0.0426
						(0.504)
Constant	2.729***	0.419	2.892***	1.207**	1.101	0.0965
	(0.789)	(0.964)	(0.573)	(0.575)	(0.867)	(2.012)
Observations	11	11	11	11	11	11
R-squared	0.959	0.936	0.947	0.960	0.864	0.836

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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