

# Nicotine Standard for Combusted Cigarettes Could Have Major Economic Impacts on Tobacco Growers

A. Ford Ramsey

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On March 16, 2018, the U.S. Food and Drug Administration (FDA) issued an advance notice of a potential product standard for combusted cigarettes (83 FR 11818, 2018). The proposed rule would limit the amount of nicotine allowed in cigarettes; the FDA also sought information on whether the scope of the proposed standard should be expanded to cover cigars, pipe tobacco, and other tobacco products. Nicotine is the addictive chemical in cigarettes. If the nicotine content is substantially limited, the cigarette becomes nonaddictive or minimally addictive. The FDA believes that a dramatic reduction in nicotine will prevent smokers from achieving sustained addiction. While a product standard limiting nicotine content could have significant public health implications, it is also likely to have negative economic impacts on tobacco growers.

The Family Smoking Prevention and Tobacco Control Act of 2009 (Pub. L. No 111-31) gave the FDA the ability to regulate tobacco products. Although the legislation initially allowed the FDA to regulate cigarettes, roll-your-own tobacco, and smokeless tobacco, regulatory authority has since been expanded to include nearly all tobacco products (such as hookah and pipe tobacco) as well as other emerging devices such as e-cigarettes and nicotine gel packs. The legislation allows the FDA to set requirements on nicotine levels in the products under its purview. However, FDA is restricted from “requiring the reduction of nicotine yields of a tobacco product to zero” (Family Smoking Prevention and Tobacco Control Act of 2009, Pub. L. No 111-31). The language in the legislation leaves open the possibility of nicotine levels so close to zero that the product is unlikely to sustain addiction.

The FDA does not have the authority to directly regulate farm production practices. However, tobacco manufacturers effectively manage such practices through the nature of the production contracts they sign with growers. This provides a mechanism for any product standard to be passed on from regulators to manufacturers and then to growers. In light of this link, this article discusses the implications for tobacco growers of limited nicotine in combusted cigarettes. We first provide a brief summary of the potential proposed rule and the current state of the tobacco leaf market. We then suggest two avenues through which the economic welfare of tobacco farmers could be affected. Welfare losses to farmers would likely arise through decreases in domestic demand for legal cigarettes and increased production costs for tobacco leaf. These losses should be balanced against any public health benefits when considering a potential product standard.

## Potential Rulemaking

The FDA issues an advance notice of proposed rulemaking when it is considering implementing a policy change. The advance notice period allows for members of the public, researchers, and industry stakeholders to enter comments on the proposed rule. The FDA’s advance notice of proposed rulemaking on a tobacco product standard for nicotine level of combusted cigarettes sought comments on nicotine levels in the range of 0.3–0.5 milligrams of nicotine per gram of tobacco filler (83 FR 11818, 2018). Over a three-month comment period, the notice attracted strong interest, with 7,729 public comments. In contrast to the nicotine levels suggested by the FDA, standard

cigarettes have roughly 14–20 milligrams nicotine per gram of tobacco filler, assuming 0.7 grams of tobacco per cigarette; this is well above the 0.2–0.3 milligrams nicotine per gram of tobacco believed to be below the addiction threshold (Benowitz and Henningfield, 1994). The World Health Organization (WHO) has suggested nicotine reduction as a global policy, referring to a threshold around 0.4 milligrams nicotine per gram of tobacco filler (WHO Study Group on Tobacco Product Regulation, 2015).

In terms of scope, the product standard would cover combusted cigarettes. However, the FDA sought information on whether the standard should include roll-your-own tobacco, cigars, pipe tobacco, and waterpipe tobacco. The advance notice also requests research in terms of implementation, technical achievability, and a variety of additional considerations. Among these considerations is the impact that a reduction in nicotine levels could have on tobacco growers. Two of the most important components of a proposed rule will be the scope (products affected) and the maximum amount of nicotine allowed in the products. These components will have direct impacts on the efficacy of the rule in terms of reduced smoking and will likely generate welfare losses to tobacco manufacturers and farmers.

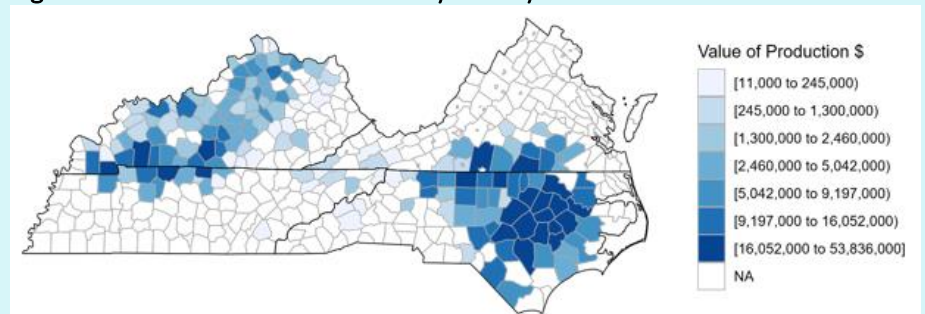
Assessing the economic impact of a nicotine standard is difficult because there are many variables that affect tobacco markets and little available research on reduced-nicotine products. However, standard economic tools allow for the direction of the impact (either a gain or a loss) to be determined after making some simplifying assumptions. The gist of the advance notice is that the nicotine content in cigarettes will be low enough that the tobacco product is nonaddictive and cannot be used in such a way as to provide meaningful nicotine absorption. Under this policy, the two main factors affecting growers are likely to be domestic cigarette demand and changes to cost of production.

Schmitz et al. (2013) conducted a cost–benefit analysis of the impact of different demand and supply factors on tobacco markets and discussed some basic analytical tools. Tiller, Feleke, and Starnes (2011) estimated that if domestic demand for cigarettes fell by 10% and cost of production increased by 30%, tobacco revenue would fall between roughly 7% and 9.5%. The nicotine standard could result in an even more dramatic decrease in domestic demand, suggesting even larger losses in terms of revenue. However, most available estimates of the responsiveness of tobacco supply and demand to price changes were calculated prior to the tobacco buyout, had a wide range, and may not be relevant in the current market environment (Goodwin and Sumner, 1990; Brown, Snell, and Tiller, 1999; Fulginiti and Perrin, 1993). This is because—until 2004—tobacco production was subject to a quota system that limited the amount of tobacco any one producer could grow. The tobacco program ended in a buyout of quota rights and substantial changes in tobacco markets (Brown, Rucker, and Thurman, 2007).

## Impacts on Domestic Demand

The clearest avenue for the nicotine standard to affect leaf growers is through decreased demand for tobacco leaf. Three main types of tobacco are grown in the United States: flue-cured, burley, and dark tobacco. The types produced for combustible cigarettes are flue-cured and burley. Production of tobacco is heavily concentrated in North Carolina, Virginia, and Kentucky, although the 2017 Census of Agriculture reports tobacco production in 18 states. Figure 1 shows the value of production by county in the top four states in terms of sales.

Figure 1. 2017 Tobacco Production by County



Source: USDA-NASS, 2019.

Demand for tobacco leaf is a derived demand (see Box 1). The demand for tobacco is derived from the demand for cigarettes, cigars, and other tobacco products. Some of this demand is domestic and some is excess demand from the rest of the world. End users purchase tobacco either through direct contracts with growers or through middlemen who have direct contracts with growers. This supply chain links the markets for tobacco leaf and tobacco products, so that any impacts in the end markets are transmitted to farmers.

**Box 1**

Derived Demand: The demand for an input to production is often referred to as a derived demand because the quantity and price of the input in the market are directly impacted by demand for the final product. Demand for the input can be more or less elastic than the demand for the product from which it is derived.

Table 1 shows total U.S. domestic cigarette production and consumption and tobacco production, compiled from the U.S. Department of the Treasury Alcohol and Tobacco Tax and Trade Bureau Monthly Statistical Release for Tobacco (2019) and U.S. Department of Agriculture – National Agricultural Statistics Service Quick Stats (2019). The table shows declining cigarette production and domestic demand. The quantity of leaf produced has also declined, but the table should reinforce the point that only a portion of U.S. tobacco is used for domestic cigarette production. Through the derived demand mechanism, the decline in cigarette consumption has resulted in changes to tobacco production and a decrease in the number of tobacco farms. Other important factors in reducing the number of tobacco farms include reduced profit margins, labor supply issues, and increased wages for agricultural labor as well as a reduction in price competitiveness relative to major international producers.

**Table 1. U.S. Cigarette Production, Consumption and Tobacco Production**

Year	Cigarette Production (millions)	Cigarette Consumption (millions)	Tobacco Production (thousand lb.)
2004	492,750	374,978	881,875
2005	489,375	362,964	645,015
2006	483,987	364,437	727,897
2007	450,006	348,317	787,653
2008	396,556	335,384	800,504
2009	337,435	308,388	822,581
2010	326,692	292,753	718,190
2011	318,914	286,353	598,252
2012	303,766	279,838	762,709
2013	292,626	266,088	724,266
2014	277,570	254,487	876,689
2015	284,488	259,721	719,563
2016	270,264	249,825	628,720
2017	245,632	239,297	710,161

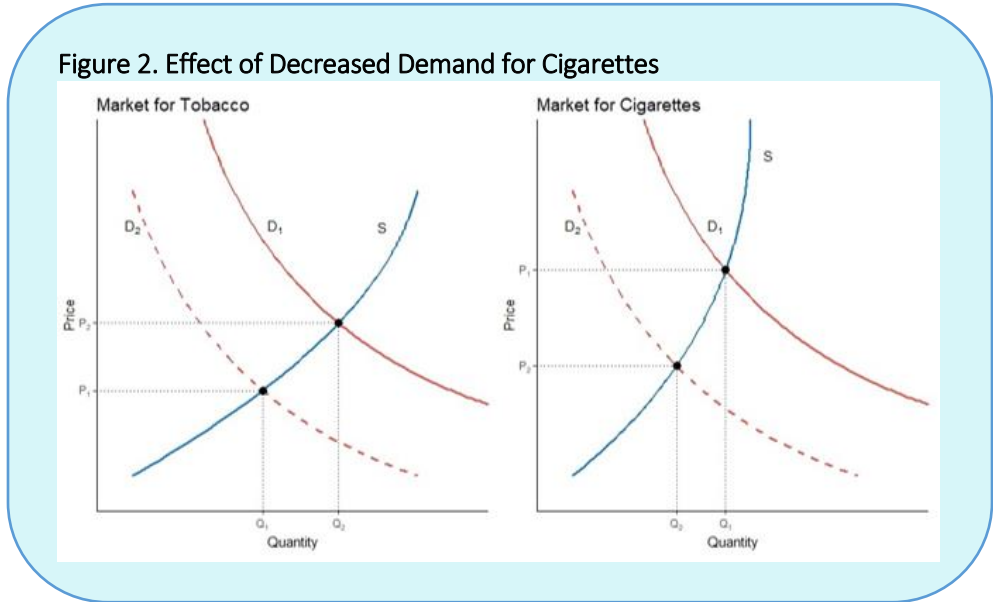
Source: USDT-TTB, 2019 and USDA-NASS, 2019.

A majority of cigarette users smoke for the delivery of nicotine; however, other cigarette users only smoke occasionally—often for social reasons. While light and intermittent smokers may comprise 25%–33% of all smokers, they are unlikely to account for a significant volume of cigarette purchases (Coggins et al., 2009). Frequent smokers, primarily smoking for nicotine consumption, have the greatest impacts on cigarette demand. Even though they may account for only a small portion of cigarette purchases, light and intermittent smokers may be more sensitive to changes in the price of cigarettes. A nicotine product standard accompanied by an increase in the price of cigarettes could potentially affect the purchasing behavior of smokers in both groups.

Low-nicotine cigarettes of the type described in the proposed rule can be viewed as a low-quality nicotine-delivery mechanism. Quality as defined in this context should be taken to refer only to nicotine content and not to sensory

experience or quality of the tobacco leaf (although a nicotine reduction could also result in reduced consumer acceptability in terms of other characteristics). This reduction in quality will cause a decline in the demand for legal cigarettes as consumers substitute to other sources of nicotine. Other sources include black-market cigarettes, electronic cigarettes, chewing tobacco, snuff, and other tobacco products. Consumers might also increase the number of cigarettes they smoke to sustain addiction, potentially increasing cigarette purchases and leaf usage. The end result depends on whether the proposed standard extends to legal cigarette substitutes, the degree of substitution between cigarettes and other products, and whether the nicotine level is low enough that addiction cannot be sustained.

As the demand curve for legal cigarettes shifts, it induces a shift in the demand curve for tobacco leaf (see Figure 2 for a graphical representation of the tobacco market). The market for leaf is shown as derived from the demand for cigarettes, and it is easy to trace out the effect of a decline in cigarette demand on the tobacco leaf market. As demand for cigarettes shifts from  $D_1$  to  $D_2$ , so does the demand for tobacco leaf. This leads to a lower market quantity of tobacco leaf, a lower market price, and a decline in revenue to tobacco growers.



The demand curve for cigarettes would not only shift under a nicotine standard but would also become more elastic because cigarettes would presumably be minimally addictive. Increased elasticity results in a larger response in terms of quantity demanded. In terms of welfare effects, tobacco growers suffer welfare losses. By welfare losses, we mean a reduction in producer surplus: an additional private benefit that accrues to producers when the price in the market is above the minimum price for which they would be willing to supply tobacco.

In 2018, the total value of the U.S. tobacco crop was just under \$1.1 billion (USDA-NASS, 2019). The size of the crop was 533 million pounds. Only a portion of the tobacco leaf is used for domestic purposes; around 50% to 70% is exported. Burley is more commonly used for domestic production, while flue-cured is mostly exported, so declines in domestic consumption would more strongly impact burley producers. If the nicotine product standard resulted in a complete decline in domestic demand, and assuming that 60% of tobacco is exported, then the immediate economic impact would be a loss of \$440,000,000 of revenue at current levels of production.

## Impacts on Cost of Production

In addition to changes in domestic demand for tobacco leaf, low-nicotine requirements could also impact tobacco growers' production practices. Provided that producers still wished to sell their leaf for tobacco products consumed in the United States, they would most likely be required to comply with specific practices aimed at lowering nicotine content. The FDA has proposed several possible avenues for producing products that comply with the standard, including processing the leaf after harvest, changing production practices on the farm, or development of varieties of tobacco with low nicotine content. In most cases, these changes would result in increased cost of production for growers or costs that would likely be passed through from the manufacturer. There is limited evidence that any combination of these practices could consistently reduce nicotine content to meet the levels proposed by the FDA in the current production environment (Lewis, 2018).

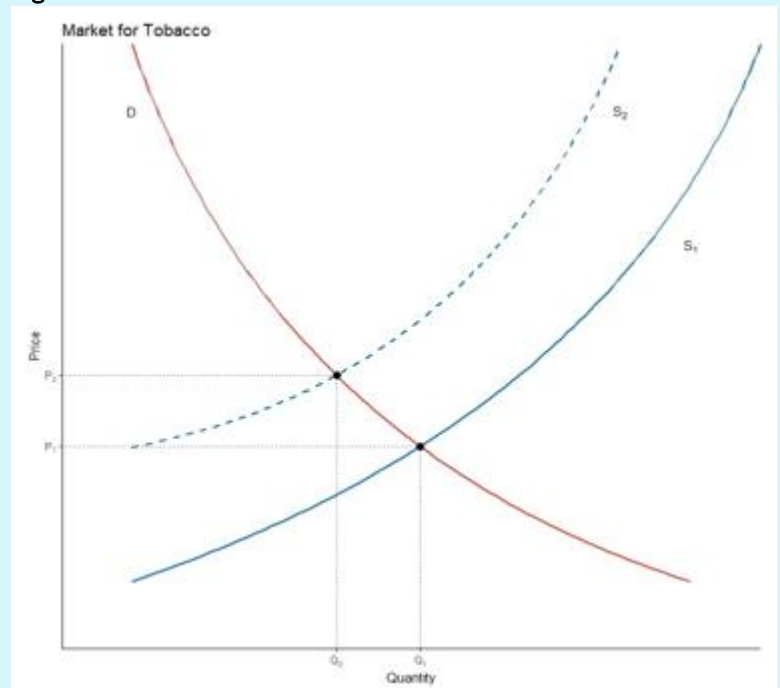
If the nicotine standard were implemented using cross-breeding, genetic engineering, or changes to growing and harvesting practices, then cost of production could be directly impacted. Some specific practices suggested in the advance notice include once-over harvesting, high plant density, or no topping. There is little available research on the efficacy of these practices at reducing nicotine levels in tobacco or their impacts on yields and quality. Lewis (2018) discusses the possibility of genetic modification to achieve low nicotine levels in tobacco. While genetic modification may be able to produce tobacco with low nicotine content, it brings a number of additional economic considerations.

Growers of genetically modified tobacco could see increased production costs because of intellectual property rights and licensing requirements. Most of the largest importers of U.S. tobacco refuse to purchase genetically modified leaf. In many countries, genetically modified imports are legally prohibited. Growers would have to choose between producing for the domestic or foreign market. They would also run the risk of a potential ban on exports if segregation between genetically modified and nongenetically modified tobacco could not be maintained. Even trace amounts of genetically modified crops can be enough to cause significant trade disruptions (Gunther, 2007; Johnson, 2013). Such disruptions could impact foreign demand for U.S. tobacco, again resulting in a decline in demand in the tobacco market and a loss in producer welfare.

Changes in terms of production practices and varieties could also affect the risk associated with tobacco production. It could be more difficult to consistently grow tobacco that yields the same quantity, and the variation in yield could be more pronounced. Such risks could be lessened over time as more research on low-nicotine tobacco is conducted. If the cost of production were to increase, then leaf growers would supply less tobacco at every possible price. As shown in Figure 3, the supply curve of tobacco shifts to the left resulting in less tobacco supplied to the market, a higher price for tobacco leaf, and an ambivalent result in terms of total revenues accruing to tobacco growers.

The outcome in terms of revenue and producer surplus depends on the elasticity of demand for tobacco. Revenues would increase if demand remained inelastic after the regulatory change. But, as explained previously, the demand curve would most likely shift back and become more elastic. The more likely end result of these coincident responses to the policy change is losses to producer surplus.

Figure 3. Effect of Increased Production Costs



## Tobacco in the 21st Century

Following the end of the tobacco program in 2004, U.S. tobacco production has become increasingly concentrated. From an industry that had 16,234 farms in 2007, only 6,237 farms remained in 2017. Tobacco is no longer sold through auctions in large warehouses but is primarily sold through direct contracts. The first two decades of the twenty-first century have seen watershed changes in the structure of tobacco markets and the demand for tobacco products. While these changes have often been spurred by government policy, they have also been driven by the development of alternative products for nicotine delivery and technological change.

The proposed rule limiting the nicotine content of combusted tobacco products is intended to reduce addiction to harmful products and allow consumers to more easily lower or eliminate their use of cigarettes. Standards for nicotine content will have indirect and potentially significant impacts on farmers. Domestic demand for cigarettes—and along with it, the domestic demand for tobacco—is likely to fall dramatically. Production costs for low-nicotine tobacco are likely to be higher than those for standard tobacco, at least in the near term. The market for domestic tobacco could be significantly reduced outside of use of noncombusted products. Provided that genetic modification is not used to implement the standard, growers would still have access to export markets that currently account for a portion of leaf grown in the United States.

An alternative to conventional cigarettes, which could be a source of demand for leaf, are heat-not-burn tobacco devices. Such devices contain tobacco, which is heated to produce an aerosol that contains nicotine. The tobacco in the device is not combusted, and heat-not-burn products typically use 33%–55% of the tobacco used in a conventional cigarette. However, heat-not-burn products are currently classified as cigarettes for tax purposes and could potentially be affected by an expanded nicotine standard. The FDA approved a heat-not-burn device for sale in the United States on April 30, 2019, implying that it views the device as appropriate for the protection of public health. Modified-risk tobacco product applications for heat-not-burn devices have not yet been approved; these would allow the manufacturer to gain authorization for a relative-risk claim on the product. Heat-not-burn devices have seen increased penetration in some markets (such as Japan), but it is still unclear how low-income cigarette consumers in the United States will respond to this higher-priced product (Du and Huang, 2019).

More research is needed to understand the potential impacts of a product standard for combusted cigarettes on tobacco growers. At this point, any *ex ante* analysis is likely to require strict assumptions and will have to rely on the limited data available on tobacco markets since the buyout. A starting point for a more detailed analysis would be estimates of elasticities of supply and demand for tobacco leaf in the market as it stands today. In addition, it will be important to know how cigarette consumption is affected by nicotine content and the degree to which consumers are willing to substitute between conventional cigarettes, e-cigarettes, and heat-not-burn devices.

## For More Information

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#### Author Information

A. Ford Ramsey (aframsey@vt.edu) is Assistant Professor, Department of Agricultural and Applied Economics, Virginia Tech, Blacksburg, VA.

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