

Poland's Changing Tobacco Market: Emerging Evidence on the EU Menthol Cigarette Ban and the Growth of Heated Tobacco Product Sales

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Summary

The Polish tobacco market has been in flux in recent years. In May 2020, menthol cigarettes were banned from sale in fulfillment of the European Union's Tobacco Products Directive. At the same time, via the initiative of tobacco companies, the introduction and growth of sales of heated tobacco potentially upended the tobacco market. We find that a ban on the sale of menthol cigarettes, which intended to make cigarettes less palatable and harder to use, was associated with only small national declines in total cigarette sales. These changes were concentrated in Warsaw, the region with the highest share of menthol cigarette sales. Overall, the effects of the menthol cigarette sales ban on total cigarette sales in the first year after implementation were muted. We find that the introduction and expansion of heated tobacco product sales led to a rise in total tobacco product sales, in marked contrast to the prior experience of Japan with the same products, where substitution away from cigarettes was the predominant trend. The consequences of these findings for public health in Poland are not overwhelmingly positive. To improve this trend in Poland or aid policy implementation elsewhere, further effort must be made to understand what maintained such consistent cigarette sales volumes in the face of such large policy and market changes.



Introduction

Tobacco use in Poland exacts an enormous toll on the country's well-being every year, whether measured in the form of billions in zloty lost to healthcare spending or millions of sicknesses and over 80,000 deaths each year.¹ The primary driver of this toll is combusted tobacco products, whose direct use causes over 90% of the toll from tobacco in Poland. The public health battle around tobacco use has been marked by decades of debates over whether tobacco products could be redesigned to make the products less harmful to users by providing nicotine through less damaging vehicles than the combusted cigarette. However, at present, conventional factory-made cigarette sales continue to dominate the Polish market and are projected to continue doing so into the not-so-distant future.² In 2020, the value of cigarette sales in Poland was three times larger than the combined value of roll-your-own smoking tobacco, heated tobacco, and e-cigarettes.

The following report seeks to understand how the Polish cigarette market has changed in reaction to two recent developments. One was a policy-driven change handed down from the European Union, and the other was a market-driven change led by the choice of tobacco companies to market new products in the Polish market. Both changes are described by their leaders as promoting the interest of the public health. The policy-driven change of interest is the menthol cigarette sales ban, put into place in May 2020. The market-driven change was the introduction of heated tobacco products (HTPs)

to the Polish market. Both changes need to be evaluated with data adequate to the task to determine whether either change may lead to public health improvements.

This report, therefore, utilizes a common source of data, Nielsen IQ sales data covering the period from May 2018 to April 2021, to analyze these recent changes to Poland's tobacco market. These data track sales in grocery stores, discounters, hypermarkets, sweet alcohol stores, kiosks, petrol stations, and tobacconists of tobacco products, including cigarettes, roll-your-own (RYO) tobacco, and HTPs. In 2019, Nielsen sales data covered 80% of Poland's cigarette sales and 70% of RYO tobacco sales.³ The sales of HTPs are estimated to cover a similarly large proportion of total sales in the latter periods of the dataset.

The findings of this report should inform future tobacco control public policy development efforts. The lessons learned here can inform Poland, the wider European Union, and interested parties around the globe who all are facing the same market, regulatory, and health dilemmas. The two following sections summarize results from the studies as they would be presented in an academic journal. A third and final section considers the impact of the studied changes on questions that are most relevant to Poland. This report was commissioned by the Norwegian Cancer Society, in the framework of a project partnership with the Polish Ministry of Health, by leveraging funding from the EEA and Norway

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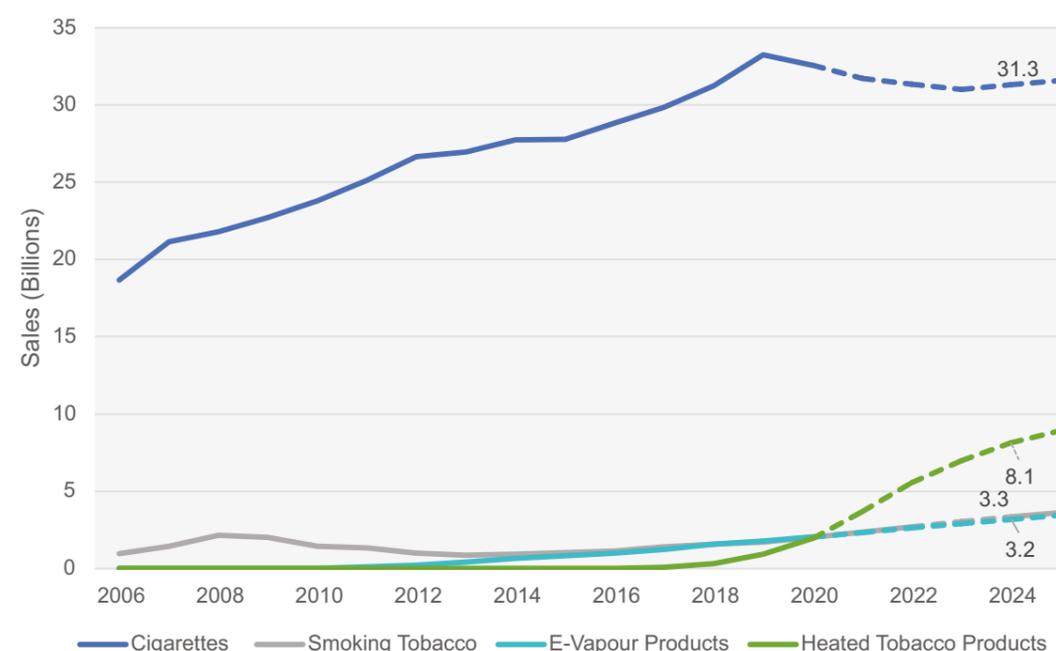


Figure 1: Past and Projected Tobacco Sales Values in Poland (Euromonitor International, Billions Current PLN)

EU TPD Menthol Cigarette Sales Ban^a

To fulfill the European Union's (EU) 2012 Revised Tobacco Products Directive (TPD), on May 20, 2020, Poland and 27 other EU member countries banned the sale of menthol cigarettes.⁴ This policy intended to decrease initiation into cigarette smoking by removing a chemical mask of the harshness of cigarette smoke.⁵ In May 2016, all other characterizing flavors except menthol were removed from cigarettes and roll-your-own (RYO) tobacco.⁶ Before the ban, menthol cigarettes were sold in two primary forms; cigarettes whose tobacco leaf is coated in menthol and cigarettes containing a crushable mentholated liquid capsule in the filter.⁷ Both were banned, in addition to menthol RYO tobacco, in 2020. Before implementation, Poland challenged the menthol cigarette ban at the European Court of Justice, arguing it created unreasonable trade barriers.⁸ That court ruled against Poland, maintaining the TPD was designed to protect public health and banning the sale of menthol cigarettes could proceed.⁹

Public health experts expect menthol cigarette users to exhibit four behaviors in reaction to a menthol cigarette ban: 1) switch non-mentholated cigarettes (which could be self-mentholated with flavoring cards or menthol capsules), 2) quit smoking cigarettes altogether,

^a This section is primarily composed of a manuscript that is in press at the *European Journal of Public Health*. I would like to thank my co-authors, Christopher Cadham, David Levy, Michael Pesko, Luz-Maria Sanchez Romero, and Michal Stoklosa for their help putting this analysis together.



3) switch to using mentholated or non-mentholated non-cigarette products, and 4) continue using menthol cigarettes obtained through illicit sources.⁵ These hypotheses are generally based on emerging evidence from countries such as Canada, which banned menthol cigarettes nationwide in 2017, or the results of stated preference surveys of menthol users.¹⁰⁻¹² Still, findings derived largely from Canada may not be generalizable to other countries with much larger menthol cigarette shares that exceed one-quarter of sales like Poland, the United States, Singapore, and the Philippines.² Results such as these provide some insights into the potential effects of a menthol ban. Still, the relative size of the group pursuing each of the four potential post-ban behaviors among pre-ban smokers is not yet established in the scientific literature.

Thus far, little research has evaluated the effects of the EU TPD's menthol cigarette ban on the tobacco market of member countries beyond a survey of menthol cigarette smokers in England and a census of tobacco company communication to retailers in the Czech Republic.^{13,14} While sales of menthol cigarettes in the EU as a whole were comparable to Canada – 7% of all cigarettes were mentholated before the EU TPD policy—in Poland, menthol cigarette sales shares were 28%, the highest of any EU country.² Before the 2020 menthol ban, some 30% of adults in Poland smoked cigarettes, and around 22% of cigarette users claimed to primarily smoke menthol cigarettes.^{15(p55)} These

menthol cigarette smokers tended to be female, younger, better educated, and wealthier than other smokers.¹⁶

Without understanding the relative distribution of users' behaviors in reaction to a real-world ban on the sale of menthol cigarettes, we cannot accurately estimate the public health impact of such menthol bans. In this paper, we describe changes in tobacco sales in Poland after the menthol ban came into effect in May 2020. We exploit differences in the pre-ban share of menthol cigarettes to determine if the menthol ban decreased total cigarette sales.

Methods

We utilize data on the sales of cigarettes and RYO tobacco collected by NielsenIQ from May 2018 to April 2021. Sales were separated by flavor (standard and menthol) for each product (cigarettes and RYO) and across eight Nielsen-designated regions in the country (Warsaw City, Central, West, East, North, South, South-East, South-West).

The Nielsen regions align with the combined borders of first-level administrative divisions of Poland, as shown in Table 2. The capital city of Warsaw was its own region. Sales are adjusted for 2018 population levels and reported on a sticks-per-capita, per-month basis. One cigarette is equivalent to one stick, and 0.75g of RYO tobacco is one stick

equivalent.¹⁷ Prices were adjusted for inflation to May 2018 levels.¹⁸

Since the EU TPD policy was implemented in Poland at a national level, it is difficult to know if any effects of the policy on tobacco purchases

were driven by the ban or other shocks occurring nationally at the same time. As an alternative, we compare the effects of the ban on cigarette purchases in Poland's regions with different menthol cigarette sales shares before the ban (see shares in Tables 2).

Nielsen Region	Poland's First-Level Administrative Divisions	May 2018 Menthol Share	International Borders
Central	Mazowieckie, Łódzkie	27.84%	None
East	Warmińsko-Mazurskie, Podlaskie, Lubelskie	27.99%	Russia, Lithuania , Belarus, Ukraine
North	Zachodniopomorskie, Pomorskie, Kujawsko-Pomorskie	25.80%	Germany
South	Śląskie	26.78%	Czechia, Slovakia
South East	Świętokrzyskie, Małopolskie, Podkarpackie	28.25%	Slovakia, Ukraine
South West	Dolnośląskie, Opolskie	26.08%	Germany, Czechia
Warsaw	Warsaw City	36.84%	None
West	Lubuskie, Wielkopolskie	25.43%	Germany

Note: **Bolded** countries are EU Members

Table 2: Nielsen Region Details

We expect to find greater effects of the menthol ban in Poland regions with more pre-TPD mentholated cigarette use. We examine whether those regions with more menthol cigarette sales before the ban observe larger changes in sales after the menthol ban by leveraging differences in the baseline (May 2018 menthol sales rate by region (ranging from 25.4% of sales by value in the Western region to 36.8% in Warsaw) and interacting this with the menthol

ban. This technique reduces concerns that co-occurring policies could confound our estimates unless these policies are also correlated with the baseline menthol share. This "bite"-style model is a form of a dose-response difference-in-differences model used to study other health policy changes.^{19,20}

An indicator variable captures the menthol ban effect for the proportion of each month that

the ban was in place. The first month of data is excluded from the multivariate analysis because it forms the menthol share "bite" variable. The "bite" variable measures the amount of treatment or intervention applied to each region. If the bite value is larger, we should see more policy effect.

We estimate a generalized linear model, using maximum likelihood estimators with standard errors clustered at the region level at which our bite variable, the menthol share at baseline, varies. The model also includes regional fixed-effects to control for time-invariant variables within regions and a continuous-time trend to control for variables that vary over time linearly but do not differ across regions. We applied the following equation:

$$(1) \text{ Per Capita Cigarette Sales}_{it} = \alpha + \beta_1 \text{Menthol Ban} + \beta_2 (\text{Menthol Ban}_t * \text{May 2018 Menthol Share}_{it}) + \beta_3 \text{Heating Degree Days}_{it} + \beta_4 \text{EU Border Status}_{it} + \beta_5 \text{Non EU Border Status}_{it} + \beta_6 \text{Walking}_{it} + \beta_7 \text{Employment Rate}_{it} + \beta_8 \text{Price}_{it} + \omega_t + \theta_i + \epsilon_{it}$$

Where i indexes regions of Poland and t indexes the year-by-month from June 2018 to April 2021. For ease of interpretation, the May 2018 Menthol Share is indexed to 1 for the average share of 28.1%. The primary outcome of interest, the effect of the menthol ban in a region with an average-sized menthol share in the baseline period, is obtained by summing β_1 and β_2 . We attempt to control for additional sources of variation with additional covariate controls.

We use the quarterly employment rate in each Nielsen region to account for the economic environment.²¹ For changing weather patterns, which have been found to affect cigarette sales²², we use the average monthly proportion of heating degree days (days below 10°C) in each Nielsen region.²³

We also control for several other co-occurring changes related to the first wave of the COVID pandemic hitting the country, which coincided with introducing the EU TPD menthol cigarette ban. To control for the closure of international borders²⁴, we calculate an EU border open and a non-EU border open variable for each region (see values in Supplemental Figure 1). The variables are equal to the proportion of each month in each Nielsen region that Poland and each EU member states' or non-EU member states' borders were open to bi-directional travel. For the South and South-West regions which border two EU countries, this proportion was averaged each month between both borders. For regions without an external border, this value was set to zero. We expect closing borders with non-EU countries to cause sales of cigarettes in Poland to rise, as illicit cigarette channels from Ukraine, Belarus, and Russia are cut off.²⁵ We also expect that closing EU borders will be associated with a fall in cigarette purchases. In 2020 Poland had the least expensive cigarettes of any of its EU neighbors, and such price-motivated cross-border purchasing activity into Poland should decline.³ Further, we



The COVID-19 pandemic affected the lives of everyone, and had to be accounted for in the analysis

attempt to control for changes in mobility during the COVID pandemic using average monthly data on walking and driving movements at the regional level from Apple Maps.²⁶ This data has been used to study the spread of COVID around the globe.²⁷

We also consider prices for cigarettes and RYO by dividing the inflation-adjusted monetary value of sales by the volume of sales for each region and flavor of tobacco product. We control for this in some specifications of the model, in which we implicitly assume that prices are not impacted in any way by the menthol flavor ban. However, the menthol flavor ban may impact the average prices paid for all cigarettes because mentholated cigarette prices were more expensive than non-mentholated cigarette prices (See Supplemental Figure 2). Additionally, prices may have responded accordingly because the menthol ban may have affected the demand for cigarettes that we observe in the Nielsen data. Alternatively, if we assume the industry is operating in a less-than-fully competitive environment, then the industry may have sufficient market power to set prices. Tobacco companies might then respond to the menthol ban by lowering prices to prevent losing customers.

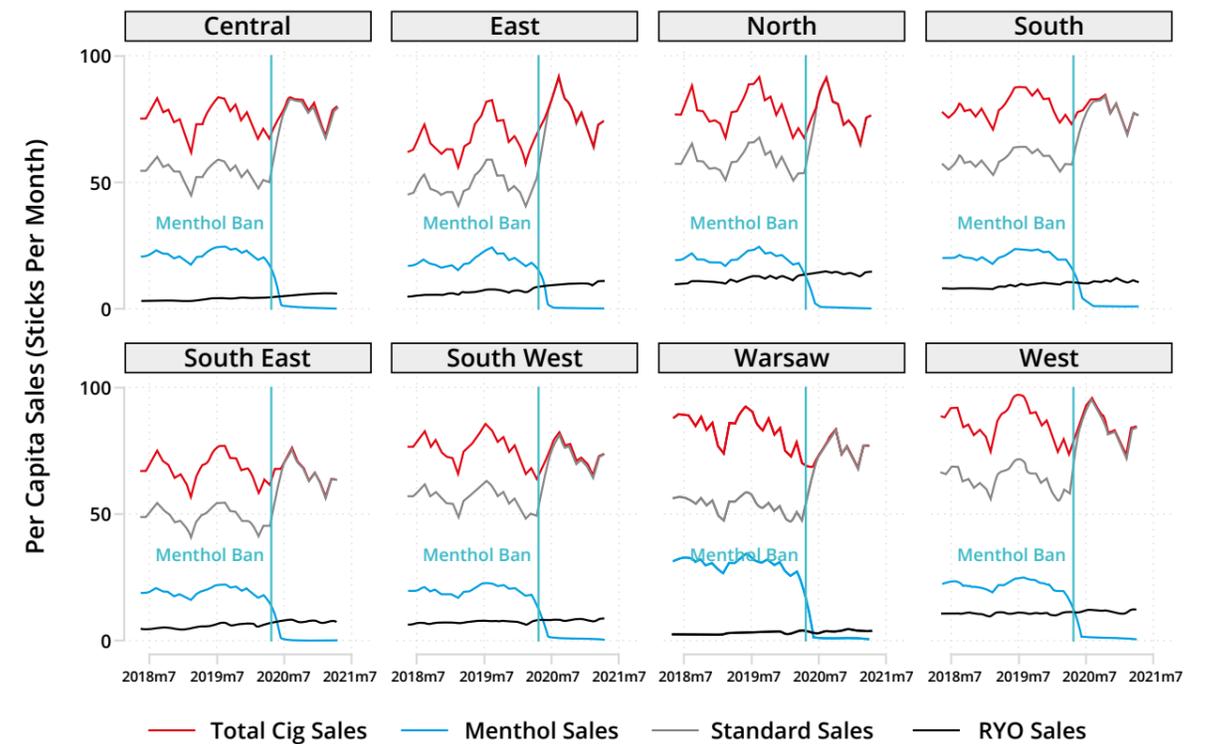
Before we proceed with analyzing the full model, we test whether it is suitable to determine if localities with more menthol share before the menthol ban had similar trends before the policy change than localities with less menthol

share (e.g., the "parallel trends" assumption). We conducted an event study by replacing the event of the menthol ban in the previous equation with a year-by-month time indicator to study how cigarette sales changed over time in localities with higher menthol share compared to lower menthol share. Ideally, coefficients in the pre-ban period are relatively small, suggesting no differential trending across regions before the ban.

We add an analysis of RYO sales (using per-capita stick equivalents) to assess whether smokers may have substituted towards those products after the menthol ban. Mentholated filters, crush ball filters, and mentholated rolling papers were introduced by tobacco companies in the months leading up to the menthol ban and could be a source of legally mentholated cigarettes after the ban.²⁸ We evaluate model fit by minimizing Akaike information criterion (AIC) and Bayesian information criterion (BIC) values. We also report model results without price, as we see that prices declined soon after the menthol ban, and observing the effect of that variable's inclusion is important to evaluate the findings.

Results Descriptive Statistics

Figure 2 illustrates the per capita cigarette and RYO sales pattern by region across Poland from May 2018 to April 2021. Sales of menthol



Note: 1st Quartile (lowest) menthol share regions = North and West; 4th quartile (highest) menthol share regions = South East and Warsaw. Standard = Unflavored cigarettes

Figure 2: Per Capita Cigarette Sales by Nielsen Region (May 2018—April 2021)

cigarettes declined by 97% after the ban, while sales of unflavored "standard" cigarettes rose on average by 38% in their place. Total cigarette sales appear to follow the same seasonal sales patterns after the ban as before, making a level change in sales difficult to detect. RYO sales appear to grow over time, but the rate of change seems to vary across regions. Supplemental

Figure 2 shows that prices for menthol cigarettes remained higher than standard cigarettes and RYO tobacco throughout the study period in every region. After the menthol ban, as menthol cigarette sales dwindle, the total cigarette price converges with standard cigarette prices. It then begins a steady decline through the end of the study period Table 3 displays the unweighted

mean of model covariates before and after the implementation of the menthol ban split between regions by 1st quartile (Low), Inter Quartile Range (IQR), and 4th quartile (High) by May 2018 menthol share.

Table 3 also reports comparison-of-means test p-values corresponding to whether the 1st and 4th menthol share quartile regions had average values significantly different from the IQR regions before and after the menthol ban. Table 3 shows that in regions with the highest shares of menthol sales, before the menthol ban, per capita sales of menthol cigarettes were significantly higher ($p < 0.001$) than in counterparts with fewer menthol sales. Those regions with the most menthol share also had significantly lower standard cigarette sales before the ban ($p = 0.007$). Total cigarette sales were highest in regions with the lowest menthol shares before the ban ($p < 0.001$) but similar when comparing the highest menthol share regions to those in the IQR ($p = 0.253$).

After the ban, there was no significant difference in menthol cigarette sales between the quartiles (both, $p > 0.779$). Standard cigarette sales rose across the board. Unadjusted results show that total cigarette sales fall by five sticks per capita per month in the highest (4th quartile) pre-ban menthol share regions while rising by four sticks per capita in the IQR and falling by less than one stick per capita in the lowest (1st) quartile. While the data presented in Table 2 suggest that regions with the highest menthol sales before the ban

had the largest reduction in total cigarette sales after the menthol ban, several other control variables change meaningfully before and after the menthol flavor ban. Therefore, a fully adjusted regression model using a more precise measure of the pre-ban menthol cigarette share is important to study this relationship more accurately.

Multivariate Results

Regression models examine the effect of the menthol ban on cigarette sales in Table 4. For ease of interpretation, at the bottom of Table 4, we display the menthol ban's average effect size and p-value for a region with an average pre-ban menthol share. We see that although the menthol ban seems to be associated with a small decrease in total cigarette sales (effect without price control -2.15 sticks per person per month, effect with price control -1.03 sticks per person per month), this effect is not statistically significant at the 95% confidence level. However, we find that the larger the pre-ban menthol share was in a region, the larger the decline in total cigarette sales after the ban. In Supplemental Figure 3, we display the predicted sales split out by pre-ban menthol share and note that we observed a statistically significant decline in sales in the region with the highest pre-ban menthol share (Warsaw) after the menthol ban. We also detect a non-statistically significant increase in the sales of RYO tobacco for an average pre-ban menthol

share region (Effect without price control -0.03 stick equivalents per person per month, Effect with price control -0.03 stick equivalents per person per month).

Supplemental Figures 5 and 6 show evidence that cigarettes and RYO tobacco sales did not trend differently before the ban in regions with higher menthol share (i.e., meeting the "parallel trends assumption"). There was a sharp temporary reduction in cigarette sales in the post-ban period that appears to have dissipated after three months. The Table 3 analysis confirms this decline. The interaction between menthol shares and the post-ban variable is significant and negative for cigarettes and RYO, meaning that the post-ban decline in sales of cigarettes and RYO was steeper in regions with higher pre-ban shares of menthol cigarette sales. We can also rule out the possibility that more flavored RYO products were purchased, as only 0.4% of RYO tobacco in Poland was flavored before the menthol ban. That figure declined to 0.3% of all RYO sales after the ban (even though these products were still subject to the same 2016 ban on characterizing flavors as cigarettes).

Our models identified various other statistically significant covariates. RYO sales increased significantly over time, while cigarette sales were unchanged. Colder months, where heating degree days were more common, had significantly lower cigarette and RYO sales. The employment rate and the Apple Walking index

were consistently associated with significantly higher cigarette sales. Having an open EU border was associated with significantly higher cigarette sales while having an open non-EU border was consistently associated with significantly lower cigarette sales. Higher prices were associated with lower cigarette sales, while the effect of RYO price on RYO sales was not statistically significant. (Table 3)

Discussion

We found no significant change in the sale of cigarettes in Poland attributable to the menthol ban. Our bite-style analytical design lets us parse whether those regions with more prior exposure to menthol sales saw larger changes after the menthol ban. We find that regions with more menthol share before the ban saw a significant reduction in total cigarette sales, like Warsaw. Regions with sub-average baseline menthol cigarette share did not see significant declines. These limited effects resulted in a non-statistically significant overall reduction in cigarette sales. These blunted effects in Polish regions with lower menthol shares should be seen as a troubling sign for other EU nations hoping to see lower cigarette sales after the menthol cigarette ban. Even in Polish regions with the lowest menthol cigarette sales shares (Nielsen West; Lubuskie and Wielkopolskie district), more than 25% of pre-ban sales consisted of menthol cigarettes, a figure multiple times larger than EU counterparts (Figure 3).

Cross-border sales effects proved to be significant in the analysis. Our findings indicate that COVID-related border closures altered regional sales flows in licit and illicit markets. Changes in movement during COVID also provided a source of regional variation that was significantly associated with cigarette sales.

The findings here add evidence to a growing list of research about the effects of banning the sale of flavored tobacco products in jurisdictions where the sale of such products is quite substantial. Notably, evidence has emerged from San Francisco, USA detailing the effect of that city's efforts to ban the sale of flavored tobacco products that made up nearly 40% of sales before the policy change. Studies using sales data suggest decreases in all flavored tobacco products occurred, without significant substitution towards jurisdictions still selling flavored products.²⁹ However, a tobacco use prevalence study found that youth cigarette smoking increased after San Francisco's ban.³⁰ The large-scale dislocation of consumers seeking to replace menthol cigarette sales in Poland requires close study and careful implementation to ensure that such flavored tobacco sales bans produce positive public health outcomes.

Limitations

Our findings are not without limitation. We cannot examine whether there was a differential substitution for flavored tobacco products that

the EU TPD menthol ban did not cover. Nielsen could not provide region-level data on sales of flavored e-cigarettes, cigars, or heated tobacco products that continued to be sold after the EU menthol ban. Survey research from the US finds that cigarette smokers claim they are interested in switching to these products after a flavor ban⁵, but we cannot observe it here. Further work must determine if substitution happened to these products as a real-life menthol ban played out across Europe.

We can also not track whether consumers moved to illicit cigarette sources in the aftermath of the ban. However, we attempt to control for access to illicit cigarette sources by using border variables. Also, we have an incomplete understanding of movement trends before COVID. The Apple mobility data was only provided after February 2020, so we cannot fully understand the role of movement in the pre-COVID period. Future efforts to understand the role of movement and cigarette sales could better disentangle how this intriguing variable operates.

We are aware of attempts made by commercial entities and consumers alike to evade the effects of the menthol ban by selling and using products that impart a menthol flavor.¹¹ These strategic workarounds could raise costs and inconvenience consumers who smoke mentholated cigarettes. But, since non-mentholated cigarettes were cheaper than mentholated cigarettes in Poland, it is unclear if these workarounds

result in differing overall costs to smoke. Further work could track menthol-imparting products' sales, prices, and usage patterns to determine

if they truly undermine a menthol cigarette ban's implementation.

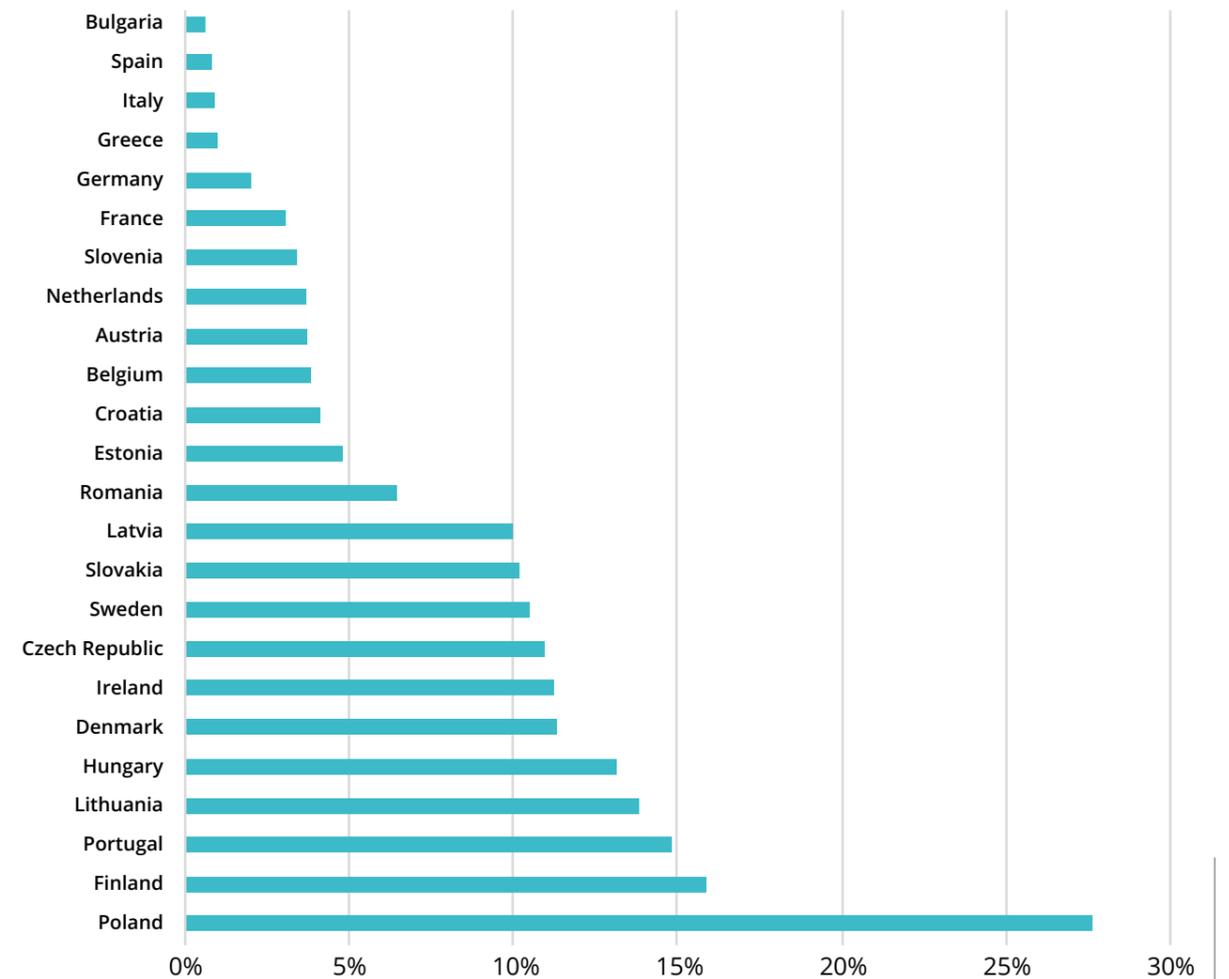


Figure 3: Flavored Cigarette Sales Share (2018, Euromonitor International)

Heated Tobacco Sales Expansion^b

The second analysis of this project focused on examining the effects of the introduction and growth of heated product sales in Poland, especially as it contrasted with the experience of Japan, the only other country which has been extensively studied on this subject. In a 2019 article, Stoklosa and colleagues found that the introduction of heated tobacco products (HTPs) to the Japanese market was strongly associated with a decline in cigarette sales.³¹ This paper and another by Cummings *et al.*³², provide suggestive evidence that the Japanese population replaced cigarettes sold with HTPs. Instead of delivering nicotine from tobacco leaves through combustion, HTPs heat tobacco to considerably lower temperatures and deliver nicotine to users via an aerosol containing fewer toxic substances than cigarettes, and could reduce health risks for users.³² If this substitution pattern in Japan reflects persistent individual behavior changes, health improvements could follow.

Philip Morris International has used this independently-produced research to lobby governments to gain favorable terms of market access for their HTPs.³³ However, it merits examining whether trends in Japan mirror changes elsewhere. In particular, we explore

^b This section is based on an article published in December 2021 in the journal, *Tobacco Control* (doi: 10.1136/tobaccocontrol-2021-056887). I would like to thank my co-authors Christopher Cadham, K. Michael Cummings, David Levy, Michael Pesko, and Luz-Maria Sanchez Romero as well as three anonymous peer reviewers for their help which dramatically improved the final manuscript.



Poland, one of about 60 other countries where HTPs are sold, because it has some key differences with Japan: HTPs were introduced in Japan in 2015, and in Poland in 2017, e-cigarette sales are not allowed in Japan but are sold in Poland, and HTP excise taxes as a percent of retail prices in 2020 were 43% in Japan and 12.4% in Poland.³⁴ However, in 2019, both markets had similar shares of menthol cigarette sales and similar levels of male smoking.² Further in both countries, in the five years before the entry of IQOS, per capita sales of cigarettes declined by an average of 4.7% per year.²

Here, we employ a limited sales dataset to explore whether the HTP market trajectory in Poland resembles that in Japan. We used data on monthly sales of cigarettes, roll-your-own tobacco (RYO), e-cigarettes, and HTPs at the national level in Poland, covering the same period as the menthol ban analysis; May 2018 to April 2021. We excluded e-cigarette sales because Nielsen captured less than 20% of sales while capturing large majorities of other categories (determined by Euromonitor estimates of total value sales²). In Figure 4, we plot unit sales and inflation-adjusted 20-stick-pack equivalent prices by tobacco product in Poland.¹⁷

In Japan's first four years of HTP availability, HTP sales increased to 22.9% of combined cigarette and HTP sales, while cigarette sales volumes fell 45%.² In Poland, we do not observe an obvious

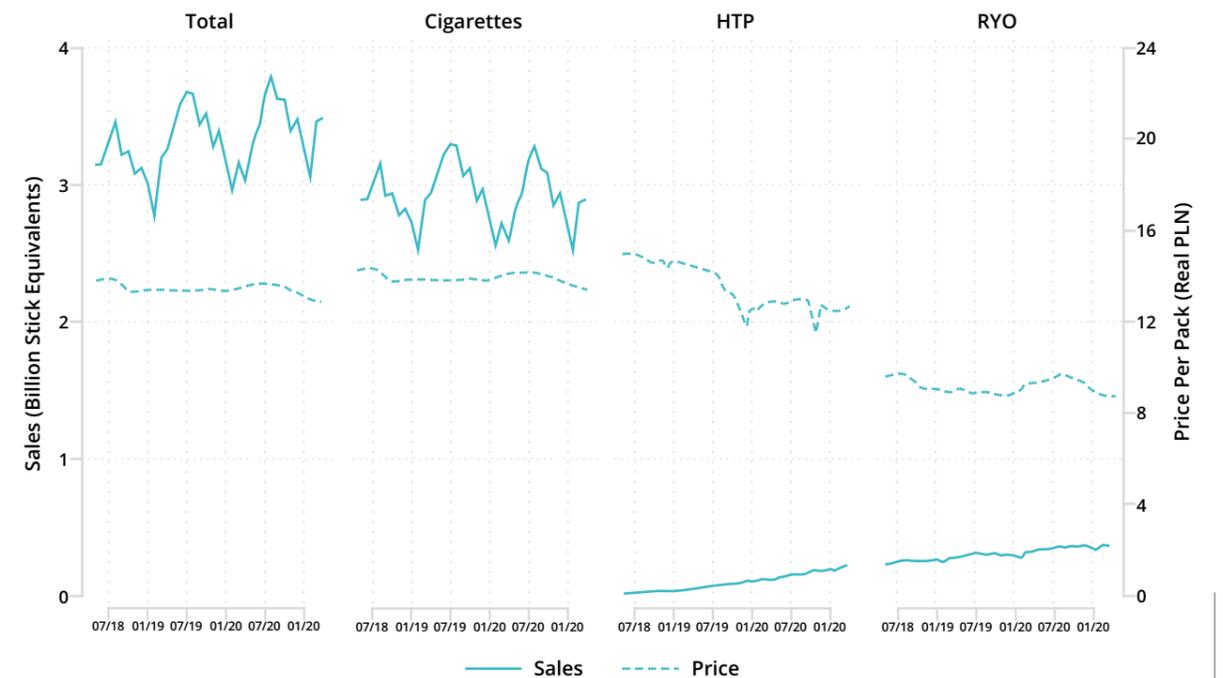
replacement of cigarette sales with HTP sales in the form of rising HTP sales corresponding with falling cigarette sales. Cigarette sales continue to fluctuate on a seasonal basis and remain relatively flat. Total tobacco sales (combined cigarette, HTP, and RYO) are rising, largely due to HTP sales, which grew 13-fold in volume in 3 years, rising from 0.5% to 6.5% of the total tobacco market. RYO sales also grew during this period but half as fast as HTPs, from 7.5% to 10.6% of total tobacco sales. Accordingly, the Eurobarometer survey from September 2020 had past-month use among Polish adults at 1.0% for HTPs, 1.2% for e-cigarettes with nicotine, 4.4% for RYO tobacco, and 21.8% for manufactured cigarettes.³⁵

Prices for HTPs were initially higher than cigarettes, but real HTP pack prices declined 15.4% over the study period, while cigarette prices simultaneously declined by 5.3%. In July 2019, HTP pack prices sank below cigarette pack prices, providing a small incentive to use HTPs over cigarettes. RYO prices remained well below cigarettes and HTPs, but they too declined by 8.8% during the study period. HTP device prices have also declined 50.3% from 2020 to 2021. A pack-a-day smoker still needs to consume a pack of HTPs instead of cigarettes for 77 days in 2021 (down from 113 days in 2020) to recoup their initial purchase cost of a reusable tobacco heating device.³⁶

The experience of Poland with HTPs has not mimicked sales trends in Japan. Before the

entry of HTPs, cigarette sales volumes declined at equivalent rates in both countries², but upon HTP entry, those patterns diverged. In Poland, HTP sales appear to stack on top of existing cigarette sales, whereas in Japan, cigarette sales have declined in parallel with the introduction of HTPs. It is not clear why the HTP experience in Poland differs from Japan, although several possible explanations exist. In Poland, e-cigarette availability could potentially compete with HTP products as substitutes for cigarettes. However, this possibility is complicated because smokers

in Poland overwhelmingly believe e-cigarettes are as dangerous as tobacco cigarettes.³⁷ The price differential between cigarettes and HTPs could contribute to this pattern; however, Poland levies less excise tax as a share of price on HTPs than Japan.³⁷ Market competition could be responsible for these patterns, as Philip Morris International, the largest manufacturer of HTPs in Poland and Japan, has the largest share of the cigarette market in Poland. In contrast, Japan Tobacco dominates the cigarette market in Japan.²



Note: HTP sales refer to heated tobacco sticks and exclude heating devices. Prices are in PLN, the official currency of Poland.

Figure 4: Monthly Tobacco Sales and Prices in Poland by Category (Millions Nominal PLN)

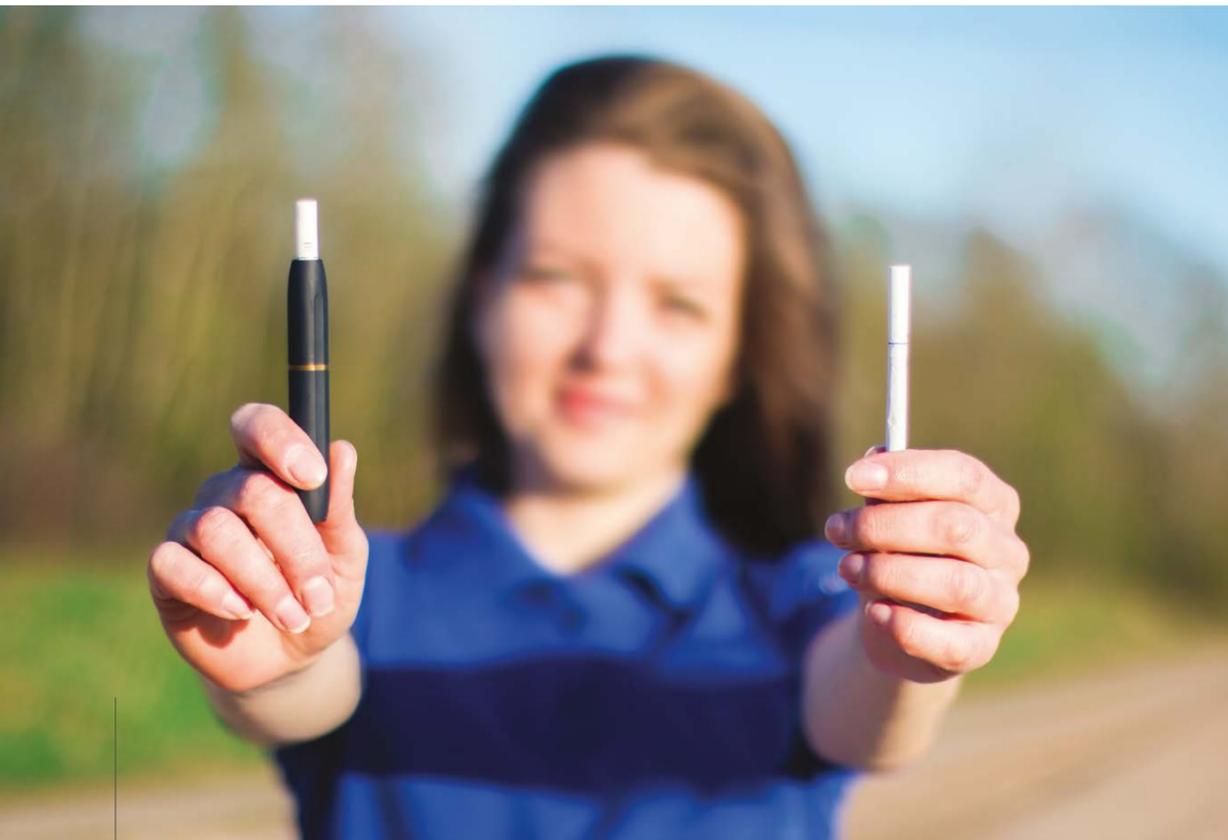
Consequences of These Findings for Poland

We can divide an analysis of the consequences of these changes in the tobacco market in Poland into four categories: impacts on the broader public health, impacts on health equity, impacts on excise revenues, and impacts on the illicit trade in cigarettes.

First, the impact of these outcomes on public health ranges from neutral to negative. The fact that menthol cigarettes were removed from the market and significant declines in sales can only be spotted in one region, Warsaw. The rest of Poland has not seen a meaningful decrease in sales. The growth in heated tobacco sales alongside a flat cigarette sales pattern indicates that we should not consider Japan's HTP experience inevitable in all markets. As HTPs still pose some unknown level of risk to human health simply by exposing sensitive tissues to aerosolized tobacco byproducts, we should suspect that this pattern of HTP growth will not improve public health outcomes in Poland.

To see declines in health harms, we would need to see cigarette sales fall, and neither the introduction and growth of the HTP segment nor the banning of menthol cigarette sales seems to have accomplished this goal, at least in the short run. In the long term, the elimination of menthol cigarettes may very well increase tobacco cessation rates among current smokers and decrease tobacco initiation rates among youth, as has been found in other settings.^{5,38}

Second, the health equity effects of these market and policy changes are unlikely to be positive, in the sense that they would close pre-existing gaps in smoking status by socioeconomic group. In Poland, smoking is more common in lower-income groups than in upper-income groups.³⁹ We do not have sufficient data yet to understand who is using HTPs or changed their smoking habits in reaction to the menthol ban. But, using proxy figures from other countries, we can make educated



Young woman holding heated tobacco and a cigarette

Product	Size	Pre January 2020	Post January 2020	Unit Price April 2021
Cigarettes	20 Pack	4.6 zł + 32.05% retail price	4.6 zł + 32.05% retail price	13.4 zł
E-Cigarette Liquid	10 ml bottle	0 zł	5.5 zł	~
Heated Tobacco Products	20 Pack	1.6 zł	0.8 zł + 32.05% retail price	12.7 zł
Smoking Tobacco	15 g packet	3.8 zł	3.8 zł	8.7 zł

Note: ~ = Nielsen data to estimate this is lacking

Table 1: Tobacco Excise Tax Rates and Unit Prices in Poland⁴⁵

^cData from the UK43 in the very earliest stages of the HTP rollout conflicted with this pattern wherein low socioeconomic status persons used HTPs more than higher positioned folks.

assumptions about the effects of these changes on health equity. We also know that experiences across Japan⁴⁰, Korea⁴¹, and Hong Kong⁴² have found that HTP users have a younger, wealthier, and better-educated user profile than combusted cigarettes.^c We do not expect the growth of HTPs in Poland to improve health equity by decreasing absolute health harms among disadvantaged groups. If HTP growth concentrates among high socioeconomic status individuals in the country, this might grotesquely rectify health inequalities. **But, inflicting more harm than before among high socioeconomic status individuals and closing a relative harm gap with lower socioeconomic status individuals is no one's preferred public health policy.**

The menthol cigarette ban's effects are also not likely to improve health equity in Poland. Before the ban, menthol cigarettes were disproportionately used by better-educated, female, and urban Poles.¹⁶ The only region that saw significant declines in cigarette sales was Warsaw, the wealthiest and best-educated region in the country. In contrast, less educated and prosperous regions saw no significant change (much less a decline) in cigarette sales. **We have seen that cigarette prices have fallen in the wake of the menthol cigarette ban, possibly redounding to increased smoking among low-income Poles, as those groups tend to react most strongly to changes in tobacco prices.**⁴⁴ This portends health improvements for the wealthy and possible diminishing

conditions among the less well off. In short, more can and must be done to rectify health inequities caused by tobacco use in Poland.

Third, the effects on tax revenue on these recent market and policy changes should be seen as minimal to positive. The menthol cigarette ban has not cut broadly into the legal tax-paid sales on cigarettes, and HTP sales do not seem to be causing cigarette sales to drop. If cigarette sales do not decline and heated tobacco sales continue to expand, excise revenues may climb. But, it bears noting that tobacco companies are taking larger profit margins on sales of HTPs than for cigarettes (Table 1). The 4zł gap in excise taxes per pack translates into a price difference of less than 1zł. The large majority of the tax advantage being granted to HTPs by Poland is being consumed by tobacco companies rather than passed onto consumers looking for a price signal of which product is preferable for them to buy.

The tobacco companies predicted that the menthol ban would be a disaster for excise revenues, a prediction that, to put it mildly, has missed the mark. Poland's National Association of the Tobacco Industry predicted in 2014 that when the EU TPD menthol cigarette sales ban was put in place, excise revenues would fall PLN 9 billion per year.⁸ This prediction seems to have missed its mark as the most consistent pattern we can identify in Nielsen and European Commission data is that cigarette sales volumes are flat. A modest 2% decline in cigarette sales

volumes (and subsequent excise collections) is more than made up for by the excise collections for HTPs, even factoring in the lower excise rates on those novel products.

Finally, we must consider the matter of the illicit market. Tobacco industry-backed reports have indicated that illicit tobacco volumes have been declining in recent years.⁴⁷ As has been detailed elsewhere, these tobacco industry-backed estimates of the scope of the illicit

tobacco trade are often much higher than what is found in independent reports.²⁵ Such reports have even been found to be retroactively revised to fit a current tobacco industry narrative that suits current policy necessities.⁴⁸ So, taking this all into account, it is certainly plausible that illicit (and legal cross-border) trade volumes decreased in Poland during the study period and that this pattern could explain some of the findings highlighted above.

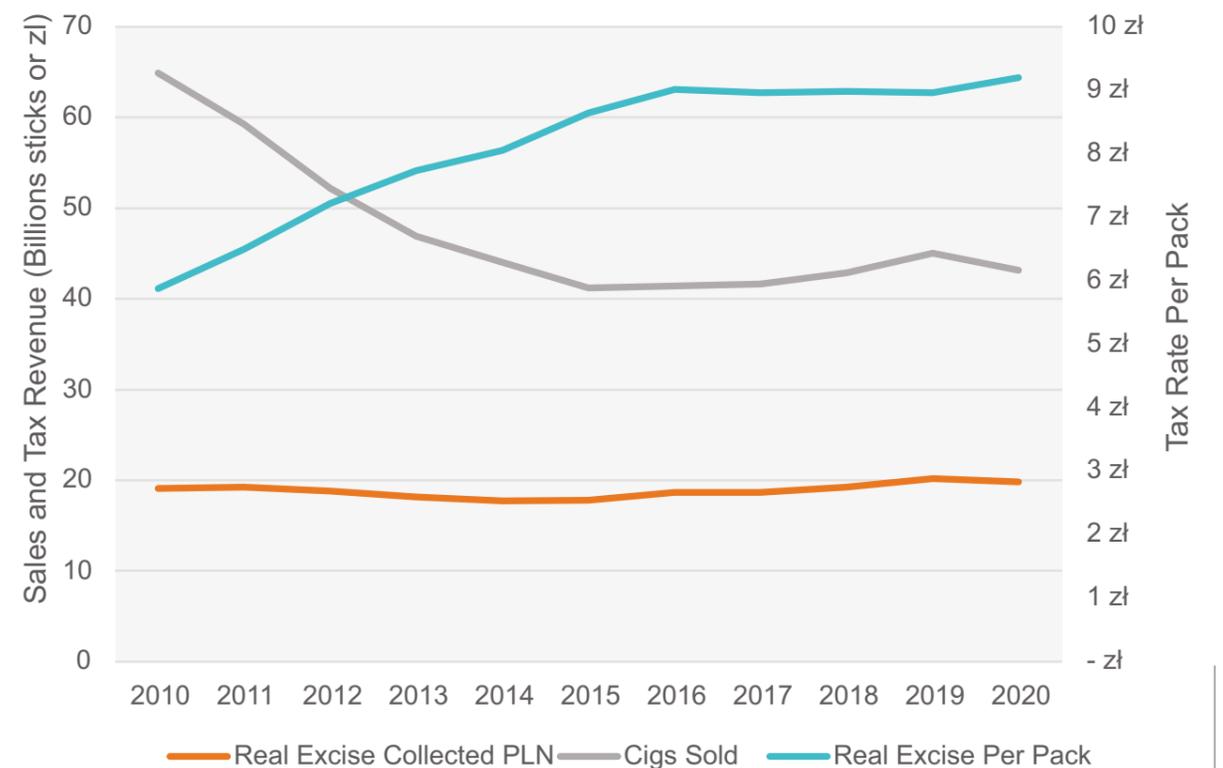


Figure 5: Cigarettes Released for Sale in Poland, Real Excise Collections and Real Excise Per Pack (2010–2020)⁴⁶



Figure 6: Percent of Persons Reporting Having Been Offered Black Market Cigarettes⁴⁹

Conclusion

After a protracted eight-year delay between the passage of the EU TPD and the implementation of the menthol ban, a great deal of change came to the Polish cigarette market in 2020. Stacked on top of the introduction of heated tobacco products and the continued changes in the e-cigarette and roll-your-own markets, nothing about tobacco in Poland is at equilibrium.

We found that in the EU country that was most exposed to the bloc's menthol cigarette sales ban, total cigarette sales have not significantly changed. **We find that heated tobacco product sales exhibit growth patterns that are worrisome for public health. And, little of any notably improving conditions is likely to redound to the benefit of the least well off in Poland.**

These findings should not ultimately be cause for despair, though. Instead, they should be seen as a diagnosis of problems needing solutions. Further work can be done to explore what policy measures are needed to strengthen the menthol cigarette ban or put sufficient downward pressure on cigarette sales. There are plenty of positive examples to follow and plenty of reasons to pursue such goals.

Acknowledgments

My study co-authors and spectacular colleagues made this report possible; Christopher Cadham, K. Michael Cummings, David Levy, Michael Pesko, Luz-Maria Sanchez Romero, and Michal Stoklosa. I wish to thank Nonguebzanga Maxime Compaore for his support of this work. Tomasz Zapala designed this impeccable final report.

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Tables

	Before Menthol Ban					After Menthol Ban				
	Mean		p-value			Mean		p-value		
	1 st Qtile	IQR	4 th Qtile	1 st v IQR	IQR v 4 th	1 st Qtile	IQR	4 th Qtile	1 st v IQR	IQR v 4 th
Per Capita Menthol Cigarette Sticks Sold	20.934	20.338	24.851	0.404	<0.001	1.413	1.639	1.518	0.779	0.881
Per Capita Standard Cigarette Sticks Sold	61.358	53.868	51.154	<0.001	0.007	80.084	76.615	69.466	0.080	<0.001
Per Capita Total Cigarette Sticks Sold	82.292	74.206	76.005	<0.001	0.253	81.496	78.254	70.984	0.060	<0.001
Per Capita Total RYO Sticks Sold	11.039	6.315	4.197	<0.001	<0.001	12.865	8.655	5.529	<0.001	<0.001
Menthol Cigarette Stick Price (Real PLN)	0.713	0.709	0.722	0.016	<0.001	0.742	0.727	0.755	0.018	<0.001
Standard Cigarette Stick Price (Real PLN)	0.688	0.683	0.696	0.010	<0.001	0.696	0.689	0.702	0.035	<0.001
Total Cigarette Stick Price (Real PLN)	0.694	0.690	0.704	0.020	<0.001	0.697	0.690	0.702	0.039	<0.001
Total RYO Stick Price (Real PLN)	0.461	0.462	0.475	0.852	0.018	0.472	0.467	0.475	0.579	0.335
Employment Rate (%)	56.802	55.279	57.558	<0.001	<0.001	56.335	54.992	57.035	0.025	0.001
Heating Degree Days (%)	0.240	0.279	0.262	0.426	0.724	0.296	0.336	0.320	0.650	0.858
EU Border Open (%)	0.935	0.623	0.466	<0.001	0.052	0.878	0.585	0.439	0.014	0.215
Non-EU Border Open (%)	0.000	0.305	0.468	<0.001	0.030	0.000	0.017	0.078	0.660	0.126
Walking Volume	97.130	95.681	96.516	0.632	0.782	128.49	104.42	69.724	0.028	0.002

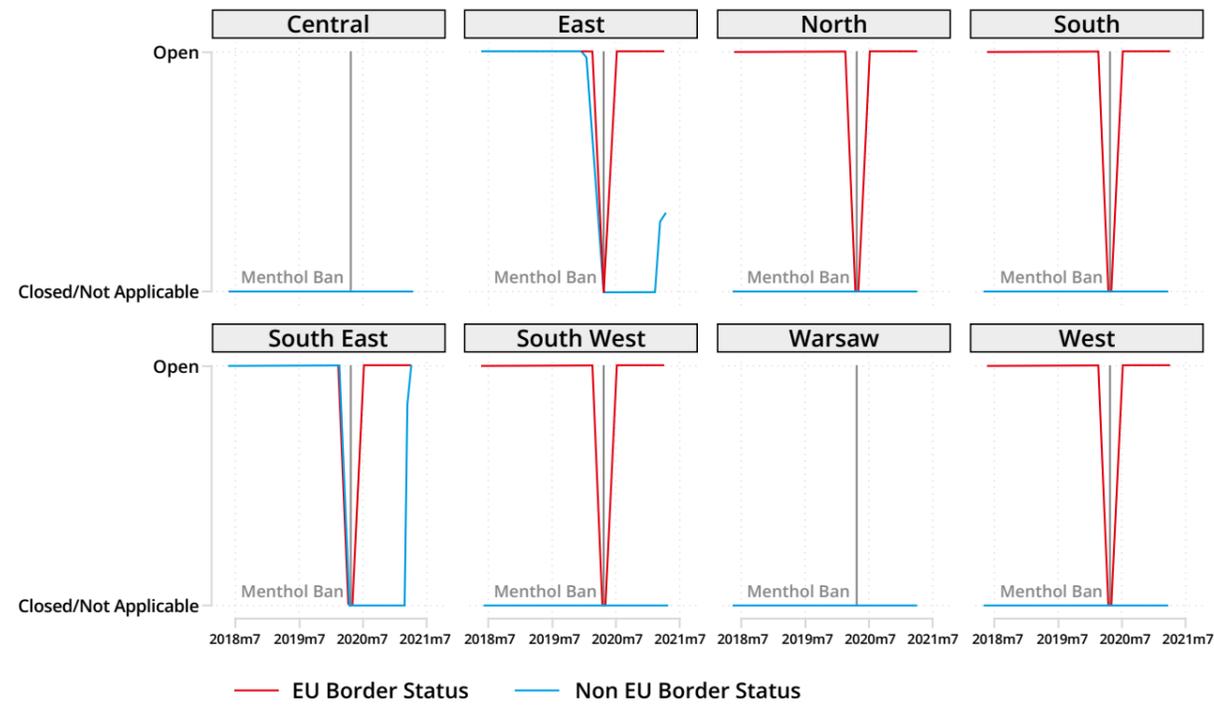
Note: May 2020 is included in the After-ban group. 1st quartile (lowest) menthol share regions = North and West; 4th quartile (highest) menthol share regions = South East and Warsaw; Remaining are in IQR. Menthol share groupings throughout this table correspond to sales in May 2018.

Table 3: Average Monthly Model Covariate Values Before and After Menthol Ban Implementation in Regions with 1st Quartile, Inter-Quartile Range (IQR) and 4th Quartile May 2018 Menthol Shares

	(1) Cigarettes	(2) Cig + Price	(3) RYO	(4) RYO + Price
Post	12.87* [2.893,22.85]	15.83** [4.862,26.80]	2.312* [0.334,4.291]	2.320* [0.441,4.199]
Pre-Menthol Share # Post	-15.02*** [-22.49,-7.558]	-16.86*** [-24.94,-8.784]	-2.285* [-4.304,-0.266]	-2.288* [-4.266,-0.309]
Time Trend	0.0908 [-0.0696,0.251]	0.0314 [-0.142,0.205]	0.0883*** [0.0558,0.121]	0.0881*** [0.0517,0.125]
Heating Degree Days	-13.15*** [-15.56,-10.74]	-14.26*** [-16.26,-12.25]	-0.574*** [-0.811,-0.337]	-0.575*** [-0.812,-0.337]
EU Border Open	8.446*** [6.226,10.67]	4.528** [1.606,7.450]	0.0103 [-0.729,0.749]	0.00536 [-0.736,0.747]
Non-EU Border Open	-6.766* [-13.52,-0.00966]	-7.371* [-13.17,-1.567]	-1.110* [-2.119,-0.101]	-1.110* [-2.119,-0.101]
Walking Volume	3.695*** [1.678,5.711]	4.939*** [2.962,6.915]	0.222 [-0.238,0.682]	0.222 [-0.243,0.687]
Employment Rate	0.865* [0.00475,1.726]	1.380*** [0.667,2.092]	0.105 [-0.0826,0.294]	0.107 [-0.0901,0.304]
Average Cigarette Price Per Pack (PLN Real)		-7.594*** [-10.57,-4.623]		
Average RYO Price Per Stick Eq. (PLN Real)				-0.118 [-4.957,4.722]
Constant	-15.29 [-151.4,120.8]	154.1 [-30.49,338.8]	13.38 [-8.435,35.19]	13.64 [-13.26,40.54]
Observations	272	272	272	272
Mean Menthol Ban Effect Size	-2.150	-1.032	0.0272	0.0326
Mean Menthol Ban Effect P-Value	0.199	0.561	0.798	0.841

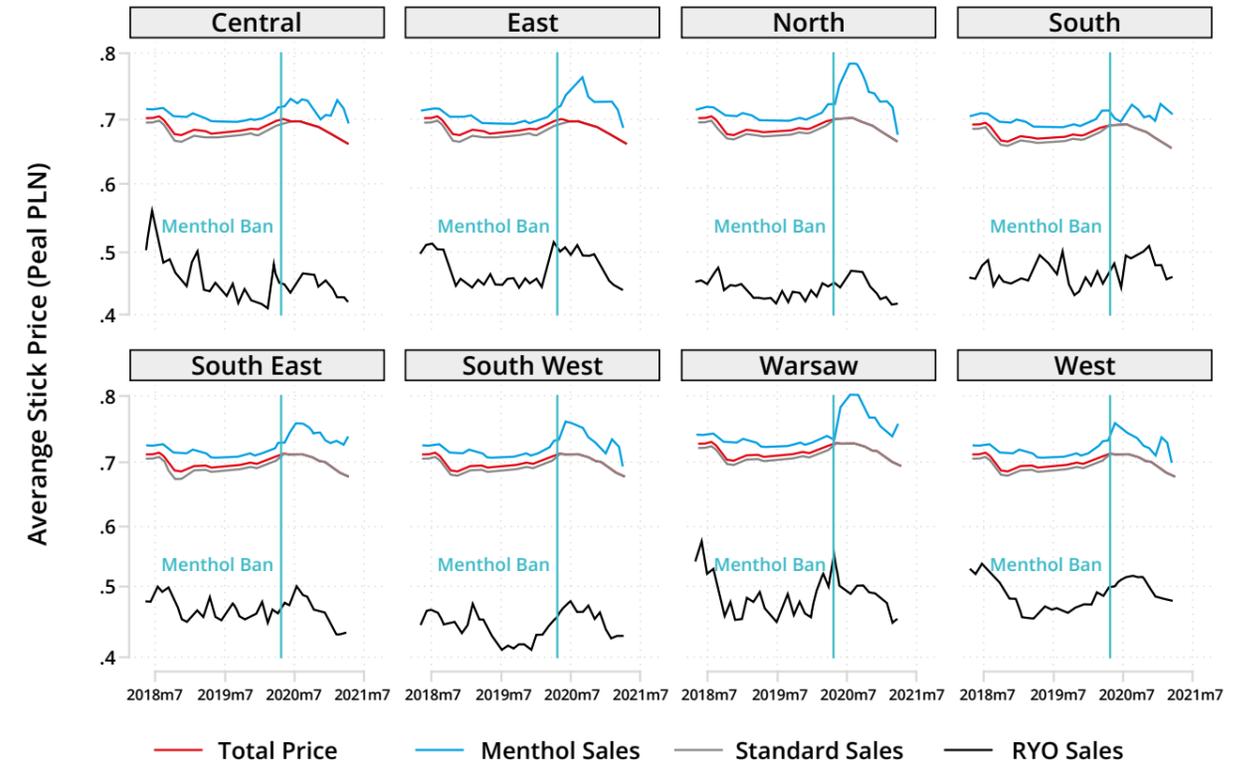
Note: Region-fixed-effects coefficients are suppressed for space considerations. Mean Menthol Ban Effect Size equals the sum of the Post coefficient and the interaction of Average Pre-Ban Menthol Share and the Post coefficient. RYO = Roll-Your-Own. 95% confidence intervals in brackets; * p < 0.05, ** p < 0.01, *** p < 0.001

Table 4: Fully Adjusted Regression Results Table for Per Month Per Capita Total Cigarettes and Roll-Your-Own Tobacco



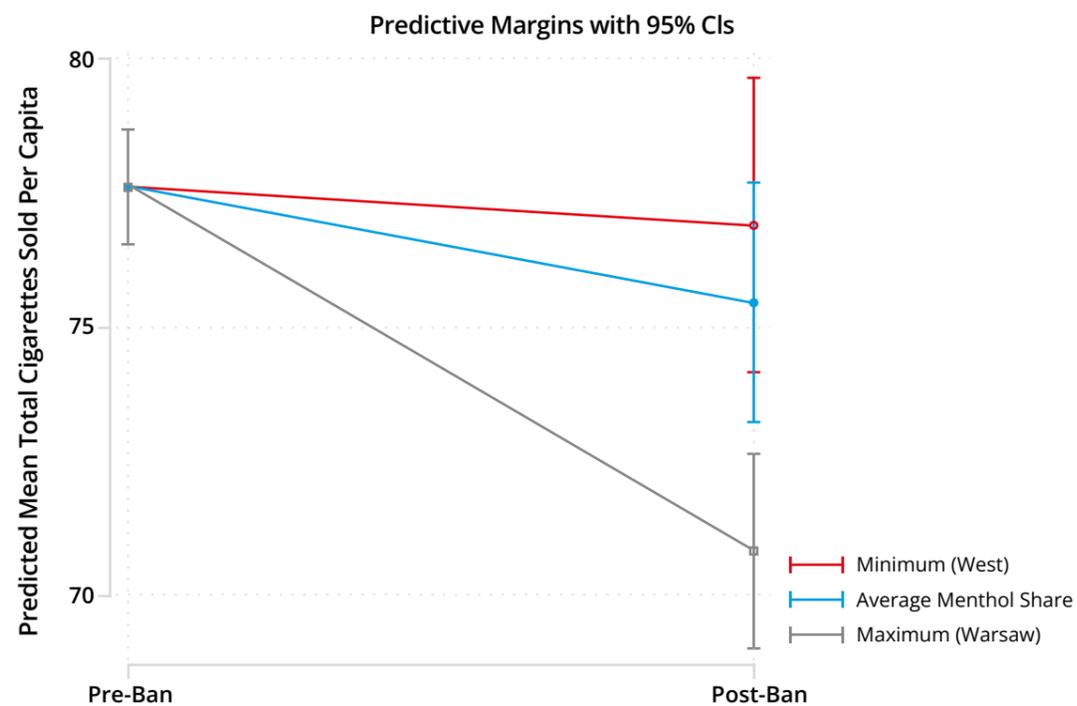
Note: Open has a numeric value of 1, and Closed/Not Applicable has 0.

Supplemental Figure 1: Regional Border Opening Status (May 2018—April 2021)

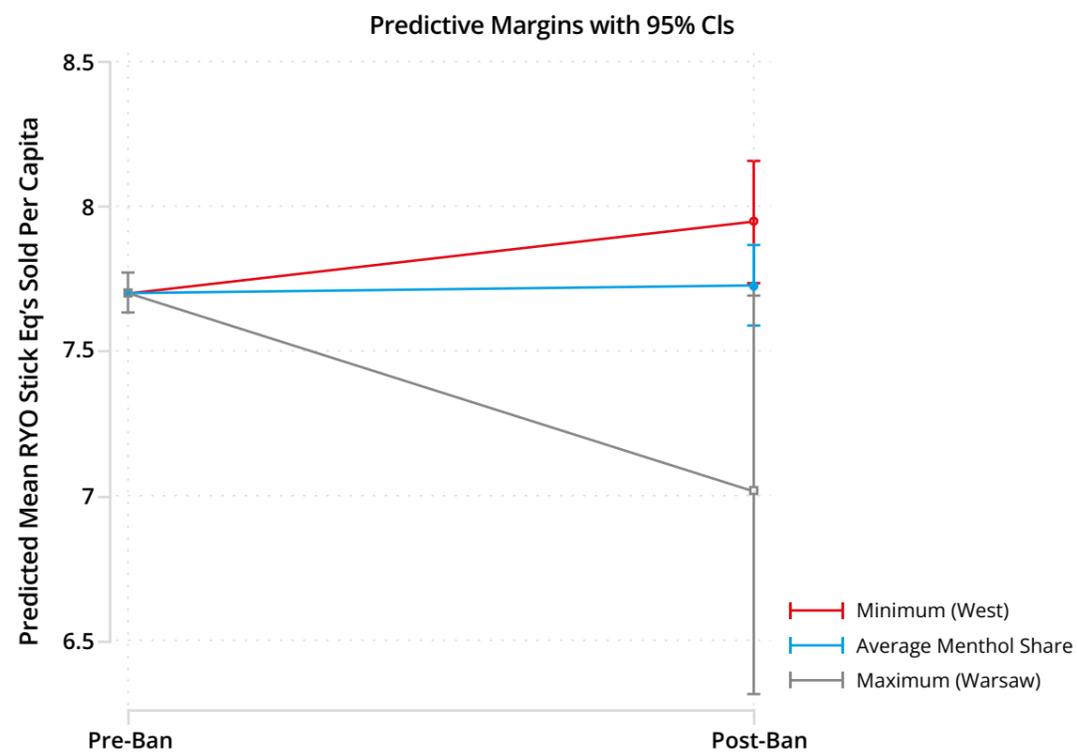


Note: Standard = Unflavored cigarettes

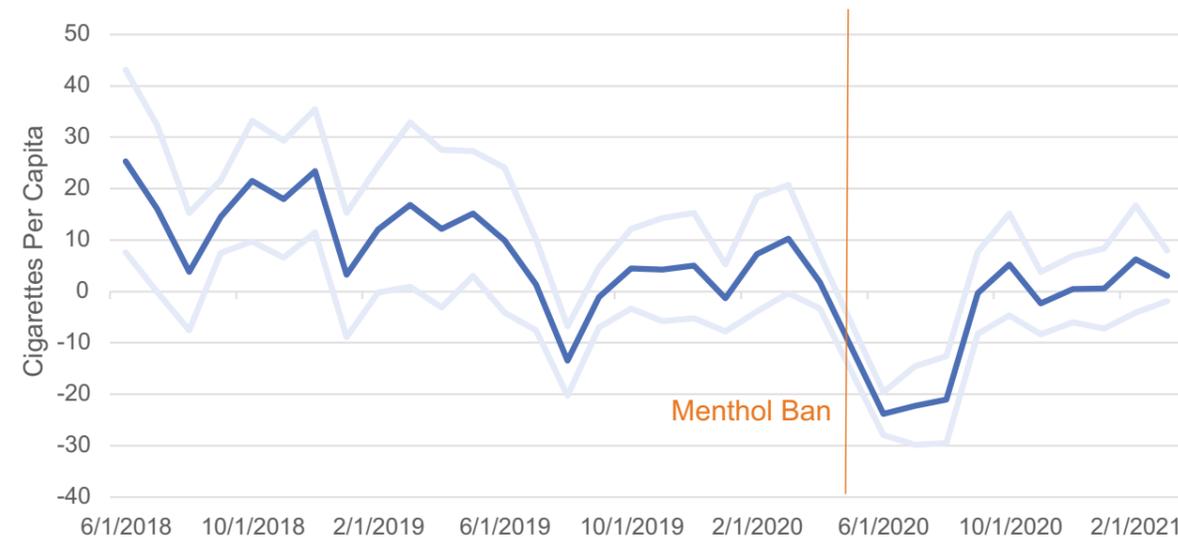
Supplemental Figure 2: Regional average cigarette price (Real PLN per stick, May 2018—April 2021)



Supplemental Figure 3: Changes in Predicted Cigarette Sales Before and After the Menthol Ban Based on Pre-Ban Menthol Share

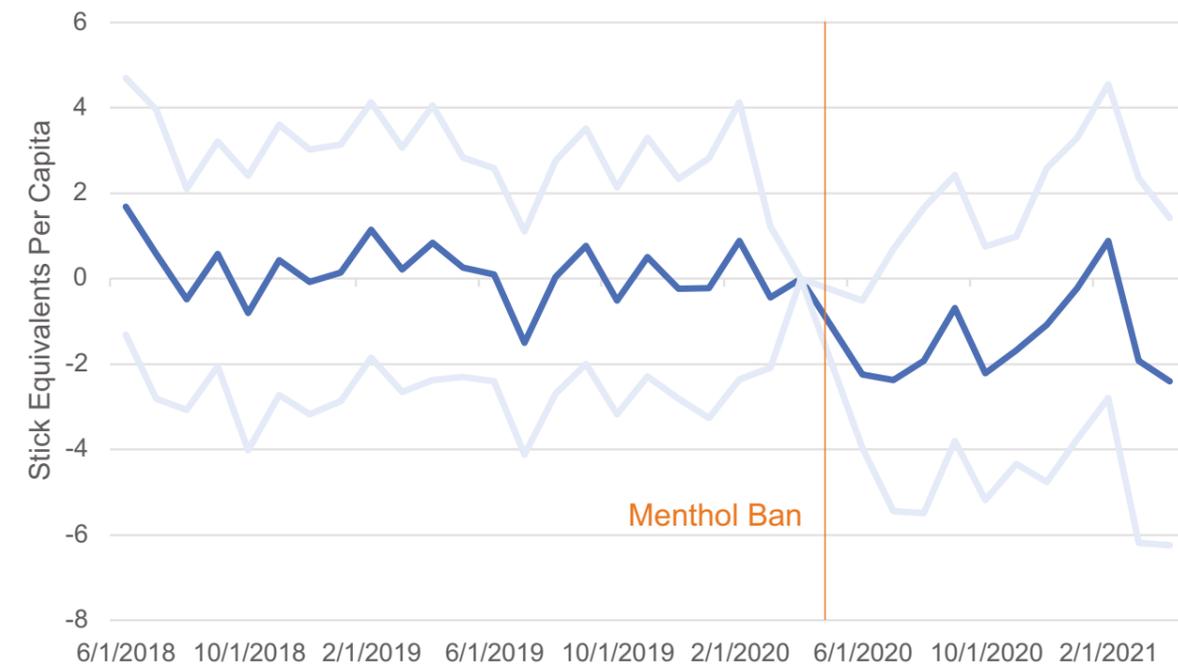


Supplemental Figure 4: Changes in Predicted RYO Tobacco Sales Before and After the Menthol Ban Based on Pre-Ban Menthol Cigarette Share



Note: The dark blue line represents the interaction coefficient for each period in the event study, while the light blue lines mark the edge of the 95% confidence interval for that coefficient. They are estimated with all controls included in model 1 from Table 4.

Supplemental Figure 5: Event Study for Cigarette Sales



Note: The dark blue line represents the interaction coefficient for each period in the event study, while the light blue lines mark the edge of the 95% confidence interval for that coefficient. The model is estimated with all controls included in Model 3 from Table 4.

Supplemental Figure 6: Event Study for RYO Tobacco Sales

	(1) Base	(2) +HDD	(3) +EUBorder	(4) +nonEUBorder	(5) +Walking	(6) +Employment	(7) +Price
Post	24.52***	21.30**	18.76*	17.23***	13.20**	12.87*	15.83**
Pre-Menthol Share # Post	-19.80**	-19.47**	-18.87**	-18.70***	-15.59***	-15.02***	-16.86***
Time Trend	-0.257***	-0.0354	0.0664	0.0665	0.0840	0.0908	0.0314
Heating Degree Days		-14.30***	-15.18***	-15.23***	-13.98***	-13.15***	14.26***
EU Border Open			9.213***	11.16***	9.284***	8.446***	4.528**
Non-EU Border Open				-6.573	-7.340*	-6.766*	-7.371*
Walking Volume					3.719***	3.695***	4.939***
Employment Rate						0.865*	1.380***
Price							-7.594***
Constant	259.4***	105.2*	33.02	33.47	17.08	-38.52	78.07
Observations	272	272	272	272	272	272	272
AIC	1759.9	1631.2	1603.9	1582.2	1573.6	1570.4	1550.0
BIC	1770.7	1645.6	1621.9	1603.8	1598.8	1595.7	1575.2
Mean Menthol Ban Effect Size	4.722	1.830	-0.112	-1.473	-2.386	-2.150	-1.032
Mean Menthol Ban Effect P-Value	0.0003	0.149	0.949	0.407	0.164	0.199	0.561

Note: Region-fixed-effects coefficients are suppressed for space considerations. * p < 0.05, ** p < 0.01, *** p < 0.001

Supplemental Table 1: Cigarette Sales Model Building

	(1) Base	(2) +HDD	(3) +EUBorder	(4) +nonEUBorder	(5) +Walking	(6) +Employment	(7) +Price
Post	2.999	2.830	2.860	2.596*	2.353*	2.312*	2.320*
Pre-Menthol Share # Post	-2.582	-2.564	-2.571	-2.542*	-2.354*	-2.285*	-2.288*
Time Trend	0.0760***	0.0877***	0.0865***	0.0865***	0.0875***	0.0883***	0.0881***
Heating Degree Days		-0.753***	-0.742***	-0.751***	-0.675***	-0.574***	-0.575***
EU Border Open			-0.109	0.226	0.113	0.0103	0.00536
Non-EU Border Open				-1.133*	-1.180*	-1.110*	-1.110*
Walking Volume					0.225	0.222	0.222
Employment Rate						0.105	0.107
Price							-0.118
Constant	-50.42***	-58.53***	-57.68***	-57.60***	-58.59***	--58.59***	-65.23***
Observations	272	272	272	272	272	272	272
AIC	518.3	491.1	492.9	451.4	451.0	448.1	448.1
BIC	529.1	505.6	510.9	473.0	476.2	473.3	473.3
Mean Menthol Ban Effect Size	0.418	0.265	0.288	0.0536	-0.00162	0.0272	0.0326
Mean Menthol Ban Effect P-Value	0.00639	0.101	0.0856	0.597	0.989	0.798	0.841

Note: Region-fixed-effects coefficients are suppressed for space considerations. * p < 0.05, ** p < 0.01, *** p < 0.001

Supplemental Table 2: RYO Model Building

