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Illicit Cigarettes Consumption:

Empty Packs Survey in Six Indonesian Cities

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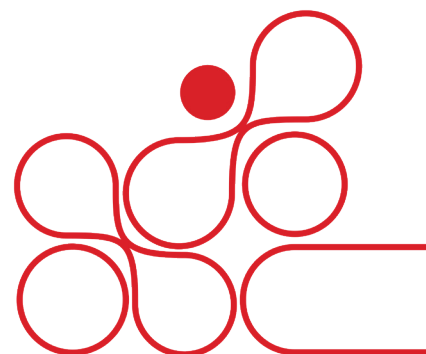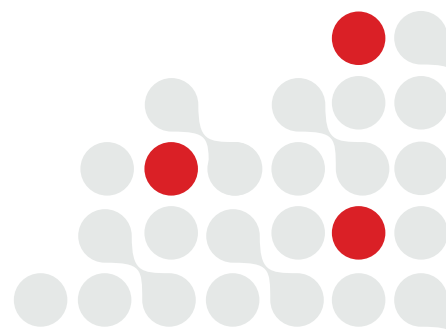Fariza Zahra Kamilah

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EXECUTIVE SUMMARY

Illicit cigarettes pose a significant challenge to Indonesia's efforts to reduce its high smoking prevalence. The trade of these products can also cause significant revenue loss for the government. The evidence on the magnitude of illicit cigarettes in Indonesia remains limited, and this research contributes new, important findings. This study aimed to estimate the level and nature of consumption of illicit cigarettes in six large cities in Indonesia.

This study employed an empty-pack survey method with a cluster sampling design. Data collection involved gathering discarded empty cigarette packs from the streets from October 23 to November 4, 2024, in six major cities—Jakarta, Bandung, Semarang, Surabaya, Medan, and Makassar. The analysis of tax stamps and pictorial health warnings (PHW) compliance was then performed to classify packs as licit or illicit.

Out of a total of 8,179 collected packs, 7,417 (90.76%) packs were eligible for analysis. Among these, 799 (10.77%) packs were considered illicit. The majority of illicit packs consisted of packs with unregistered brands, lacking both tax stamps and PHW (63.58%). Comparative analysis across the selected cities revealed that Makassar (21.48%) and Surabaya (20.61%) had the highest prevalence of illicit cigarette consumption. The substantial prevalence of illicit cigarette consumption across six Indonesian cities highlights the urgent need for government intervention to cease micro-small scale illicit manufacturers operations, secure high-risk areas such as cities with big ports, and to implement trace-and-track measures.

Out of 8,179 collected packs, 7,417 (90.76%) were deemed eligible for analysis. Among these, 799 packs (10.77%) were identified as illicit. The majority of illicit packs were unregistered brands that lacked both tax stamps and pictorial health warnings (63.58%). A comparative analysis across the selected cities revealed that Makassar (21.48%) and Surabaya (20.61%) exhibited the highest prevalence of illicit cigarette consumption. These findings underscore the urgent need for government measures, including specifically enhanced surveillance in high-risk areas—particularly port cities, enforcing regulations against micro- and small-scale illicit manufacturers, and a robust track-and-trace system to curb the circulation of illicit tobacco products.

1
INTRODUCTION

With more smokers than any other country in Southeast Asia, Indonesia continues to confront formidable obstacles in its fight against tobacco use. According to the Global Adult Tobacco Survey 2021, there were 69.1 million smokers in Indonesia. The survey also reveals that smoking is still highly prevalent, particularly among adult males (64.7%) (1). Globally, a tobacco excise tax that increases the price of tobacco products has been known as an effective policy to reduce tobacco use (2). However, tobacco products remain affordable for most Indonesians (3,4) as Indonesia's tobacco excise tax tariff is considered among the lowest in the world (5).

The tobacco excise tax structure in Indonesia is also very complex. The tax structure currently consists of 8 brackets, which are determined based on the type of tobacco products, the scale and method of production, and the retail price range (6). For cigarettes, the most consumed tobacco products by Indonesians, there are three brackets of excise tax for each different type, namely hand-rolled kreteks (*sigaret kretek tangan*/"SKT"), machine-rolled kreteks (*sigaret kretek mesin*/"SKM"), and machine-rolled white cigarettes (*sigaret putih mesin*/"SPM"). Within each of those brackets, three different tiers of excise tax tariff gradually increase as the tiers go higher. This structure was initially designed to accommodate and protect small cigarette producers. However, as large-scale cigarette companies can sub-contract their production to these small-scale producers, the structure incentivizes them to aim their products to fall within lower excise tax brackets/tiers (7). Consequently, the market as it is currently structured will always be supplied with many cigarettes that are sold relatively much cheaper, creating the "downtrading" phenomenon, i.e., smokers switching to lower-priced cigarette alternatives (8).

Besides the problem of affordability and excise tax structure, the presence of illicit cigarettes is also harmful to Indonesia. As they are typically sold at very affordable prices, they are often considered attractive options, particularly for young people and people of lower socioeconomic background (9). Illicit cigarettes also cause tax revenue loss to the government. One study from 2018 noted that illicit cigarettes caused significant and unnecessary loss of cigarette excise tax revenue (10). However, unlike in a few neighboring countries like Malaysia and Laos (11), the illicit cigarette trade in Indonesia is mainly dominated by domestic tax evasion. Cigarette smuggling in Indonesia was suggested to be only around 5% of domestic sales (12). This is due at least partly to the fact that the majority of Indonesian smokers (more than 90%) consume kreteks or cigarettes with both tobacco and cloves that are produced domestically (12).

Estimating the magnitude of illicit cigarettes in Indonesia is challenging; however, there are previous studies that have attempted to do it with several limitations. Researchers at the University of Gadjah Mada purchased cigarette packs from selling points (local retailers or *warung*) and found that the circulation of illicit cigarette packs in Indonesia increased from 6.1% in 2010 to 12.1% in 2016 and decreased to 7.0% in 2017 (13). This study attempted to investigate the supply side of illegal cigarettes in Indonesia. The other two studies used a gap analysis method to estimate the magnitude of illicit cigarettes. Using a gap analysis method, the researchers at the University of Indonesia (Ahsan et al.) estimated that illicit cigarettes were 17% and 9% of the total consumption in 2004 and 2013, respectively (14). Using an improved gap analysis method, another team at the University of Indonesia (Kasri et al.) also estimated that illicit cigarette consumption was at 5% in 2013 and 19% in 2018 (10). While the gap analysis method
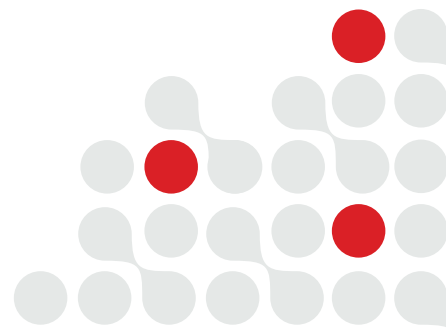
can indicate the magnitude of illicit cigarettes by comparing the gap between the national sales, consumption, and tax revenue the government received, it lacks precision and is primarily suited for identifying general trends (15). Another study was conducted by Prakarsa in 2018, which interviewed 1,440 adult smokers in six provinces and collected 1,201 cigarette packs, of which 2% were found to be illicit through careful validity checks of excise tax stamp attributes and pictorial health warning images (11). However, the sample size in the study was considered relatively small, and thus, the results might not be very accurate. The last known study that measured the magnitude of illicit cigarettes was conducted by Oxford Economics, which used empty-pack surveys and found that illicit consumption increased from 8.5% in 2012 to 9.6% in 2017 (13). The study was also heavily criticized due to its non-transparent methodology and the fact that tobacco multinationals funded it.

This study seeks to provide a comprehensive and updated assessment of the magnitude of illicit cigarette consumption in six major cities in Indonesia, a critical issue with far-reaching implications for public health, government revenue, and regulatory enforcement. Given the dynamic nature of the illicit cigarette market–shaped by evolving tax policies, enforcement measures, and market behaviors–this study aims to generate robust, evidence-based insights to inform policymakers and stakeholders. Specifically, it seeks to (1) estimate the overall prevalence of illicit cigarette packs across six major cities in Indonesia, representing diverse geographic and socioeconomic conditions, and (2) conduct a systematic classification of illicit cigarette packs based on their non-compliance with tax stamp regulations and pictorial health warning (PHW) requirements. By refining methodological approaches and incorporating a broader contextual analysis, this study will offer crucial updates on illicit cigarette consumption. The findings are expected to support more effective tax administration, enhance enforcement mechanisms, and contribute to Indonesia's broader tobacco control agenda.

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METHODOLOGY

This study employed an empty cigarette pack survey methodology, a widely recognized approach for estimating the prevalence of illicit tobacco products. Data collection took place from October 23 to November 4, 2024, across six major cities in Indonesia. The study design and data collection process followed international best practices, specifically referencing the toolkit on measuring illicit trade in tobacco products developed by the Economics for Health program at Johns Hopkins University (2020), providing standardized guidelines for collecting and analyzing discarded cigarette packs (15). This methodology ensures the reliability and comparability of findings, offering a robust evidence base for policy discussions on tobacco control and illicit trade mitigation.

The selection of the survey cities followed a systematic multi-criteria approach to ensure a reasonably representative demographic and geographic distribution of the illicit cigarettes across a small number of major urban areas in Indonesia. The process began with a comprehensive listing of all cities and regencies in the country.

From this list, cities were assessed based on five key criteria:

1. **Population Size** – Larger cities generally have higher tobacco consumption and are more likely to be key markets for legal and illicit cigarette trade.

2. **Population Density** – Higher-density areas have greater accessibility to cigarette distribution networks, including illicit sources. Sampling high-density areas also ensures high coverage of population and cost efficiency.

3. **Smoking Prevalence** – Cities with a higher proportion of smokers were prioritized to ensure sufficient sample availability for the study.

4. **Estimated Number of Smokers** – Beyond smoking prevalence, the absolute number of smokers in a city was considered to capture areas with significant market potential for illicit trade.

5. **Geographical Representation** – To reflect the regional diversity of Indonesia, the selection included cities from the islands of Java, Sumatra, and Sulawesi, ensuring coverage of different economic, regulatory, and logistical environments that might influence illicit cigarette trade patterns.
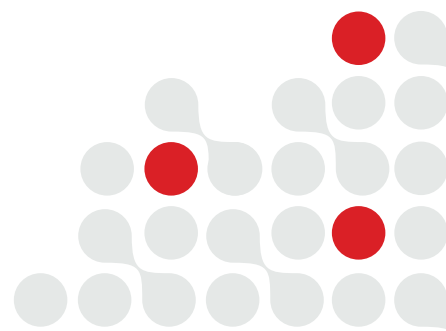
After applying these selection criteria, six cities were identified as survey sites: Jakarta, Bandung, Semarang, Surabaya, Medan, and Makassar (Figure 1). This selection ensures a balanced representation of urban centers from different parts of the country.

Each selected city plays a strategic role in Indonesia's cigarette market and reflects distinct characteristics relevant to the illicit cigarette trade:

- Jakarta, Bandung, Semarang, and Surabaya are the four most densely populated cities on Java Island, collectively home to nearly 18 million people based on Indonesia's 2022 National Socio-Economic Survey (Susenas). Java is the country's economic and political hub, with approximately 56% of Indonesia's total population residing on the island (16). Given its high tobacco consumption, Java Island serves as a significant market for both legal and illicit cigarette sales, making these cities critical for inclusion.

- Medan – As the largest city in Sumatra, Medan was selected to represent western Indonesia. It has the highest population density in Sumatra and is a key economic hub with strong trade links to neighboring countries. The city's proximity to potential illicit cigarette supply routes, including those from Malaysia, makes it a significant area for monitoring illicit trade patterns.

- Makassar – Representing eastern Indonesia, Makassar is Sulawesi's largest and most densely populated city. It is a major port city with a high volume of commercial trade, potentially serving as a transit hub for illicit tobacco products entering from international and domestic sources. Makassar's selection ensures the study captures regional variations in illicit trade across different islands.

Furthermore, according to the 2022 Susenas, these cities exhibit higher smoking prevalence and a more significant number of smokers compared to other major urban areas. This confirms their relevance and strategic importance for studying illicit cigarette distribution patterns. The characteristics of these cities are summarized in Table 1.

Table 1. Characteristics of selected cities						
City	Island	Province	Number of population	Population density (people/km²)	Adult (aged 15+) smoking prevalence (%)	Number of smoking population
Jakarta*	Java	DKI Jakarta	10,660,851	16,389	21.24%	1,751,526
Bandung	Java	West Java	2,583,710	15,409	28.44%	569,274
Semarang	Java	Central Java	1,877,230	5,022	20.48%	299,987
Surabaya	Java	East Java	2,923,780	8,341	19.86%	451,815
Medan	Sumatra	North Sumatra	2,326,112	8,778	20.46%	361,973
Makassar	Sulawesi	South Sulawesi	1,566,845	8,903	16.59%	197,160

Source: the 2022 Indonesia's socioeconomic survey (Susenas)

Note: * comprises 5 administrative cities: North Jakarta, Central Jakarta, West Jakarta, East Jakarta, and South Jakarta

By adopting a systematic selection process that accounts for population dynamics, smoking behaviors, and geographical distribution, this study ensures that its findings provide a comprehensive and reasonably representative estimate of the illicit cigarette trade in Indonesia. The results will contribute to evidence-based policy recommendations, helping authorities strengthen tobacco tax enforcement and combat illicit cigarette circulation in high-risk areas.

Figure 1. Location of the six cities included in this study
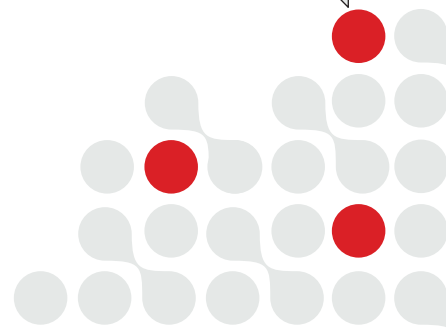
Sample design and size

This study employed a one-stage cluster sampling design. While smaller geographic area classifications, such as census blocks, are typically ideal to be determined as primary sampling units (PSUs) for an empty pack survey (15), this study opted for sub-sub district or *Kelurahan* (the fourth level of administrative areas) within each city as PSUs due to the access restriction to the census blocks data (Figure 2).

Figure 2. Levels of administrative areas in Indonesia.

Level 1
Provinces *(Provinsi)*
one province consists of several districts

Level 2
Districts *(Regencies/Kabupaten and Cities/Kota)*
one district consists of several sub-districts

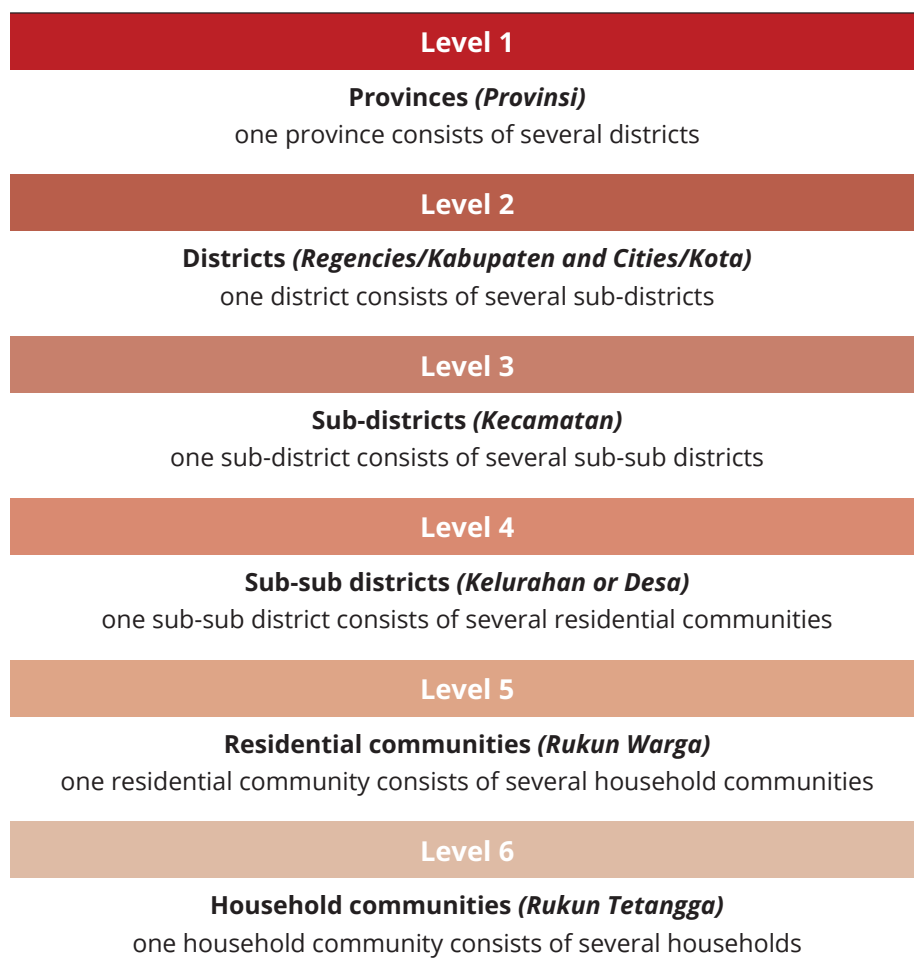| Level 3 |
| :---: |
| **Sub-districts *(Kecamatan)*** |
| one sub-district consists of several sub-sub districts |

Level 4
Sub-sub districts *(Kelurahan or Desa)*
one sub-sub district consists of several residential communities

Level 5
Residential communities *(Rukun Warga)*
one residential community consists of several household communities

Level 6
Household communities *(Rukun Tetangga)*
one household community consists of several households

Source: Law No. 23, 2014

In selecting the PSUs as collection sites, we encountered a limitation due to the unavailability of demographic data at the PSU level, such as individual age, education attainment, and income. Consequently, the Probability Proportional to Size ("PPS") sampling method could not be applied to select PSUs with potentially higher prevalence of smokers as priority samples. Considering that the majority of smokers in Indonesia are men, we utilized data on the total number of men residing in each PSU obtained from the Ministry of Home Affairs (17).

The minimum sample size of this study was determined by the following formula:

$$n = \frac{Z^2_{1-\alpha/2} \cdot P(1-P) \cdot DEFF}{\delta^2} \quad n = \frac{Z^2_{1-\alpha/2} \cdot P(1-P) \cdot DEFF}{\delta^2}$$

where:

$Z^2_{1-\alpha/2}$ $Z^2_{1-\alpha/2}$ = quantile of the standard normal distribution for 95% confidence (critical Z score is $Z_{1-0.05/2}$ = 1.96)

P = proportion of illicit packs

δ = estimation error for the proportion of illicit packs

$DEFF$ = design effect.

The sample size was determined by the estimated proportion of illicit packs, P. In this study, P was set to be 10%, the average of two estimated sizes of illicit packs based on the two previous studies (10,18). $DEFF$ was set to be equal to 2, as the estimates of design effect were not available (15). With a confidence level of 99% (or 1% margin of error), the formula resulted in 6,920 packs to be collected.

Then, by multiplying the share of smokers per city (the number of smokers per city divided by the total number of smokers in all six cities) and the minimum sample size of 6,920, the minimum number of packs collected by cities is shown in Table 1. To ensure a timely and efficient field data collection, we assigned a total of 49 pack collectors and 10 field supervisors[1]. During the field data collection, we collected a total of 8,172 packs (1,252 or 18% more packs).

Table 2. Number of empty packs to be collected by chosen cities			
City	**Number of smokers per city***	**Minimum sample size per city**	**Empty packs collected during the fieldwork**
Jakarta	1,751,526	3,337	3,856
Bandung	569,274	1,085	1,312
Semarang	299,987	572	665
Surabaya	451,815	861	1,082
Medan	361,973	690	779
Makassar	197,160	376	485
Total	**3,631,735**	**6,920**	**8,179**

*Obtained from the 2022 Indonesia's socioeconomic survey (Susenas)

[1] The number of pack collectors and field supervisors assigned per city:
  Jakarta   : 24 pack collectors and 5 supervisors
  Bandung   : 7 pack collectors and 1 supervisor
  Semarang   : 4 pack collectors and 1 supervisor
  Surabaya   : 6 pack collectors and 1 supervisor
  Medan   : 5 pack collectors and 1 supervisor
 Makassar   : 3 pack collectors and 1 supervisor
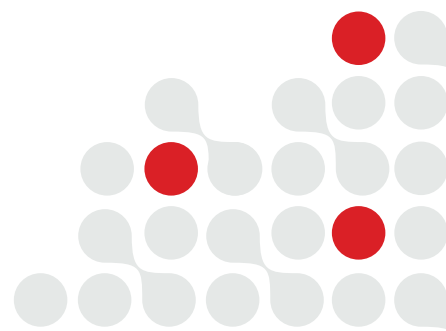
Collection of empty packs

Trained pack collectors systematically collected every discarded cigarette pack along designated routes. Each route began at the center of each selected fraction and extended around four city blocks (1 km in for each perimeter) following a prescribed pattern (Figure 3). For instance, starting from a randomly generated point within the sampled PSUs, pack collectors might walk north for 1 km. Afterward, they would turn right and continue walking until they completed a square with a total walking distance of 4 km. This pattern could be repeated four times, each time beginning in a different starting direction.

We monitored the pack collectors' walking routes using a GPS tracking app called Gaia GPS (19) to ensure compliance with the prescribed route. If the number of packs collected along the specified route did not meet the minimum sample requirements, a new starting point was generated within the same PSU. If the collectors still failed to meet the minimum sample requirements after exploring all feasible starting points within the PSU, new starting points would then be generated in a new PSU.

Figure 3. Prescribed walking protocol
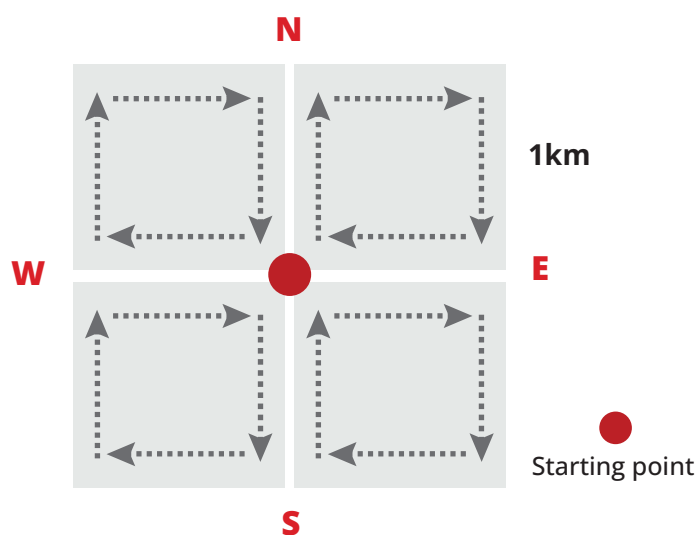
Several parameters were set. First, the route's starting points were generated if there was a selling point(s) of cigarettes, such as a convenience store, supermarket, or local stall, within a 100m distance in the area. Second, the areas such as tourist sites, busy public transportation terminals, and central business districts were avoided. Third, the pack collectors were permitted to collect cigarette packs only from the street surface for safety and hygiene reasons. This means they were not allowed to gather packs from trash cans. Lastly, the collectors focused exclusively on collecting conventional cigarette packs, excluding e-cigarettes and other tobacco product packs.

Data collection: Tax stamps and pictorial health warning (PHW) image attributes

We gathered information on cigarette packs' tax stamps and pictorial health warning (PHW) image attributes, which were later used to classify the packs into licit and illicit categories. For the tax stamp, we followed guidelines set by the Ministry of Finance, which specifies the attributes that must appear on a legitimate excise tax stamp (see Figure 4a) (20). The data input staff inspected the packs and filled out a series of questions that asked regarding the presence and visibility of various attributes, such as the national symbol, the budget year, the hologram, and others. They also verified the key information on the tax stamp matched the information on the respective cigarette pack, this included the type of cigarettes, number of sticks, and budget year. Additionally, the tax stamp attributes that are only visible under UV light and are reflective of unique patterns and fibers (Figure 4b) were also inspected.

Figure 4a. Legitimate excise tax stamp on cigarette pack
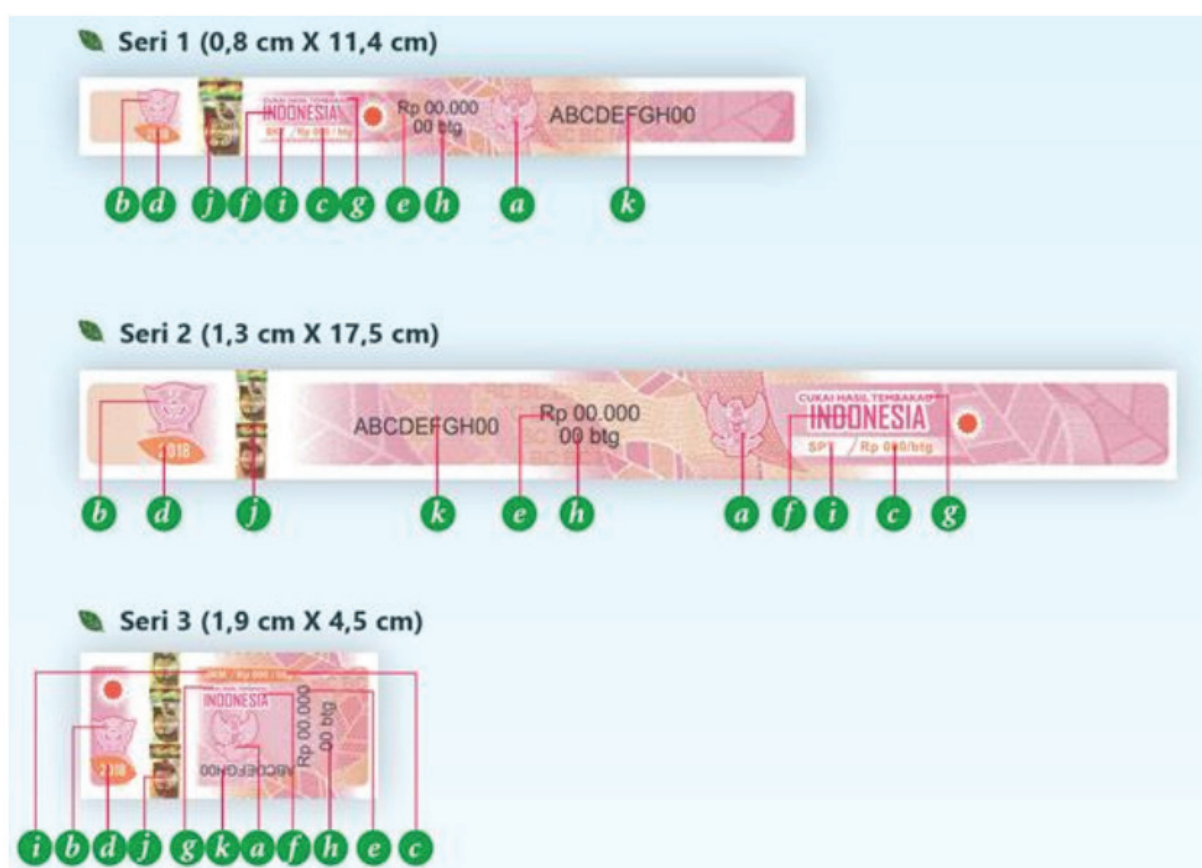
Source: Directorate General of Excise and Customs, Ministry of Finance of the Republic of Indonesia, 2024

Notes: a) National symbol; b) The Directorate General of Customs and Excise Logo; c) Excise tax tariff; d) The budget year; e) Minimum per pack retail price; f) "INDONESIA" text; g) "CUKAI HASIL TEMBAKAU" text; h) Number of individual cigarettes; i) Type of tobacco product; j) Hologram; k)Personalization
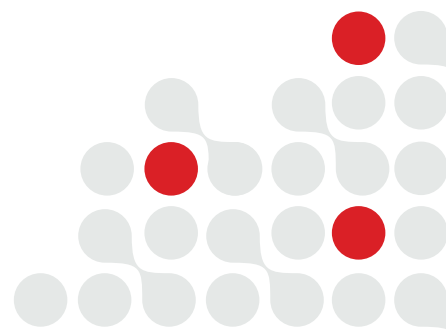
Figure 4b. Legitimate excise tax stamp under UV light
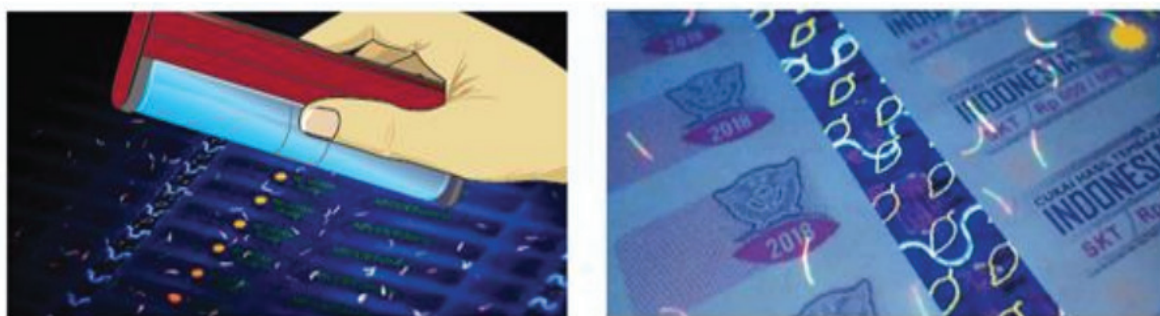
Source: Directorate General of Excise and Customs, Ministry of Finance of the Republic of Indonesia, 2024

The data input staff thoroughly examined the image and warning message on the PHW. It is imperative that any legitimate PHW on cigarette packs must be precisely similar to one of the regulated images and warning messages stipulated by the Ministry of Health (MoH)'s regulation (Figure 5) (21).

Figure 5. Legitimate PHWs

Source: Directorate General of Disease Prevention and Control, MoH of Indonesia, 2018

Data analysis: Classification of licit and illicit packs

In unsold conditions, four identifiers can be used to classify domestic illicit packs as illicit based on compliance with tax stamps and PHW regulations (11). The first identifier is the absence of an excise tax stamp. The second is the inappropriateness of the tax stamp, which includes scenarios where one or more security features are absent or incorrect; for instance, discrepancies between the stated information in the tax stamp and the actual product details, such as the type of cigarettes, number of sticks, and production year. The third is the absence of PHW. The fourth is the inappropriateness of PHW, which means that the picture and the messages do not conform to the regulated standards. Generally, a pack is classified as illicit if it fulfils one of these four conditions. However, since the condition of empty packs varied widely (e.g., some packs have been partially damaged, some of the tax stamps have been wholly or partially ripped off without any visible trace, etc.), we adopted an alternative approach. It also involves checking the registration status of the brand on the packs to classify them into licit and illicit categories.

Figure 6 depicts the framework we used to classify packs into licit/illicit categories. We first verified the registration status of the collected packs' brand with the assistance of the MoF. This step allowed for the immediate classification of specific packs as illicit categories, particularly those associated with unregistered brands that are likely to be illegal. Subsequently, we proceed to verify the tax stamp and PHW of those packs to determine why they are illegal. We further assessed whether a tax stamp was present for packs with registered brands. If the tax stamp was absent, we excluded the pack from further analysis due to the uncertainty of its previous compliance with tax stamp regulations. If a tax stamp was present, we examined the presence and appropriateness of its security features. We classified a pack as illicit if the condition of the pack and/or the stamp was undamaged and the security features were found to be incorrect, incomplete, or not matching the required standards. On the contrary, if the condition of the pack and/or the stamp were only partially damaged, we considered the pack as potentially legal if sufficient features and relevant information remained accurate. In this step, we also utilized UV light to validate the legitimacy of the tax stamp. For packs deemed potentially legal, we assessed the presence and appropriateness of the PHW. If the PHW was absent or inappropriate, we classified the pack as illegal. Meanwhile, if the PHW was both present and appropriate, the pack was ultimately classified as legal.

As for foreign packs, we could determine whether the packs were foreign since their brand and health warning labels were written in a foreign language. However, we excluded them from our analysis since we could not determine whether they were legally brought to the country or smuggled.
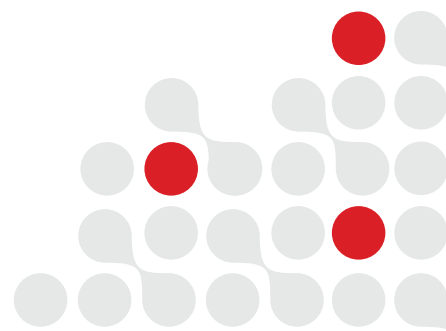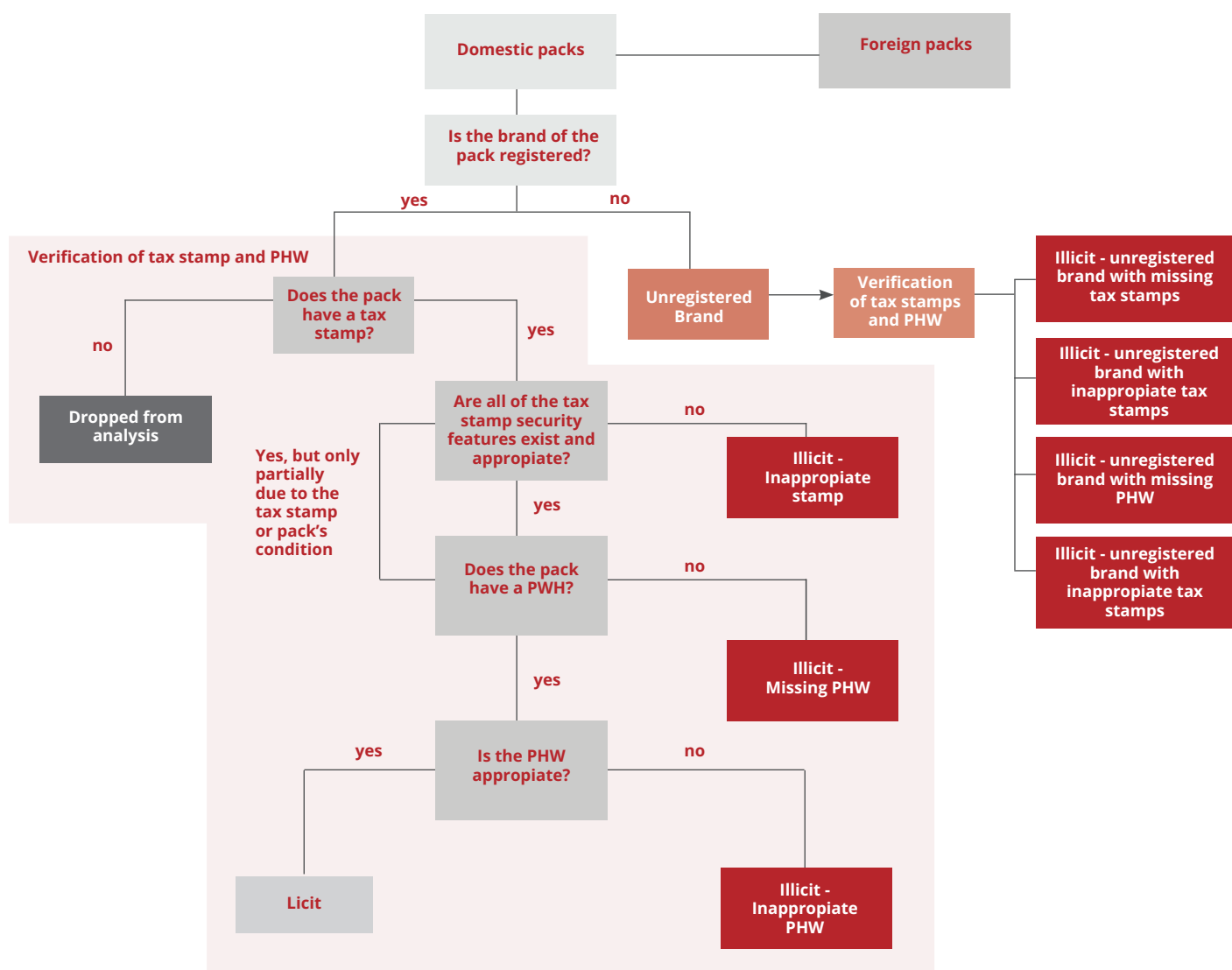
Figure 6. Analysis framework

Source: Authors' elaboration

3
RESULTS

Overview

Table 3 provides a detailed description of the sample. From a total of 8,179 collected packs, almost all of them (99.91%, n: 8,172) were identified as domestic packs. Comparing the number of collected packs across the cities, the number of collected packs in Jakarta is the highest, which accounts for 47.15% (n: 3,856) of total collected packs, followed by Bandung (16.04%, n: 1,312), Surabaya (13.23%, n: 1,082), Medan (9.52%, n:779), Semarang (8.13%, n: 665), and Makassar (5.93%, n: 485).

Among the collected packs, the packs of SKM dominated our sample the most (64.26%, n: 5,251), followed by SKT and SPT (*sigaret putih tangan,* hand-rolled white cigarettes) (27.92%,

n: 2,282). Meanwhile, the packs of SPM, SKTF (*sigaret kretek tangan filter*, hand-rolled filter kreteks) and SPTF (*sigaret putih tangan filter,* hand-rolled white filter cigarette) were less common to be found compared to SKM, SKT, and SPT. Notable regional variations were also present, with Makassar showing the highest proportion of SKM cigarettes (83.30%) compared to other cities. Surabaya had the highest percentage of unidentified cigarette types (11.65%), significantly higher than the average across other regions. Regarding foreign packs, a total of 7 packs were found, with 1 of them originating from China, while the origin of the rest of them is unknown.

Table 3. General overview of the sample														
	City													
	All		**Jakarta**		**Bandung**		**Semarang**		**Surabaya**		**Medan**		**Makassar**	
Total pacpacks collected	8,179		3,856		1,312		665		1,082		779		485	
Domestic packs	8172 (99,91%)		3,855 (99.97%)		1,306 (99.47%)		665 (100%)		1,082 (100%)		779 (100%)		485 (100%)	
Type of cigarettes	n	%	n	%	n	%	n	%	n	%	n	%	n	%
SKM	5,251	64.26	2,445	63.42	778	59.57	421	63.31	700	64.70	503	64.57	404	83.30
SPM	180	2.20	83	2.15	24	1.84	13	1.95	20	1.85	24	3.08	16	3.30
SKT and SPT	2,282	27.92	1,175	30.48	400	30.63	219	32.93	234	21.63	202	25.93	52	10.72
SKTF and SPTF	9	0.11	3	0.08	2	0.15	1	0.15	2	0.18	1	0.13	0	0.00
Other (not stated on the pack)	459	5.51	149	3.87	102	7.81	11	1.65	126	11.65	49	6.29	13	2.68
Foreign packs	7 (0.09%)		1 (0.03%		6 (0.53%)									
Country of origin	n	%	n	%	n	%	n	%	n	%	n	%	n	%
China	1	14.28	1	100	0									
Unknown	6	85.72	0	0	6	0100								

Note:a Proportion (%) is calculated from the total number of collected pack

Abbreviations: SKM, sigaret kretek mesin (machine-rolled cigarette), SPM, sigaret putih mesin (machine-rolled white cigarette), SKT, sigaret kretek tangan (hand-rolled kreteks), SPT, sigaret putih tangan (hand-rolled white cigarette), SKTF, sigaret kretek tangan filter (hand-rolled filter kreteks), SPTF, sigaret putih tangan filter (hand-rolled white filter cigarette).

Licit/Illicit packs

Figure 7. Licit/illicit packs by category of compliance
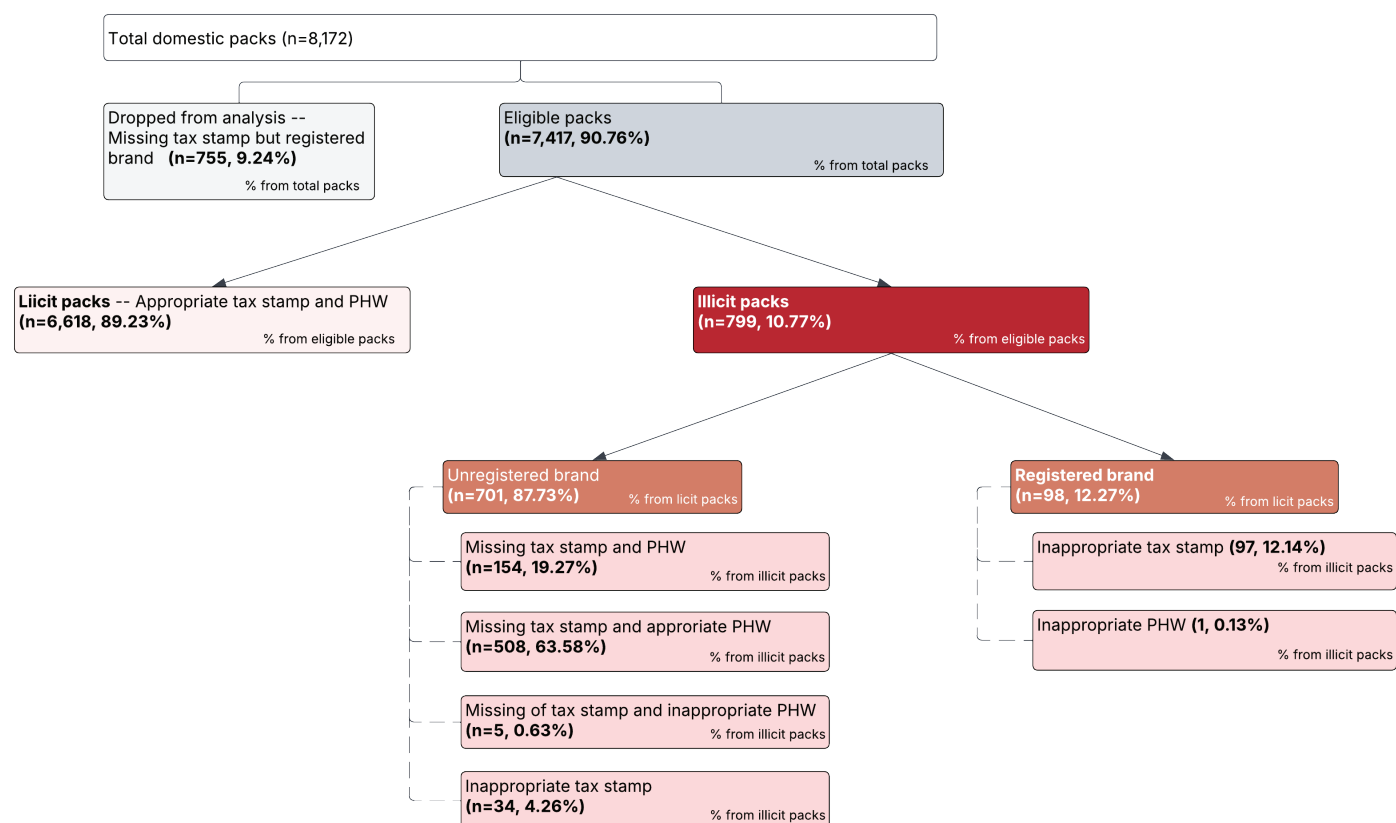
Source: Authors' calculation

Figure 7 shows the distribution of licit and illicit packs by compliance. Out of a total of 8,172 domestic packs collected, 7,417 packs (90.76%) were eligible for analysis. The remaining 9.24% (n: 755) were excluded from the analysis as these are registered brand packs with missing tax stamps. Among the eligible packs, 6,618 packs (89.23%) were identified as licit, and 799 packs (10.77%) were identified as illicit. Among the illicit packs, 701 packs (87.73%) were unregistered brand packs, and 98 packs (12.27%) were registered brand packs. The latter had two compliance issues: inappropriate tax stamps (12.14%, n:97) and inappropriate PHW (0.13%, n:1).

Figure 7 also outlines the non-compliance characteristics of illicit unregistered brand packs. The most common form of non-compliance—found in 508 (63.58%) unregistered brands of illicit packs—was the absence of a tax stamp despite having an appropriate PHW. This was followed by 154 packs (19.27%) of unregistered brand illicit packs without tax stamps and PHW. Furthermore, 34 packs (4.26%) of unregistered illicit brand packs had inappropriate tax stamps.

Figure 8 shows the breakdown of illicit packs by type of cigarettes, with SKM accounting for the largest share (68.24%, n=546). The comparison of licit and illicit packs' proportion across cities (see Figure 9) highlights the geographical variation of illicit pack prevalence. The highest prevalence was found in Makassar (21.48%) and Surabaya (20.61%), where about one in five packs were illicit, while the lowest was in Semarang (1.86%).

Figure 8. Illicit packs by types of cigarette

Unknown
27%

SKTF and SPTF
0.5%

SKT and SPT
2.5%

SPM
1.6%

SKM
68.3%

n of illicit packs=799
Source: Author's calculation
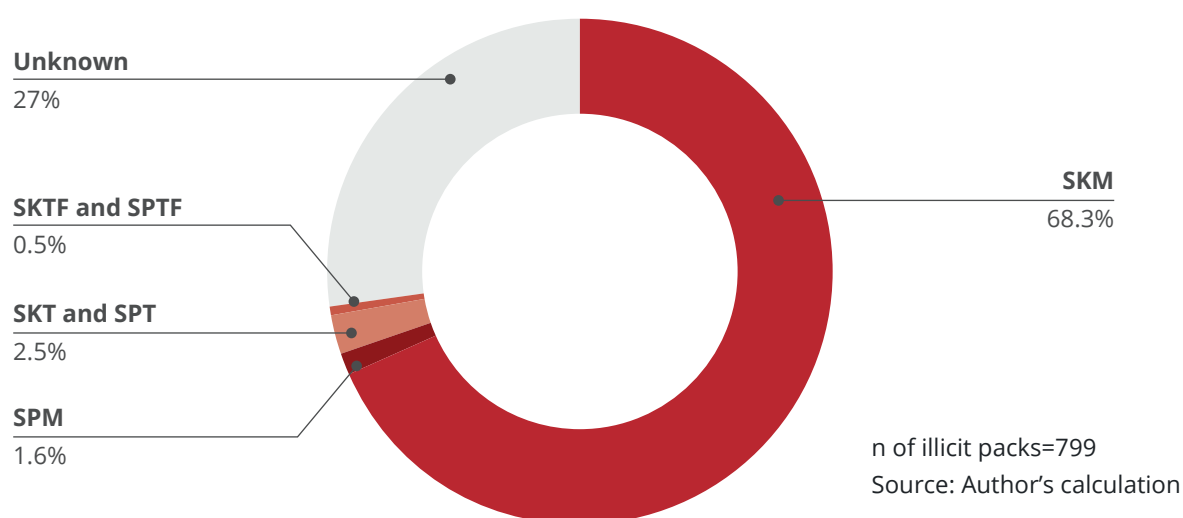
Figure 9. The licit-illicit proportion by cities

City	Illicit
Jakarta	8.25%
Bandung	14.82%
Surabaya	20.61%
Semarang	1.86%
Medan	4.26%
Makassar	21.48%
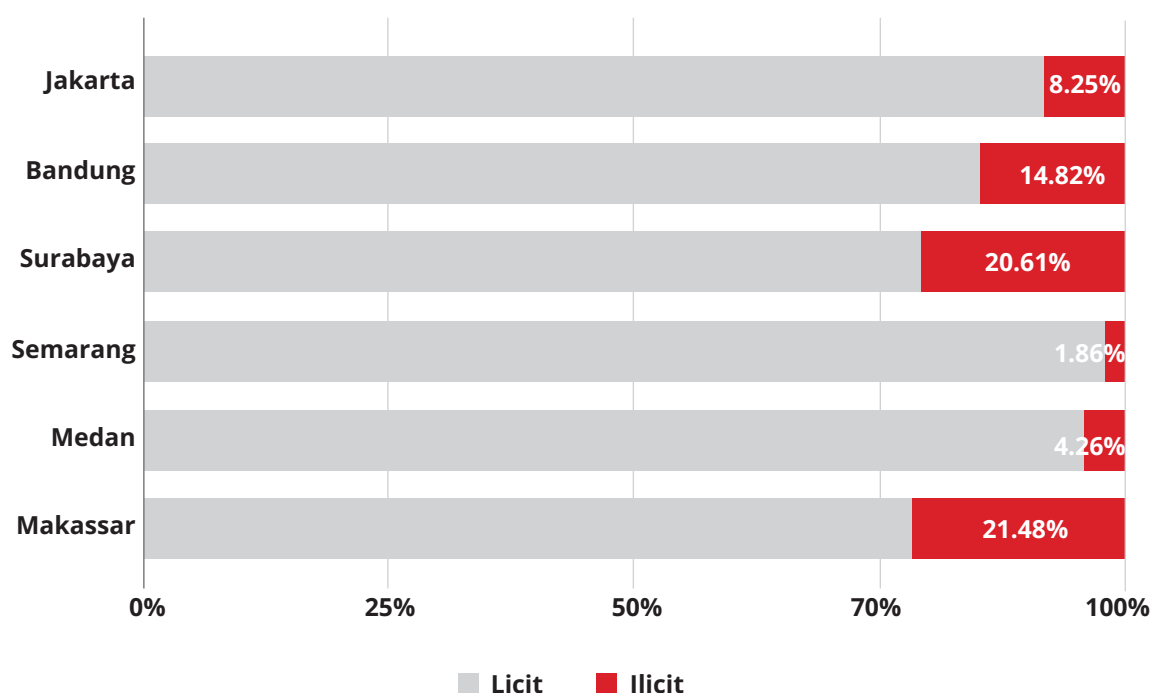
Licit   Ilicit

n of eligible packs=7,414
Source: Author's calculation
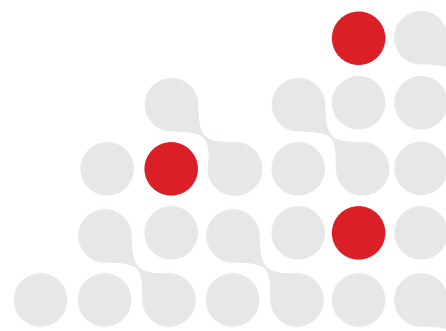
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DISCUSSION

In this study, we have estimated that the overall percentage of illicit packs in six major Indonesian cities is 10.77%. We found this result to be very close to ~10%, which is the average of two estimated sizes of illicit packs based on the two previous studies in Indonesia (10,18). We found that the prevalence of illicit packs in Makassar (21.48%) and Surabaya (20.61%) is significantly higher. There are two factors that likely contribute to this phenomenon. First, the province of East Java, where Surabaya is located, is the province with the largest tobacco plantation area and the highest number of tobacco factories (22,23). At the same time, evidence also shows that it is the province with the highest number of court offenses and prosecutorial activities related to illicit cigarettes (24). This suggests a positive correlation between a large tobacco plantation area, a high number of factories, and a high presence of illicit cigarettes, particularly in this province. Second, Surabaya and Makassar are likely to be connected, as they are port cities that connect the main logistics supply between the center and east sides of Indonesia. A large amount of illicit cigarettes may be transported from Surabaya to Makassar, considering the province of South Sulawesi, where Makassar is located, has relatively small areas of tobacco plantations and a small number of cigarette factories (22). Nevertheless, this is subject to further research, as no evidence can fully explain this phenomenon.

Among the observed illicit packs (n = 799), we found that most illicit packs are unregistered brand packs (87.73%). Meanwhile, we found the registered brand illicit packs relatively less common (12.14%). This suggests that most of the illicit products are marketed under unregistered brands. These unregistered brand packs will likely be produced by micro or small-scale manufacturers who did not legally register their products and operate illegally. In Indonesia, owning a cigarette-rolling machine to start a small-scale cigarette business is relatively easy as it is not restricted by law (25). For the tax stamp, we found that most illicit packs

were devoid of tax stamps. This indicates that many illicit manufacturers opt to sell their products without tax stamps rather than counterfeiting them. Furthermore, we found that most illicit packs were devoid of tax stamps for the tax stamp that almost all of the packs displayed proper PHW, including the illicit ones. This observation implies that it was easy for illicit manufacturers to produce a proper PHW on their products.

Our findings yield two significant implications for future policy change. First, this study emphasizes the necessity for the government of Indonesia to take further steps to control the kretek/cigarette supply chain. Indonesia currently relies only on tax stamps and field enforcement operations and some straightforward and evidence-based changes could complement these measures readily and at low cost. The government should intensify monitoring and enforcement efforts in high-risk port cities such as Surabaya and Makassar, where illicit cigarette prevalence is notably high. These major ports are strategic entry points that may facilitate the movement of illicit products. Likewise, free trade zones (FTZs) require closer scrutiny, as emerging evidence suggests they may also serve as channels for the illicit cigarette trade (26,27). Second, the government should strongly consider ratifying the WHO Framework Convention on Tobacco Control and the WHO Protocol to Eliminate Illicit Trade in Tobacco Products. The latter treaty, among other provisions, emphasizes licensing all producers including micro and small-scale cigarette manufacturers, which would be a crucial next step (28). Strengthening oversight of these smaller producers—particularly those operating without registration—should be a policy priority. This may include regulating the sale and ownership of cigarette-making machinery to prevent misuse and enhance traceability within the supply chain.

Ultimately, the government should strongly consider the implementation of an effective track and trace system that

would allow the tax authorities to know where any product is at any given time, from where it came and where it is going. Countries of all income levels, including Kenya (29) and Saudi Arabia (30) have successfully implemented such systems and are reaping the rewards, including far fewer cheap illicit products and markedly higher excise tax revenues. Furthermore, best practices counsel that the systems be entirely paid for by the tobacco companies, though they are not permitted to have any involvement in the system whatsoever. These companies benefit because they are much less likely to be undersold by cheaper illicit brands. There are well-known and experienced vendors independent of the tobacco industry who specialize in such systems, and technical assistance is available from international governmental organizations to ensure their successful implementation.

Several necessary clarifications must be made regarding our study results. Although the overall prevalence of illicit cigarettes in our sample is substantial, it should not be interpreted as a nationally representative estimate. Furthermore, the wide variation in prevalence across surveyed cities, with some cities showing significantly higher rates while others, such as Semarang and Medan, report much lower levels, indicates that illicit cigarette prevalence is unlikely to be driven by the excise tax. This is because the tax is applied uniformly at the national level and does not vary across jurisdictions.

This study possesses several notable strengths while also acknowledging certain limitations. One of the key strengths is the incorporation of tax stamp authenticity inspection in identifying illicit cigarette packs. By directly verifying tax stamp compliance, this study provides a more accurate and reliable measure of the extent of the illicit cigarette trade in Indonesia. Without this inspection, estimates of illicit cigarette prevalence would rely solely on packaging characteristics, which could lead to misclassification and underestimation of the issue.

Another major strength lies in the robust sampling design, which ensures a large sample size and wide coverage of sampling units. The study systematically selected survey locations across six major cities, employing a methodologically sound approach that enhances the validity and generalizability of findings within urban settings. The selection of cities was based on critical demographic and geographic factors,

including high population density, high smoking prevalence, a large number of smokers, and strategic geographical representation. These factors ensure that the study captures variations in illicit cigarette trade dynamics across different urban areas in Indonesia.

However, the study also has certain limitations. Since the data sources are of discarded empty packs, there are potential inaccuracies stemming from the condition of the collected tax stamps. Many of these stamps were damaged, partially torn, or entirely ripped, which could affect the ability to assess their authenticity accurately. Although trained field staff followed standardized procedures to minimize errors, some uncertainty remains in cases where tax stamps were not fully intact and could not be included. That said, we have every reason to believe that the distribution of these "unreadable" packs was random and they should not meaningfully affect the overall results.

Additionally, despite the extensive coverage of major urban settings, this study—like other empty-pack surveys (31–34)—does not provide nationally representative estimates. The exclusion of smaller cities, rural areas, and remote regions means that illicit cigarette trade patterns in these locations remain unexamined. Given that illicit cigarette distribution channels may differ between urban and rural areas—due to differences in law enforcement intensity, accessibility, and market demand—future research should consider extending the survey to semi-urban and rural settings to obtain a more comprehensive national picture.

Despite certain limitations, this study offers valuable and timely insights into the illicit cigarette trade in Indonesia. While the findings may not fully capture the extent of potential tax stamp misconduct and cover the national landscape, they nonetheless highlight critical issues related to the circulation of illicit tobacco products, particularly in urban areas. These insights provide an evidence-based foundation for policymakers to strengthen enforcement mechanisms, improve tax compliance, and formulate targeted interventions to curb the spread of illicit cigarette packs. As such, the study contributes meaningfully to ongoing policy efforts aimed at addressing the public health and economic challenges posed by the illicit tobacco market.
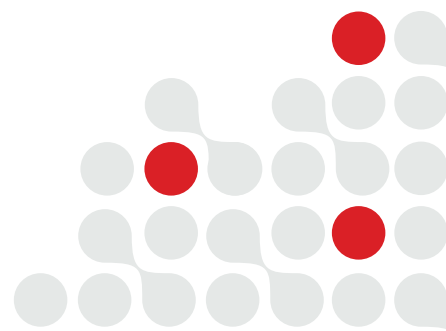
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CONCLUSION

This study provides critical evidence on the prevalence of illicit cigarette packs across six major Indonesian cities, highlighting a challenge to tobacco control efforts, public health objectives, and government revenue collection. The circulation of illicit cigarettes undermines the effectiveness of excise tax policies, weakens smoking reduction initiatives, and leads to significant fiscal losses for the government. These findings underscore the urgent need for more robust measures to secure the kretek/cigarette supply chain and curb illicit trade and ensure compliance with existing tobacco regulations.

To address this issue, the Indonesian government must better secure the high risk areas such as cities with big ports and prioritize licensing and ultimately the implementation of a comprehensive track-and-trace system that enables authorities to monitor cigarette production, distribution, and retail sales more effectively. Such measures can significantly enhance regulatory oversight, detect tax evasion, and prevent the infiltration of illicit products into the market. Strengthening enforcement through inter-agency coordination involving customs, law enforcement, the judiciary and health authorities is also crucial to disrupting illicit supply chains. Finally, this study particularly reinforces the need to shut down unregistered micro and small scale manufacturers that appear to be supplying the market with unregistered brands of illicit cigarettes. Restriction on the ownership and the purchase of cigarette making machines also need to be put in place.

Given the limitations of this study, future research should adopt a more comprehensive and multidimensional approach to understanding the dynamics of the illicit cigarette trade in Indonesia. Beyond expanding the geographical scope, subsequent studies should incorporate larger and more representative sample sizes, as well as utilize diverse methodologies–including household surveys, vendor interviews, and supply chain analyses–to triangulate and validate findings. While the study primarily examines the prevalence of illicit cigarette packs, future research should investigate both the demand and supply dimensions of the illicit trade. Key areas of inquiry include:
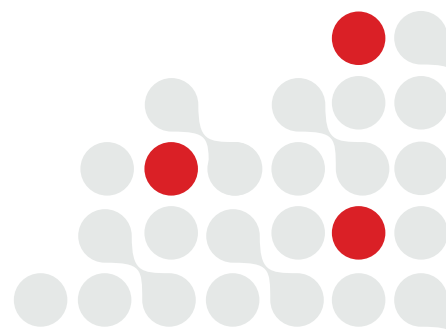
- Consumer behavior and the socio-economic factors that influence the purchase of illicit cigarettes;

- The structure and operations of distribution networks, including cross-border smuggling routes, domestic unlicensed production, counterfeiting and retail-level participation; and

- The effectiveness and enforcement gaps within current regulatory frameworks in curbing illicit cigarette circulation.

By broadening the scope of research and enhancing evidence-based policymaking, Indonesia can strengthen its tobacco control strategy, safeguard public health, and improve excise tax compliance, thereby advancing a more sustainable and coordinated response to the illicit tobacco market.

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