Mitigating Unintended Consequences from Banning Menthol Cigarettes

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Abstract

The US Food and Drug Administration has proposed banning menthol cigarettes, motivated by evidence that, above and beyond the harms cause by tobacco smoking, the use of menthol in cigarettes facilitates uptake and encourages the transition from experimentation to regular smoking. In the USA the use of menthol cigarettes is overwhelmingly concentrated among African American smokers and those from lower socio-economic backgrounds; groups in which smoking-related harms are concentrated. The proposed ban raises many economic and policy questions that the FDA does not appear to be fully considering. In particular, the nature and extent of illicit trade in tobacco products (ITTP) that may follow a menthol ban is under-examined. But the proposed ban would criminalize patrons of any illicit market for menthol cigarette. Doing so would impose significant social and economic harms on such consumers, many of whom may belong to already-disadvantaged communities. This paper explores the ITTP likely to follow from a menthol ban, discusses the resultant harms, and considers how enforcement of the menthol ban might influence ITTP and the resulting harms. Enforcement against the supply side of the illicit market will likely raise prices, revenue, and violence. Enforcement against the demand side will result in economic costs and harm civil liberties in the very communities the menthol ban intends to help. However the harms may be mitigated if e-cigarettes are exempted from the menthol flavor ban. E-cigarettes provide a "safety valve" for former menthol smokers; offering an alternative to illicit menthol cigarettes or menthol additives for those who are unwilling to stop using menthol products. Econometric evidence, using panel data from markets around the world, suggests that in markets where ease of access to e-cigarettes is greater, the link between tighter cigarette regulation and illicit markets is attenuated. The policy calculus thus suggests that potential harms from banning menthol can be alleviated by allowing menthol e-cigarettes to remain available for adult nicotine users.

I. Introduction

In April 2021 the FDA announced that it was initiating a rulemaking process to ban menthol as a characterizing flavor in cigarettes sold in the USA, and the proposed regulations were released in April 2022 (FDA, 2022).[1] The intent of a ban on menthol cigarettes is to improve public health, given evidence that menthol may facilitate uptake, accelerate the transition from experimental smoking to regular use and impede the success of attempts to quit smoking. Proponents also point to surveys of current menthol smokers suggesting that many would try to quit in response to a ban. Advocates of a ban thus hope that eliminating menthol from cigarettes would therefore reduce the morbidity and mortality associated with smoking. Moreover, since use of menthol cigarettes is concentrated among youth, young adults, lower socio-economic smokers and Black smokers, advocates of the ban hope to redress existing tobacco-related health disparities experienced by these groups.

However, the proper social calculus underlying a menthol ban should be based on consumers' revealed responses to such regulation rather than their stated intentions, which differ widely. Fewer than one in ten attempts to quit smoking is successful. Evidence from menthol bans around the world shows that some of those who are unable or unwilling to quit switch to other combustible products, including illicit menthol cigarettes. These responses would lessen the intended benefit of the ban and create unintended consequences. These possibilities raise economic and policy-related questions that the FDA does not appear to be considering fully. Chief among these are the illicit trade in tobacco products (ITTP) likely to follow a ban and the burden of crime, violence, and enforcement likely to fall on already-disadvantaged communities. Given that the proposed ban was motivated partly out of concern for the wellbeing of Black smokers, among whom about one-third of US menthol cigarettes are

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consumed, the prospect of criminalizing the sale of menthol cigarettes deserves careful consideration. This paper explores the ITTP likely to follow from a menthol ban, discusses the economic and other harms from ITTP, and considers what enforcement of a ban against ITTP may look like and what additional harms enforcement may entail. Special attention is paid to whether menthol e-cigarettes can provide an alternative to illicit menthol cigarettes.

Previous literature suggests that tighter regulation can increase the share and scale of the illicit market for cigarettes (Prieger et al., 2019). Evidence for this from menthol bans is presented in section II. Section III presents novel econometric evidence that higher cigarette prices, which typically occur because of regulation and taxation, increase ITTP. The latter section also includes evidence suggesting that the harms from ITTP can be mitigated if e-cigarettes are exempted from the menthol flavor ban. We hypothesize that e-cigarettes can provide a "safety valve" for former menthol smokers after a ban, so that they turn to e-cigarettes instead of illicit markets for menthol cigarettes or menthol additives. Econometric evidence suggests that in markets where access to e-cigarettes is greater, the link between tighter cigarette regulation and illicit markets is attenuated. Our econometric estimations use panel data from about 70 to 100 markets around the world, 2006-2020, to arrive at this finding. Harms from ITTP, including circumvention of tobacco control goals, lost tax revenue, related criminal activity, and possible funding for terrorist organizations, are discussed in section IV. The likely nature of enforcement of a ban, and the harms from such enforcement, are presented in section V. Enforcement against the supply side of the illicit market will likely raise prices, revenue, and violence, while enforcement against the demand side will result in economic and civil liberty harms against the very communities the menthol ban is meant to help. A final section concludes with discussion of the results and application to the policy discussion surrounding the proposed menthol ban. The policy calculus thus suggests that potential harms from banning menthol may be alleviated by allowed menthol e-cigarettes to remain available for adult nicotine users.

Note: for this short version of the paper for the conference, sections II, IV, and V are abbreviated. The bulk of the novel analysis (and all the econometric work) is in section III, which is presented in full.

II. Would a menthol ban increase ITTP?

What might menthol smokers do if their product of choice were to be banned? Although one of the goals of a menthol ban is to promote cessation from smoking, not all menthol smokers will do so. In studies surveying smokers' intended responses, between 25 and 64% of US menthol smokers say that they would attempt to quit smoking (Cadham, et al., 2020). Instead of quitting, between 13% and 46% of US menthol smokers report that after a menthol ban they would switch to non-menthol cigarettes, and between 12% and 18% of them say they would switch to menthol e-cigarettes if they were available (Cadham, et al., 2020; D'Silva et al., 2015; O'Connor et al., 2012; Pearson et al., 2012; Wackowski et al. 2015). In contrast with the legal options mentioned above, other menthol smokers would attempt to continue to buy menthol cigarettes despite a ban. Estimates of the proportion of menthol smokers pursuing illicit sources of supply range from 8.5% to 25% (D'Silva et al., 2015; O'Connor et al., 2012).[2]

Of course, smokers' stated intentions may be a poor indication of their actual responses, not least because quitting is so difficult. According to CDC data, while 21.5 million smokers tried to quit in 2018, only 2.9 million were successful (Creamer et al. 2018). For purposes of predicting US menthol smokers' responses to a ban, the actual responses in jurisdictions with bans are more important than stated intentions. In recent years, Brazil, Canada, Ethiopia, the EU, Moldova, Turkey, and the UK have all banned menthol cigarettes. In addition, the state of Massachusetts and over 300 counties and cities in

[2] Also noteworthy is that about a third of US participants in another study said they would buy menthol cigarettes from illicit sources after a menthol ban, although participants were not random sample of menthol smokers (Denlinger-Apte et al., 2022).

the US have also enacted menthol bans.[3] Of menthol smokers subject to bans in Canada, 59% switched to non-menthol tobacco products, 21.5% quit smoking, and 19.5% continued to smoke menthol cigarettes (purchased mainly from First Nations reserves; Chung-Hall et al., 2021). The probability of purchasing cigarettes from a First Nations reserve rose 4.3 percentage points, which Carpenter and Nguyen (2021) describe as "very large" relative to pre-ban behavior. Shortly after a provincial ban, 14% of smokers in Ontario purchased menthol cigarettes from a First Nations reserve, another province or country, or online, and a year after the ban 22% of the pre-ban daily menthol users reported purchasing menthol cigarettes (Chaiton et al., 2018, 2020).

In the UK, between 17.5% to 30% of pre-ban smoker of menthol cigarettes continued using them after the ban that began May 2020 (Kock et al., 2021), and in the EU (where a ban began around the same time) 13% of pre-ban menthol smokers reported purchasing menthol cigarettes from "other sources," which would be illicit if purchased inside the EU or UK (FSFW, 2021). Following Massachusetts' menthol ban in June 2020, licit retail sales of menthol cigarettes fell by roughly 90% in the state (Asare et al., 2021), but evidence indicates that all of that decline (or more) was replaced by additional sales in the neighboring states (Rich, 2022).

Taken together these data suggests that while menthol bans will prompt some smokers to quit, the greater portion of menthol smokers will instead switch to other tobacco and nicotine products, licit or illicit. Some consumers will attempt to subvert a menthol ban by purchasing menthol cigarettes from out-of-area and online sources, tribal reservations (although the FDA claims it has the authority to ban menthol cigarettes there as well)[4] or by purchasing aftermarket menthol additives (legal or not).

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[3] See *States & Localities That Have Restricted the Sale Of Flavored Tobacco Products*, https://www.tobaccofreekids.org/assets/factsheets/0398.pdf

[4] See https://www.fda.gov/regulatory-information/search-fda-guidance-documents/cpg-sec-100350-fda-jurisdiction-indian-reservations for the claim. However, the FDA also notes that unless granted by the tribe in question, the agency has no power to enforce its regulations in Indian Country (https://www.fda.gov/tobacco-

III. Data and empirical results for the determinants of ITTP

Much previous research demonstrates that ITTP is related to economic factors such as the prices of (or taxes on) tobacco, distances to cheaper or illicit sources of supply, price ratios with neighboring jurisdictions with lower prices, and so forth (see Prieger & Kulick (2018) and studies cited therein; see also section II.C.4 above). However, there is no econometric literature yet on how ITTP might be causally related a ban on menthol cigarettes, apart from case studies of individual states, provinces, or countries. Given how recent most of the bans around the world are, it is not yet feasible to investigate the link between a menthol ban and ITTP directly. Instead, for the investigation here we rely on the fact that a ban is an extreme form of a price increase. I.e., a ban is economically equivalent to raising the price for legal cigarettes to a level above the maximum willingness to pay of all consumers.[5] Thus, our approach here is to see how the link between raising prices for cigarettes and increases in ITTP—for which there is ample data—is moderated by the size of the market for e-cigarettes. The latter measure is a proxy for ease of access to e-cigarettes, under the notion that (ceteris paribus) less restrictive access to ENDS increases the revenue in the market for ENDS.

The conceptual model from Prieger et al. (2019) shown in Figure 1 depicts, in broad brushstrokes, the concepts underlying the empirical work. Tobacco control policy, whether in the form of taxation, regulation, or product bans, affects the demand for both cigarettes and e-cigarettes. E-cigarettes and cigarettes have interdependent demand, depicted by the two-way arrow between them.

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products/state-local-tribal-and-territorial-governments/engagement-american-indian-and-alaska-native-tribal-governments).

[5] Modeling the unavailability of a (legal) product as one with a prohibitively high price goes back to at least Hausman (1997), who attributes the insight to Hicks (1940). Hausman's logic for new goods (and liberally using his words), as adapted to product ban, is as follows. Consumers are unable to purchase *legally* an illicit product at any price, thus, the price of the legal version of a banned good might as well be infinite. In fact, for some demand curves there is a finite reservation price that sets demand for the good to zero. At the reservation price, whether finite or infinite, a "virtual equilibrium" exists between demand and supply (at a quantity of zero).

As mentioned above, there is strong evidence that these goods are substitutes (Allcott & Rafkin, 2021; Cotti et al. 2022; Huang et al., 2014; Saffer et al., 2020; Stoklosa et al., 2016; Yao et al., 2020; Zheng et al., 2017). Since fully taxed and illicit cigarettes are substitutes, increases in cigarette prices may shift demand toward illicit markets, depicted with the red arrow in the figure. However, when e-cigarettes are readily available--i.e., not overly taxed, regulated, or banned—their substitutability with cigarettes can provide a "safety valve" for cigarette consumers who otherwise might turn to illicit markets when prices rise. This moderating effect of e-cigarette availability on the link between cigarette prices and ITTP is depicted with the green-to-red arrow from e-cigarettes running through cigarettes to ITTP.

A. The relationship between prices and illicit trade

The regression equation for this section is:

$$ITTP_{it} = \alpha_i + \beta \log\left(P_{it}^{\text{cig}}\right) + \delta_1 FFCorrupt_{it} + \delta_2 GNI_{it} + \delta_3 GNI_{it}^2 + \delta_4 \log(pop) + y_t + \varepsilon_{it}$$

When instruments are not required, the data span 2006 to 2020; employing the tax instruments necessitates losing years 2006 and 2007 from the sample. In the first several regressions in Table 2, the dependent variable $ITTP_{it}$ is the illicit share of the entire (licit and illicit) cigarette market in country *i* in year *t*. This figure is calculated from Euromonitor data, and is available for countries in all stages of development, although data for many LDCs is missing.[6] All of these estimations include country fixed effects (α_i in the equation above) to control for unobserved factors differing among countries that affect both cigarette prices and ITTP. Variable *FFCorrupt* is a measure of freedom from corruption from

[6] See the discussion of Euromonitor's data on illicit trade in Prieger & Kulick (2018). The relevant points are: 1) the data are widely used in governmental and some academic studies; and 2) the data have been criticized by some tobacco control researchers but no comparable data exist elsewhere. Prieger & Kulick (2018) show that including fixed effects in the estimations may defang the criticisms, and that conclusion about the link between cigarette prices and ITTP as estimated with Euromonitor data are robust to using alternative data sources on ITTP (each of which has other potential problems, and in any event are not available for the world-wide study performed here).

the World Bank's WGI database. It is an index measuring "perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests" (Kaufmann, Kraay, & Mastruzzi, 2011; 223). The index is measured separately for each country and year and ranges from –2.5 (poor governance) to 2.5 (good governance). Regressor *GNI* is national income (GNI) from the World Bank, and its square is also included as a control variable. All monetary variables are converted to 2017 international dollars using PPP conversion factors and the US CPI.[7] The quadratic form for GNI in the regression equation allows for diminishing returns in the way increases in income might lessen ITTP. Log population is included as an additional control variable. All except the first estimation (fixed-effects regression 1) include year fixed effects (y_t) to account for worldwide trends in the included variables that may otherwise bias the results. Summary statistics for the data are in Table 1.

The first two estimations in Table 2 show that—as expected and as found by Prieger and Kulick (2018) using earlier data only for the EU—higher prices for licit cigarettes are positively and statistically significantly associated with higher ITTP shares in the market. Since 86% of the variation in the sample in cigarette prices is driven by taxes, these results strongly suggest that, other things equal, raising taxes (infinitely so, in the case of a product ban) provides impetus to the illicit market. Income is negatively associated with illicit trade, and the relationship may be convex (i.e., the magnitude of the relationship

[7] The GNI data are converted to 2017 international dollars by the World Bank, with the following exceptions. For Australia, Azerbaijan, Hong Kong, and Slovakia, due to missing data GNI in current international dollars was converted to constant 2017 dollars using the US CPI. The World Bank collect no data for Taiwan, so for Taiwan income data from Euromonitor were converted using the PPP factor from the IMF. For other monetary variables such as prices and revenue, we first converted to current international dollars using the World Bank's PPP conversion factor for private consumption and then converted to constant 2017 dollars using the US CPI. This is Method 1 from Turner et al. (2019), who suggest it for internationally traded goods (such as tobacco products).

declines as income increases), although the statistical significance of the results is weak. Freedom from corruption, as may be expected, is associated with less ITTP..

The actual magnitude of the causal effect of the price may be better estimated with instrumental-variables regression, however, since cigarette prices may be endogenous to ITTP. Such endogeneity implies that the data cannot be analyzed as if they were generated from a natural experiment and would lead to biased estimates of the causal impact of cigarette prices on ITTP. For example, in countries with high levels of ITTP, tobacco manufacturers may lower prices to compete with illicit sales, which would bias the price coefficient downward. In the next two estimations, therefore, cigarette prices are instrumented with components of the cigarette tax. Instrumental-variables estimation exploits the independent variation in a set of exogenous instruments to identify the causal impact of an endogenous variable, in this case cigarette prices. The instruments are the ad valorem tax rate, the log specific excise tax, and the log VAT, all for the most commonly purchased brand of cigarettes in the country. The tax data are from the WHO's Global Health Observer database and must be imputed for every other year.[8] Taxes are reported in the database as a percentage of the tax-included retail sales prices, and thus if prices are endogenous these tax instruments would be as well. Therefore, each tax instrument is computed based on a fixed, baseline price for each country.[9] While this procedure does not remove country-specific endogeneity from the resulting hypothetical tax instruments, it does remove any time-varying endogeneity, and the country fixed effects in the regression will deal and country-specific endogeneity. The specific tax and the VAT instruments are per pack (in log 2017 international dollars). All cross-products of the instruments are also included as

[8] By linearly interpolating the odd years of these data, we follow Radó et al (2022).

[9] Details of the calcs here.

additional instruments, to account for the fact that in some countries the taxes may compound on one another.[10]

Switching to the IV-fixed-effects method in regression (3) increases the size of the price coefficient a small amount. Note that the sample size drops a bit because the tax instruments are not available until 2008. The estimate of 0.111 implies that a 10% increase in the price of licit cigarettes leads to a 1.11 percentage point increase in illicit share. Given that a 10% increase in prices from the sample mean is only a quarter of a standard deviation, and that the mean illicit share in the sample is about 12%, the size of this marginal effect is relatively large.

B. The moderating effect of e-cigarettes

To examine the main focus of the empirical research, whether the availability of e-cigarettes moderates the link between cigarette prices and ITTP, in regression 4 in Table 2 the size of the e-cigarette market is added as a regressor. Availability of e-cigarettes is measured as retail sales value per capita (in log 2017 international dollars), and the demeaned form of this variable (denoted $\log(R_{it}^{\text{e-cig}})$ in the equation below) is further interacted with cigarette prices. The Euromonitor data on e-cigarette revenue includes both closed (e.g., Juul) and open vaping systems but excludes heated tobacco products. The regression equation is now:

$$ITTP_{it} = \alpha_i + \beta_1 \log(P_{it}^{\text{cig}}) + \gamma \log(R_{it}^{\text{e-cig}}) + \beta_2 \log(P_{it}^{\text{cig}}) \times \log(\widetilde{R_{it}^{\text{e-cig}}}) + FFCorrupt_{it} + \delta_2 GNI_{it} + \delta_3 GNI_{it}^2 + \delta_4 \log(pop) + y_t + \varepsilon_{it}$$

The coefficient of primary interest is the interaction term β_2. If β_2 is negative then the availability of e-cigarettes moderates the price-to-ITTP connection, suggesting that e-cigarettes indeed may provide a safety valve for some cigarette consumers instead of turning to ITTP, as hypothesized. In regression (4),

[10] For example, the WHO recommends that countries apply the ad valorem tax rate to the retail sales price inclusive of all taxes, and about half of countries using such taxes do so (WHO, 2010).

the coefficients display signs in accord with a moderating effect: the main cigarette-price coefficient remains positive and the interaction coefficient is negative. A negative interaction coefficient implies that the larger is the e-cigarette market, the smaller is the (positive) link between cigarette prices and ITTP. This can be seen by recognizing that the marginal effect (ME) of cigarette prices on ITTP, which is the impact of a one-unit increase in log cigarette prices on ITTP, is given by the expression:

$$ME_{cig\ price} = \beta_1 + \beta_2 \log\widetilde{(R^{\text{e-cig}})}$$

However, in regression (4) β_2 is not significant. While the issue bears further exploration, it may be that after inclusion of country fixed effects there is not enough variation left in the data to identify the impacts on ITTP share well.[11]

To examine the hypothesized moderating role of e-cigarettes further, in regressions 5, 6, and 7 in Table 2 the dependent variable is changed to be the log of illicit-cigarette quantities (instead of share). This specification is motivated in part because previous commentators (e.g., Stoklosa, 2015, and as discussed in Prieger & Kulick, 2018) have noted that price increases make the numerator larger but shrink the denominator of the illicit-trade share, since higher licit prices are usually found to reduce overall consumption. The results from fixed effects regression 5, which apart from the dependent variable is identical to regression 2, show that the price coefficient is significant and much larger than in the share estimations. The estimated coefficient of 0.575 in the log-log specification is the elasticity of consumption of illicitly traded cigarettes with respect to the price of licit, fully-taxed cigarettes. The IV regression 6, with the new dependent variable and otherwise the same as regression 4, shows that the coefficient for price is large and positive and that the coefficients for e-cigarette revenue and its interaction with cigarette prices are negative and statistically significant. In a final estimation, regression

[11] This conjecture is prompted by the observation that the random-effects version of regression 4 (not shown in the table) yields a large, negative, and highly statistically significant estimate of the moderating effect β_2.

7, a GMM version of IV regression is employed to potentially improve the efficiency of the estimates.[12] The results are mostly similar to those of the IV estimation 6.

The implications of the IV and GMM estimates for the relationship between cigarette prices and ITTP are shown in Figure 2 and Figure 3, where the elasticity of the quantity of illicit cigarettes with respect to cigarette prices is shown. The estimated elasticity is plotted in the figures over the range of the (demeaned) moderating factor, log e-cigarette revenue per capita. The dashed lines in the figures are for the 95% confidence band for the elasticity estimates. When there is virtually no e-cigarette market (at the 5th percentile of its distribution), the elasticity of ITTP quantity with respect to cigarette prices is about 1.5 (IV) or 1.7 (GMM). The elasticity remains positive and statistically significant throughout the range of the data but decreases with the size of the e-cigarette market. Once the e-cigarette market size reaches its extreme at the large end, the ITTP elasticity has fallen by about 50% (IV) or 23% (GMM). This implies that, ceteris paribus, raising cigarette prices results in much less more ITTP when e-cigarette markets are large compared to when they are small.

C. Additional estimations

The safety valve hypothesis may also extend to other reduced-harm tobacco products. In addition to e-cigarettes proper, in recent years heated tobacco products (HTP) have been introduced. HTPs transfer energy produced by a battery or a carbon ember to tobacco leaves, heating them and producing a nicotine-containing aerosol that is inhaled by the user. There is no combustion and HTPs expose users to fewer harmful and potentially harmful compounds (HPHCs) than smoking cigarettes

[12] In this estimation, the second-step weighting matrix for the GMM minimand is an estimate of the covariance matrix of orthogonality conditions computed from first-step estimates. When there are overidentifying restrictions and the data are not i.i.d., as here, the GMM estimator is more efficient than the traditional fixed effects IV/2SLS estimator. The FE-IV and FE-GMM estimates are computed with user-contributed command `xtivreg2` in Stata 17.0 (Schaffer, 2010).

(Jankowski, et al., 2018; McNeill et al., 2018; PHE, 2017).[13] The relative risk of HTPs and cigarettes is a subject of ongoing research and debate, but a systematic literature review concluded that exposure to harmful compounds is "substantially lower" with HTPs than for cigarettes (Simonavicius et al., 2019). HTPs and e-cigarettes together form a class of devices called electronic nicotine delivery systems (ENDS). If revenue from all ENDS replaces revenue from e-cigarettes alone in estimations 6 and 7, the coefficients on the interaction (moderating) term are -0.116 (p = 0.084) and -0.125 (p = 0.010), resp. In other words, substantially similar results obtain as with availability of e-cigarettes.

ENDS are themselves part of a larger class of products generally regarded as reduced-harm tobacco products (RHTPs). Other such products include snus (moist snuff in pouches placed in the mouth), other forms of smokeless tobacco, and tobacco-free oral nicotine products. When revenue from RHTPs replaces the e-cigarette revenue variables in the regressions, the moderating coefficient is insignificant but nevertheless implies a roughly 60% reduction (with p-value = 0.11) in the elasticity of ITTP quantity with respect to cigarette prices over the range of RHTP revenue from its 5th percentile to its 95th (see Figure 4). Furthermore, in countries and years with the largest markets for RHTPs, raising cigarette prices no longer has a statistically significant impact on consumption of illicit cigarettes. On the graph, this can be seen where the 95% confidence interval no longer excludes zero, which happens at the far right of the graph in Figure 4.

[13] Public Health England (2017) determined that for the two HTPs it evaluated, "there were some HPHCs where the reduction was approximately 50%, and the reduction in other HPHCs was greater than 90%." There may be other HPHCs produced by HTPs that are not present in cigarettes, however. and they are not risk-free. The evidence, however, indicates that they to expose users to fewer harmful constituents than smoking cigarettes (Jankowski, et al., 2018; McNeill et al., 2018), a level of exposure that one study termed "substantially lower" than for cigarettes (Simonavicius et al., 2019).

IV. Harms from ITTP

If the evidence suggests that ITTP may increase after banning menthol cigarettes, it becomes important to understand and account for the possible economic, health-related, and social implications of the illicit activity. Harms from ITTP are numerous, including lost tax revenue, circumvention of tobacco control goals, increased public costs of enforcement, economic and social costs resulting from the criminal activity and the sanctioning of violations, and possible funding for terrorist organizations. The public finance cost of ITTP is large: it is estimated that ITTP costs US states and municipalities between $3 and $8 billion annually (Goodchild et al., 2020; NRC, 2015). These tax losses lead to less funding for tobacco control and cessation programs, which are often funded from excise taxes on tobacco products. ITTP also has the immediate undesirable consequence of making lower-priced cigarettes more widely available, increasing smoking.[14] Goodchild et al (2020) estimate that the elimination of ITTP in the US would result in a 3.1% reduction in cigarette consumption and a 1.6% reduction in smoking prevalence, with concomitant gains in public health. Although all cigarettes are injurious to health, counterfeit tobacco products often contain more toxic metals (He et al., 2015; Lisboa et al., 2020) and smokers of illicit cigarettes (at least countries studied) have worse health than other smokers (Aitken et al., 2009).

ITTP provides a significant revenue stream to criminal organizations, providing a "nexus to violent organized crime" (ATF, 2018). Criminal organizations often trade in a range of illicit goods, thus illicit tobacco provides capitalization that could facilitate other criminal activities including money laundering, human trafficking, and trade in illicit weapons and drugs (Remeikienė et al., 2022; US Dept. of State, 2015). In some cases in the U.S., profits from ITTP have been used to finance terrorist organizations including al Qaeda, Hezbollah, Hamas, ISIL, FARC, and other terrorist groups (Sanderson,

[14] Illicit cigarettes typically sell for about one-half to three-quarters of the price of fully taxed product (Goodchild et al., 2020).

2004; Shelley and Melzer, 2008; U.S. Dept. of State, 2015), although the extent of the connection between terrorism and ITTP is unclear (NRC, 2015).

V. Harms from enforcement

To preempt concerns that a menthol ban could lead to adverse consequences for smokers from law enforcement, particularly the Black community (among which menthol cigarette smoking is concentrated),[15] the FDA (2022) states that if it enacts a menthol ban that it will not pursue enforcement against consumers. This choice, however, does not imply that disadvantaged communities will not bear some costs on enforcement against ITTP, for two reasons. First, there is an empirically well-established link between enforcement against the supply side of illicit drug markets and violence (Kulick et al., 2016; Werb et al., 2011) which is grounded in economic theory (Prieger & Kulick, 2014, 2015). The latter logic is simple: enforcement against suppliers raises costs, shifting the supply curve up and (in the presence of inelastic demand) raising revenue. Violence increases when more money is at stake. The same communities that are disproportionately represented among menthol smokers are likely to bear the consequences of the violence that may attend ITTP and enforcement against it. Second, state and local law enforcement, if pressured to quell the supply of illicit tobacco, may exert pressure against and criminalize individuals on the demand side in order to produce results.[16]

[15] Whereas 30% of non-Hispanic white smokers choose menthol cigarettes, 85% of non-Hispanic Black smokers consume menthol cigarettes (FDA Tobacco Product Standard, 2022).

[16] As Neill Franklin (2021, at 34:46), a former Maryland state police captain, explains: "Here's what we do in policing and law enforcement when we are ordered to stomp out illicit markets: … We squeeze the people buying the untaxed cigarettes for those who are selling…. The more people we squeeze (and when I say squeeze, I'm talking about "criminalize"), the more information we get. And as we knock off those who are selling we just create an opportunity for new sellers to pop up. It is a vicious cycle… resulting in the necessary criminalization of poor folks."

VI. Discussion

The empirical results above demonstrate three main points. First, in all regressions, increases in cigarette prices within a market are associated with more illicit trade in cigarettes. Given that licit and illicit cigarettes are economic substitutes, this is unsurprising, although there is a large literature in tobacco control that denies or downplays this link. Does this relationship differ for menthol and non-menthol cigarettes? There are no data available that disaggregate ITTP into the various types of cigarettes, so this cannot be investigated directly. However, if the menthol market share is added as a regressor to FE estimation 2 or 5, it is insignificant and the price coefficient remains significant. Similarly, if menthol market share is interacted with the price coefficient, the coefficient on the interaction term is insignificant. Thus, there is no reason to believe that the link between prices and ITTP found here would differ for menthol markets.

The second main result is increases in the availability of e-cigarettes with a market are associated with decreases in market shares and quantities of illicit cigarettes. In each of the estimations including the regressor, e-cigarette revenue per capita has a negative and significant coefficient. For regression of illicit cigarette quantities, this result is unsurprising. A growing econometric literature finds that cigarettes and e-cigarettes are substitutes (Allcott & Rafkin, 2021; Cotti et al. 2022; Huang et al., 2014; Saffer et al., 2020; Stoklosa et al., 2016; Yao et al., 2020; Zheng et al., 2017), and therefore it seems natural to find that e-cigarettes and illicit cigarettes are also substitutes.

Third, greater availability of e-cigarettes, ENDS, and reduced-harm tobacco products, as proxied by retail revenue from the products, appears to have a dampening effect on the link between cigarette prices and the quantity of illicitly traded cigarettes, if not their share of the market. In fact, markets with the greatest availability of RHTPs no longer have a statistically significant relationship between changes in cigarette prices and illicit trade. Whether the link is reduced or removed, the evidence is thus in favor of the “safety valve” hypothesis.

A full policy analysis of the costs and benefits of banning menthol in cigarettes should account for harms from ITTP. In contrast, the FDA appears to discount the possibility that ITTP will even exist at scale, much less that it could create significant harms (FDA Tobacco Product Standard for Menthol in Cigarettes, 2022). The policy calculus also would appear to depend in part on the extent to which menthol e-cigarettes are readily available, affordable, and appealing to current smokers when menthol cigarettes are banned. While the FDA does not include menthol-flavored e-cigarettes in either its proposed ban on menthol cigarettes and cigars or its restrictions on flavored e-cigarettes, it is requiring regulatory approval for existing e-cigarettes to remain on the market. The FDA has been loath to issue such approvals: since the first application was filed with the agency in October 2019, the FDA has approved only six products as of June 2022 while denying over a million.[17] Other policies, including state and federal excise taxes and official and unofficial messaging from regulators and other in the public health community regarding the risks involved with e-cigarettes and their role in cessation from smoking, also affect consumers' perceived utility from e-cigarettes and illicit cigarettes. Unduly restricted access to menthol e-cigarettes may needlessly push some menthol smokers toward illicit markets and away from reduced harm products.

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[17] The six approved products (Logic Power, Logic Pro, Logic Vapeleaf, NJOY Ace, Vuse Ciro, and Vuse Vibe) are covered in 18 approved marketing orders, out of the 6.7 million Premarket Tobacco Product Applications (PMTAs) filed with the FDA. See https://www.fda.gov/tobacco-products/premarket-tobacco-product-applications/premarket-tobacco-product-marketing-granted-orders for the approvals and https://www.fda.gov/news-events/press-announcements/fda-issues-decisions-additional-e-cigarette-products for the denials and total applications.

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Table 1: Summary statistics

Variable	Units	Observations	Mean	Std. Dev.	Minimum	Maximum
Illicit share of cigarettes	Fraction of whole market	1,349	0.134	0.112	0.000	0.725
Illicit quantity of cigarettes	Million sticks	1,349	5,029.7	17,351.4	25.3	227,037.9
Cigarette price/stick	2017 international dollars (PPP)	1,349	0.261	0.126	0.034	0.966
E-cigarette revenue per capita	Millions of 2017 international dollars (PPP)	863	2.710	4.898	0.000	41.625
Population	Thousand persons	1,349	67,310.6	194,218.0	1313.0	1,406,350.0
Freedom of Corruption Indix	Arbitrary scale index	1,349	0.212	1.031	-1.587	2.470
Gross National Income	Thousands of 2017 international dollars (PPP)	1,349	24.848	18.738	1.358	94.986

Table notes: variables that are in logs in the regressions are shown here as levels instead.

Table 2: Determinants of illicit cigarette share and quantity

	Y = illicit cigarette share				*Y* = log illicit cigarette quantity		
	Fixed Effects Regression (1)	Fixed Effects Regression (2)	IV-Fixed Effects Regression (3)	IV-Fixed Effects Regression (4)	Fixed Effects Regression (5)	IV-Fixed Effects Regression (6)	GMM-FE Regression (7)
Log(cigarette price)	0.107***	0.108***	0.111***	0.145***	0.575 ***	1.215***	1.479***
	(0.027)	(0.033)	(0.040)	(0.052)	(0.180)	(0.427)	(0.293)
Log (e-cigarette				-0.021**		-0.178***	-0.147***
Revenue per capita)				(0.010)		(0.062)	(0.033)
Log(P_{cig}) × log($Revenue_{e\text{-}cig}$)				-0.008		-0.088**	-0.065***
				(0.007)		(0.040)	(0.022)
Freedom from Corruption	-0.060**	-0.061**	-0.068**	-0.041	-0.316	-0.396	-0.413**
	(0.026)	(0.026)	(0.029)	(0.030)	(0.225)	(0.293)	(0.178)
Log Population	0.195***	0.200*	0.157	0.331	2.482 ***	2.118*	1.727*
	(0.069)	(0.103)	(0.097)	(0.215)	(0.728)	(1.246)	(0.965)
Income (GNI) per capita	-0.008*	-0.008	-0.013**	-0.017*	-0.042	-0.085*	-0.070*
(int'l $ 1,000)	(0.005)	(0.005)	(0.006)	(0.009)	(0.033)	(0.047)	(0.038)
GNI per capita squared	0.000	0.000	0.000*	0.000	0.000	0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year fixed effects	N	Y	Y	Y	Y	Y	Y
N	1,349	1,349	1,148	651	1,349	651	651

*** p<0.01, ** p<0.05, * p<0.1

All regressions include country fixed effects. S.e.'s are robust to heteroskedasticity and clustering on countries.

Figure 1: Conceptual model of relationships among cigarettes, e-cigarettes, and ITTP

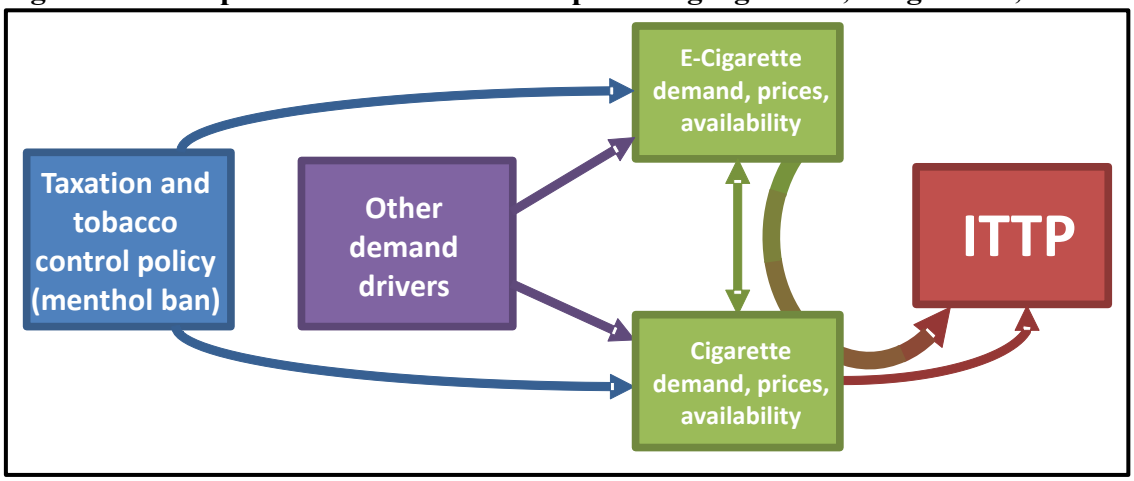

Figure 2: The elasticity of illicit cigarette quantity with respect to cigarette prices, as moderated by e-cigarette revenue (IV-FE estimation 6)

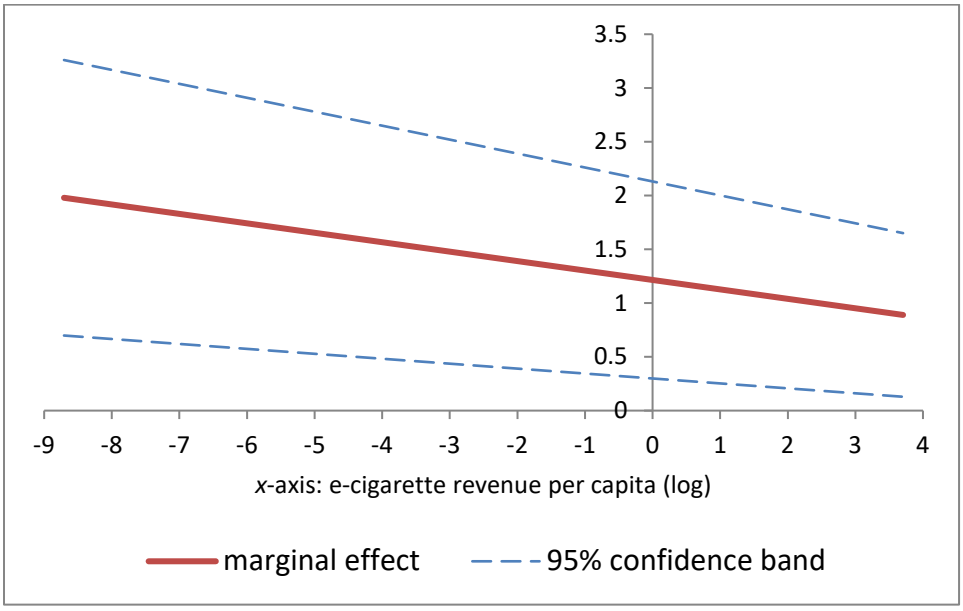

Figure 3: The elasticity of illicit cigarette quantity with respect to cigarette prices, as moderated by e-cigarette revenue (GMM-FE estimation 7)

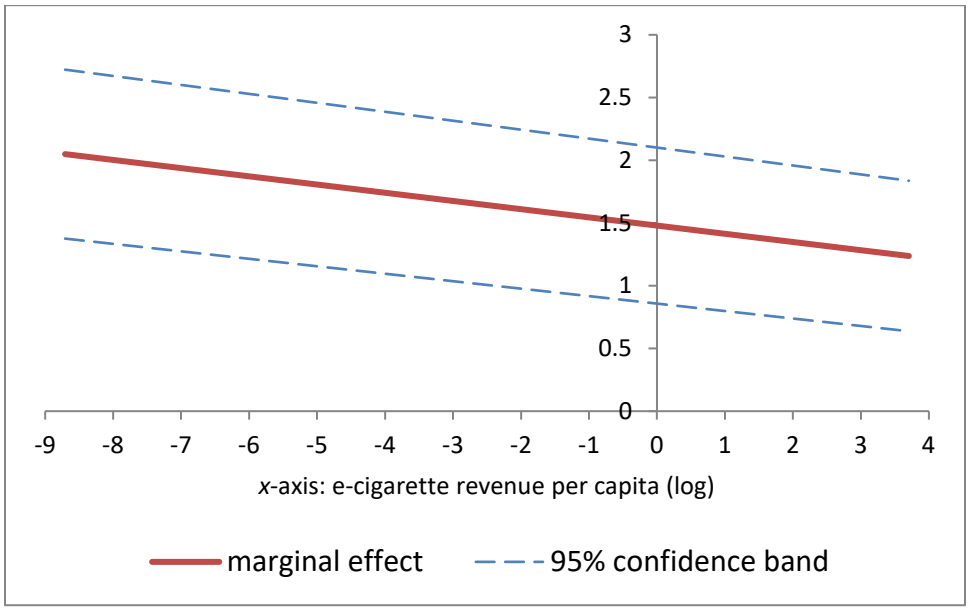

Figure 4: The elasticity of illicit cigarette quantity with respect to cigarette prices, as moderated by reduced-harm tobacco products revenue (GMM-FE estimation)