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September 2015

# ELECTRONIC CIGARETTES

Effect on Federal  
Excise Taxes  
Collected on  
Traditional Cigarettes  
Is Not Currently  
Evident

# GAO Highlights

Highlights of [GAO-15-771](#), a report to the Committee on Finance, U.S. Senate

## Why GAO Did This Study

While use of traditional cigarettes in the United States continues to decline, use of e-cigarettes is increasing. Treasury collects FET on cigarettes and other tobacco products manufactured in the United States. The Internal Revenue Code of 1986, as amended, does not specifically define or list a tax rate for e-cigarettes. The decline in cigarette use has led to a decline in cigarette FET revenue, from \$15.3 billion in fiscal year 2010 to \$13.2 billion in fiscal year 2014. FDA currently regulates four tobacco products. In April 2014, FDA proposed to deem additional tobacco products, including e-cigarettes, subject to its tobacco product authorities.

GAO was asked to examine issues related to the U.S. e-cigarette market. This report examines the extent to which (1) e-cigarette use affects cigarette FET revenue, and (2) data on quantities and prices of e-cigarettes on the U.S. market are available from federal agencies.

GAO conducted a regression analysis to assess the effect of e-cigarette use on cigarette FET revenue from April 2009 through December 2014, using Treasury data on FET revenue from cigarettes. GAO also reviewed agency documents and interviewed agency officials and industry experts.

## What GAO Recommends

GAO is not making recommendations in this report.

View [GAO-15-771](#). For more information, contact David Gootnick at 202-512-3149 or [gootnickd@gao.gov](mailto:gootnickd@gao.gov).

September 2015

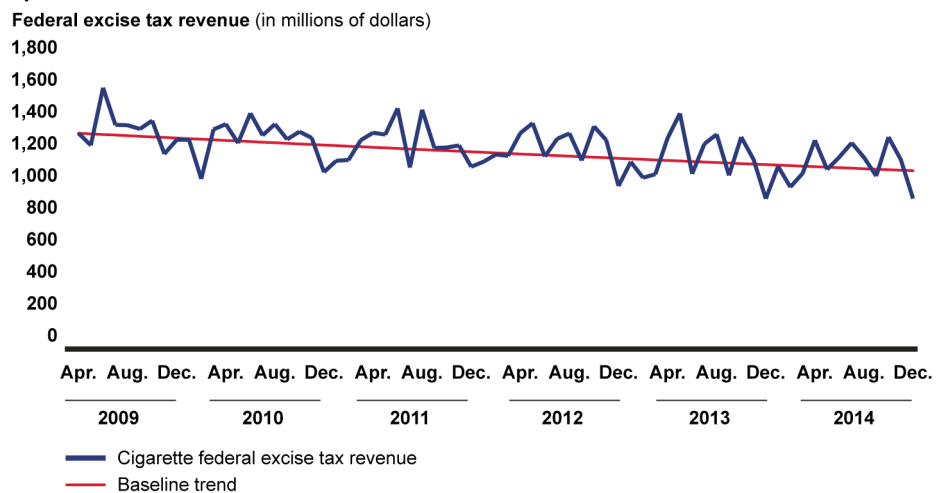
# ELECTRONIC CIGARETTES

## Effect on Federal Excise Taxes Collected on Traditional Cigarettes Is Not Currently Evident

## What GAO Found

GAO's analysis found no evidence that use of electronic cigarettes (e-cigarettes) has affected federal excise tax (FET) revenue from traditional cigarettes, which has been declining over time (see figure). Possible reasons for the lack of a detectable effect include the small size of the e-cigarette market (estimated at \$2.5 billion in 2014) relative to the cigarette market (\$80 billion in the same year); lack of comprehensive and reliable data on e-cigarette quantities and prices; and lack of comprehensive and reliable information about the extent to which e-cigarettes substitute for cigarettes. If users consume e-cigarettes instead of cigarettes, cigarette FET revenue would decline as fewer cigarettes are consumed. Data from a recent survey by the Centers for Disease Control and Prevention showing high school students' increasing use of e-cigarettes and decreasing use of cigarettes suggest that these students may substitute e-cigarettes for cigarettes to some extent. If the percentage of high school students using cigarettes continues to decline, cigarette FET revenue could also decrease at a greater rate than the average historic trend observed since April 2009, when FET on cigarettes and other tobacco products was last increased.

**Cigarette Federal Excise Tax Revenue Collected and 6-Year Historical Trend Line, April 2009-December 2014**



Source: GAO analysis of Department of the Treasury data. | GAO-15-771

Comprehensive data on e-cigarette quantities and prices are not available from federal agencies. The Department of the Treasury (Treasury) and Food and Drug Administration (FDA) do not collect data on e-cigarette quantities comparable to data that they collect for cigarettes and some other tobacco products. According to FDA officials, if e-cigarettes are deemed subject to FDA's tobacco product authorities as a result of a rule proposed in April 2014, the agency could start collecting some data on the types of e-cigarettes on the U.S. market but will not collect data on the quantities of e-cigarettes sold. The Bureau of Labor Statistics began collecting data on e-cigarette prices in September 2014 as part of its data collection for the Consumer Price Index, but these data are limited.

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Figure 3: Cigarette Federal Excise Tax Revenue Collected and 6-Year Historical Trend Line, April 2009 through December 2014

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**Abbreviations**

BLS	Bureau of Labor Statistics
CDC	Centers for Disease Control and Prevention
DOL	Department of Labor
e-cigarettes	electronic cigarettes
FDA	Food and Drug Administration
FET	federal excise tax
HHS	Department of Health and Human Services
IRC	Internal Revenue Code of 1986, as amended
Tobacco Control Act	Family Smoking Prevention and Tobacco Control Act
Treasury	Department of the Treasury
USPTO	U.S. Patent and Trademark Office

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September 14, 2015

The Honorable Orrin G. Hatch  
Chairman  
The Honorable Ron Wyden  
Ranking Member  
Committee on Finance  
United States Senate

While use of traditional cigarettes in the United States continues to decline among both adults and adolescents, electronic cigarettes—known as e-cigarettes—are becoming more popular and widely used.<sup>1</sup> For example, according to the most recent survey data from the Centers for Disease Control and Prevention (CDC), from 2011 through 2014, e-cigarette use among high school students increased from 1.5 percent to more than 13 percent.<sup>2</sup> The Department of the Treasury (Treasury) is responsible for collecting federal excise tax (FET) on traditional cigarettes (cigarettes) and other tobacco products manufactured in the United States,<sup>3</sup> pursuant to the Internal Revenue Code of 1986, as amended (IRC).<sup>4</sup> The IRC does not specifically define or list a tax rate for e-cigarettes. The decline in cigarette use has led to a decline in FET

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<sup>1</sup>Scientific and policy literature also refers to e-cigarettes as a type of electronic nicotine delivery system. The e-cigarette industry and consumers commonly refer to e-cigarettes as vapor products, to e-cigarette use as vaping, and to e-cigarette liquid as e-liquid or e-juice. In addition to e-cigarettes, electronic nicotine delivery systems include vaporizers and other electronic products, such as e-cigars, e-pipes, and e-hookahs.

<sup>2</sup>These percentages reflect e-cigarette use during the preceding 30 days as reported in the National Youth Tobacco Survey.

<sup>3</sup>The Secretary of the Treasury delegated responsibility to U.S. Customs and Border Protection for collecting FET on imported tobacco products. Treasury Order 100-16, 68 Fed. Reg. 28,322 (May 23, 2003).

<sup>4</sup>26 U.S.C. §§ 5701-02, 6301.

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revenue from cigarettes, from \$15.3 billion in fiscal year 2010 to \$13.2 billion in fiscal year 2014.<sup>5</sup>

To reduce tobacco use and protect public health, Congress passed the Family Smoking Prevention and Tobacco Control Act (Tobacco Control Act) in June 2009, amending the Federal Food, Drug, and Cosmetic Act and granting the Food and Drug Administration (FDA) authority to regulate the manufacture, distribution, and marketing of tobacco products.<sup>6</sup> The Tobacco Control Act granted FDA immediate authority to regulate cigarettes, cigarette tobacco, roll-your-own tobacco, and smokeless tobacco. The Tobacco Control Act also gave FDA the authority to regulate any other product that the agency deems by regulation to be subject to its tobacco product authorities, and in April 2014, FDA issued a proposed rule to deem additional products, including e-cigarettes, to be subject to such authorities.<sup>7</sup>

You asked us to examine a number of issues related to the U.S. e-cigarette market. This report examines the extent to which (1) e-cigarette use affects FET revenue from cigarettes and (2) data on quantities and prices of e-cigarettes on the U.S. market are available from federal agencies. Although the emergence of e-cigarettes has public health implications, this report focuses on e-cigarettes' effects on revenue. We issued a previous report about e-cigarette imports.<sup>8</sup>

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<sup>5</sup>Legislation at both the federal and state level has aimed to discourage tobacco use and raise revenues by increasing excise taxes on tobacco products. The most recent increase in FET took place in 2009 when Congress passed the Children's Health Insurance Program Reauthorization Act (Pub. L. No. 111-3, 123 Stat. 8), which amended the Internal Revenue Code of 1986 by raising FET rates on tobacco products. The increase became effective in April 2009, and the fiscal year beginning on October 1, 2010, was the first full fiscal year following the increase.

<sup>6</sup>Pub. L. No. 111-31, Div. A, 123 Stat. 1776. The Tobacco Control Act amended the Federal Food, Drug, and Cosmetic Act by inserting a new Chapter IX. Chapter IX provides the primary authority for FDA's regulation of tobacco products. For the purposes of this report, references to the "Tobacco Control Act" mean Chapter IX of the Federal Food, Drug, and Cosmetic Act, as amended. This report refers to FDA's regulatory authority over tobacco products established by Chapter IX as FDA's tobacco product authorities.

<sup>7</sup>79 Fed. Reg. 23,142 (Apr. 25, 2014). This report refers to FDA's proposed rule as the proposed deeming rule.

<sup>8</sup>GAO, *Electronic Cigarettes: Imports, Tariffs, and Data Collection*, [GAO-15-491R](#) (Washington, D.C.: May 7, 2015).

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To determine whether e-cigarette use affects cigarette FET revenue, we examined cigarette FET revenue from April 2009, when the last increase in the FET rate on cigarettes and other tobacco products took effect, through December 2014. We analyzed the effect of e-cigarettes on cigarette FET revenue only, since cigarettes represent about 90 percent of the tobacco market in the United States. For this analysis, we used data obtained from Treasury on FET revenue from cigarettes removed from domestic factories or released from customs custody for distribution in the United States. We assessed the reliability of the cigarette removals data by checking the data for inconsistency errors and for completeness, and we determined that these data were sufficiently reliable for the purposes of this report. Using these data and testimonial evidence regarding when e-cigarettes began to have a significant presence on the U.S. market, we constructed a multivariate model that estimates the effect of e-cigarette use on cigarette FET revenue. The model controls for a 6-year historical trend in cigarette FET revenue, the presence of e-cigarettes through a time variable, other tobacco products (e.g., cigars, roll-your-own tobacco, and pipe tobacco), and seasonality effects. To describe the extent to which federal agencies collect data on quantities and prices of e-cigarettes, we reviewed agency documents and regulatory actions. In addition, we interviewed officials from Treasury's Alcohol and Tobacco Tax and Trade Bureau and Treasury's Office of Tax Analysis, the Department of Health and Human Services' (HHS) FDA and CDC, the Department of Labor's (DOL) Bureau of Labor Statistics (BLS), and the U.S. Patent and Trademark Office (USPTO) to obtain information and views about e-cigarette and tobacco trends and regulation. We also interviewed industry experts, including e-cigarette industry members, tobacco industry members, financial analysts, researchers, and representatives of public health organizations as well as representatives from private companies that collect e-cigarette data. Further details about our scope and methodology appear in appendix I.

We conducted this performance audit from September 2014 to September 2015 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

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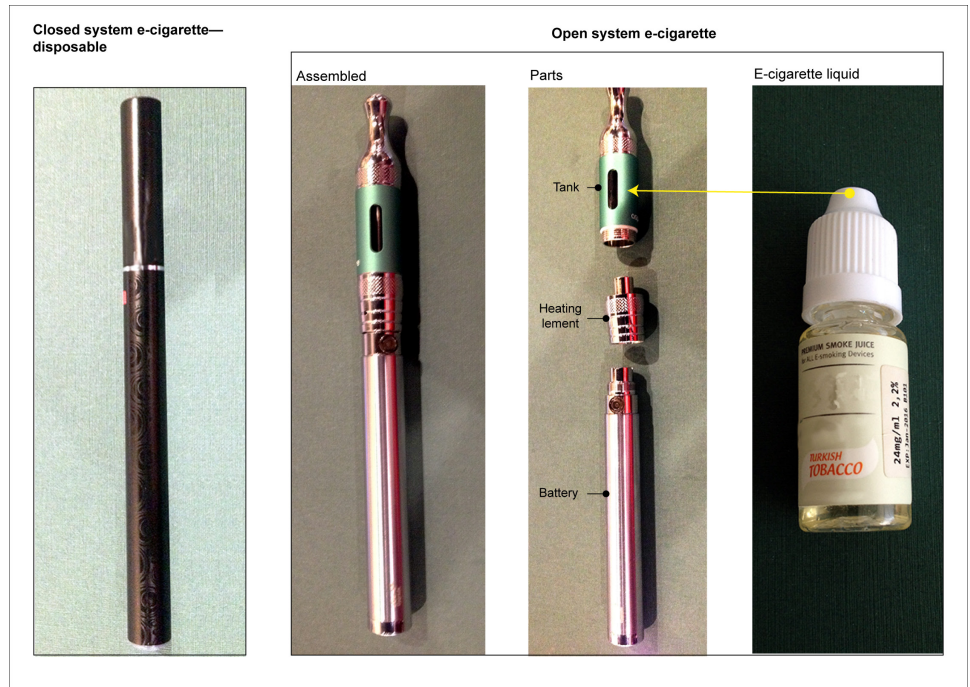
### Types of E-cigarettes

The term “e-cigarettes” refers to a wide range of products that share the same basic design and generally consist of three main parts: a power source (typically a battery), a heating element containing a wick (to deliver liquid to the heating element), and a cartridge or tank containing liquid solution. Cartridges and liquid are often sold separately from e-cigarette devices containing the battery and heating element. Liquid typically contains nicotine, a solvent (e.g., propylene glycol, glycerin, or both), and flavorings. E-cigarettes heat liquids to deliver aerosol that usually contains nicotine and other chemical substances to the user by inhalation. E-cigarettes come in two main forms:

- Closed systems that include disposable e-cigarettes or require users to buy e-cigarette components, including the cartridge with liquid, from the same manufacturer or brand.
- Open systems that enable users to purchase the heating element, battery, tank, and liquid separately and from different manufacturers or brands.



**Figure 1: Types of E-cigarettes and E-cigarette Parts**



Source: GAO (photo). | GAO-15-771

## U.S. E-cigarette Market

Industry experts we interviewed estimated that the size of the U.S. e-cigarette market in 2014 was about \$2.5 billion. Although there are no definitive data on the relative proportions of imported and domestically manufactured e-cigarettes, industry experts we interviewed told us that the majority of e-cigarettes sold in the United States are imported from China.

The U.S. e-cigarette market has developed rapidly in the last decade. U.S. Customs and Border Protection issued a customs ruling for the classification of e-cigarette imports to the United States as early as 2006.<sup>9</sup>

<sup>9</sup>Customs rulings are classification decisions that importers may request from U.S. Customs and Border Protection to determine in advance of importation the applicable Harmonized Tariff Schedule code for the product. The Harmonized Tariff Schedule provides the legal basis for the classification of every product that enters the United States and the corresponding tariff rate the importer must pay for each product. For more information, see [GAO-15-491R](#).

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USPTO issued a registration for a trademark applied to e-cigarettes as early as May 2008 and had recorded more than 1,600 U.S. trademark registrations for e-cigarette devices, parts, liquid, and services as of March 2015. Hundreds of e-cigarette companies participate in the U.S. e-cigarette market. Large tobacco companies began entering the U.S. e-cigarette market in 2012 and now manufacture some of the leading closed system e-cigarette brands, according to industry experts we interviewed. Some industry experts we spoke with predict that the U.S. e-cigarette market will continue to grow, although factors such as the extent of federal and state regulation create uncertainty about the rate of growth.

E-cigarettes are sold in multiple types of outlets, including traditional retail stores, such as convenience stores and grocery stores, as well as at “vape stores” and over the Internet.<sup>10</sup> According to industry experts, closed system e-cigarette products are mainly sold in traditional retail outlets, while open system e-cigarette products are often sold online and at vape stores.<sup>11</sup> Private companies collect point-of-sale data on the quantities and prices of e-cigarettes sold at traditional retail stores, according to documentation from these companies; however, these data do not cover online sales or “vape store” sales. Financial analysts from one firm estimate that 40 to 60 percent of e-cigarettes are sold online or at vape stores.

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## E-Cigarette Use among U.S. Adults and Adolescents

In 2014, CDC reported a statistically significant increase in the percentage of U.S. adults who had used e-cigarettes in the preceding 30 days, from 1 percent in 2010 to 2.6 percent in 2013.<sup>12</sup> Past-month e-cigarette use was especially prominent among current adult cigarette smokers and grew in this population, at a statistically significant level,

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<sup>10</sup>Vape stores are brick-and-mortar retail locations that specialize in selling e-cigarette products.

<sup>11</sup>Data on the number of vape stores are limited. According to industry experts, the number of vape stores has grown rapidly over the last few years. One industry expert, who had conducted a survey of vape store owners, estimated that as of spring 2015, 7,000 to 10,000 vape stores existed in the United States. This expert defined vape stores as stores that sell only or mostly e-cigarette products and do not sell tobacco or marijuana.

<sup>12</sup>Brian A. King et al., “Trends in Awareness and Use of Electronic Cigarettes among U.S. Adults, 2010-2013,” *Nicotine and Tobacco Research*, vol. 17, no. 2 (2015): 219-27, published online Sept. 19, 2014.

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from 4.9 percent in 2010 and 2011 to 9.4 percent in 2012 and 2013. Past-month e-cigarette use by former adult cigarette smokers also rose, from 1 percent to 1.3 percent during the same period, although the increase was not statistically significant.<sup>13</sup>

The National Youth Tobacco Survey by CDC and FDA showed a statistically significant increase in high school students' past-month e-cigarette use, from 1.5 percent in 2011 to 13.4 percent in 2014.<sup>14</sup> In addition, the survey found that in 2014, high school students' past-month e-cigarette use surpassed their use of cigarettes and other tobacco products at a statistically significant level (see fig. 2).<sup>15</sup> The survey further found a statistically significant increase in past-month e-cigarette use among middle school students.<sup>16</sup>

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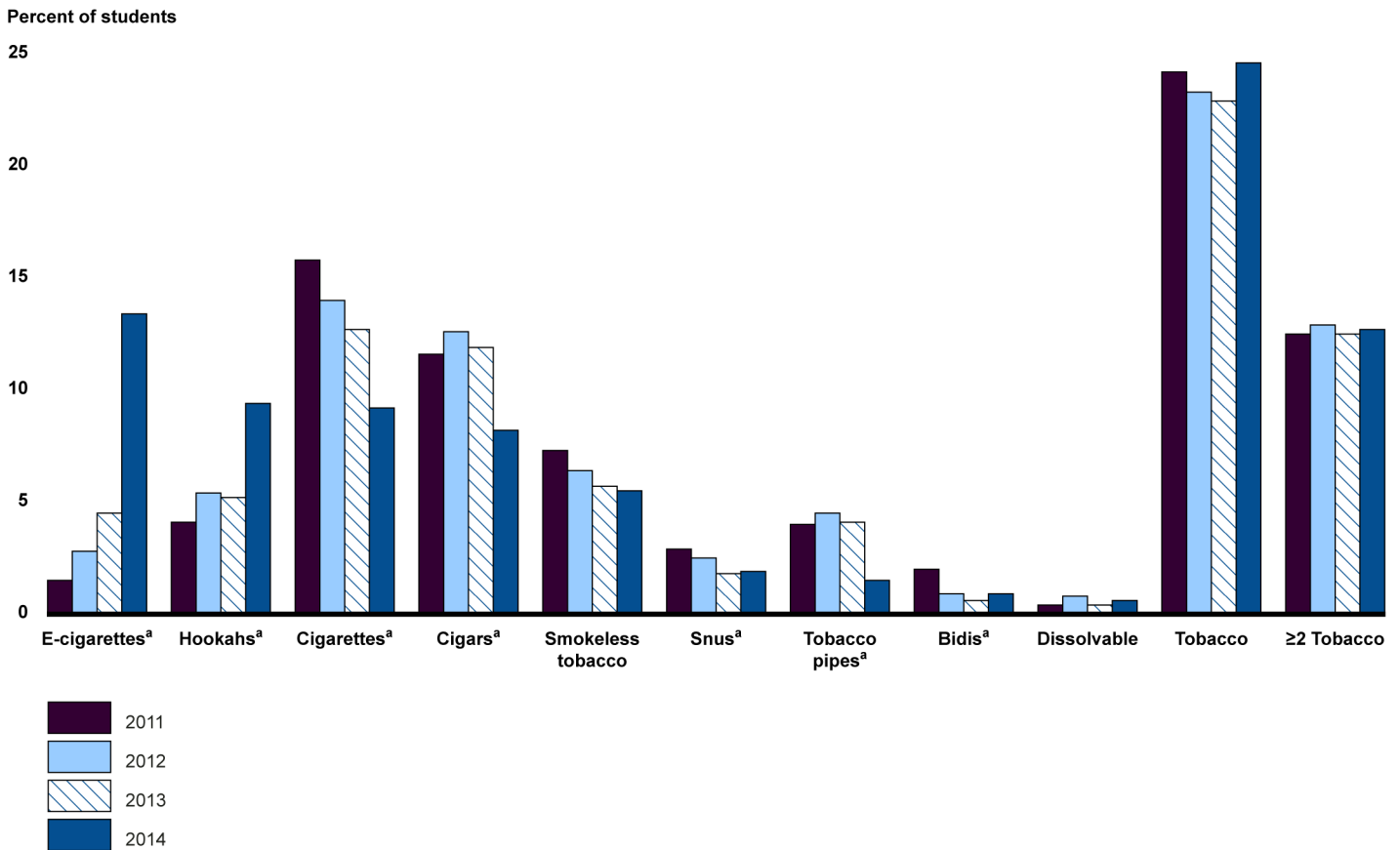
<sup>13</sup>For current and former adult smokers, CDC aggregated data for 2010 and 2011 and for 2012 and 2013.

<sup>14</sup>René A. Arrazola et al., "Tobacco Use among Middle and High School Students—United States, 2011-2014," *Morbidity and Mortality Weekly Report*, vol. 64, no. 14 (2015).

<sup>15</sup>In addition to e-cigarettes and cigarettes, the National Youth Tobacco Survey asked questions about use of seven tobacco products: hookahs, cigars, smokeless tobacco, snus, tobacco pipes, bidis, and dissolvable tobacco. Hookahs are water pipes that are used to smoke specially made tobacco that comes in different flavors. Snus is finely ground moist smokeless tobacco packaged in ready-to-use pouches placed in the mouth. Bidis are small, thin, hand-rolled cigarettes wrapped in a leaf that are imported to the United States, primarily from South Asia. Dissolvable tobacco is finely ground tobacco pressed into shapes such as tablets, sticks, or strips that slowly dissolve in the mouth.

<sup>16</sup>The National Youth Tobacco Survey findings are consistent with findings from another federally funded survey released in December 2014, which found that e-cigarette use surpassed cigarette use among teens in 2014. According to the 2014 Monitoring the Future Survey, funded by the National Institute of Drug Abuse, the following percentages of teens reported past-month use of e-cigarettes versus cigarettes, respectively: 17.1 percent versus 13.6 percent among 12th graders; 16.2 percent versus 7.2 percent among 10th graders; and 8.7 percent versus 4 percent among 8th graders.

**Figure 2: Estimated Percentages of High School Students Who Used E-cigarettes and Tobacco Products in the Preceding 30 Days, by Product—National Youth Tobacco Survey, 2011-2014**



Source: Centers for Disease Control and Prevention (CDC). | GAO-15-771

Notes: The survey defines “Tobacco” as use of any of nine products in the National Youth Tobacco Survey: e-cigarettes, hookahs, cigarettes, cigars, smokeless tobacco, snus, tobacco pipes, bidis, and dissolvable tobacco. The survey defines “Tobacco ≥2” as use of two or more of the nine products. Other CDC documents define hookahs as water pipes used to smoke specially made tobacco that comes in different flavors; snus as finely ground moist smokeless tobacco packaged in ready-to-use pouches placed in the mouth; bidis as small, thin, hand-rolled cigarettes wrapped in a leaf that are imported to the United States, primarily from South Asia; and dissolvable tobacco as finely ground tobacco pressed into shapes such as tablets, sticks, or strips that slowly dissolve in the mouth.

<sup>a</sup>According to CDC, the increases in e-cigarette use and hookah use and the decreases in cigarette, cigar, tobacco pipe, snus, and bidi use from 2011 through 2014 are statistically significant.

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## Proposed Rule to Subject Additional Products, Including E-cigarettes, to FDA's Tobacco Regulation

In April 2014, FDA issued a proposed rule to deem e-cigarettes and other products meeting the Tobacco Control Act's definition of "tobacco product" to be subject to the agency's regulation.<sup>17</sup> FDA received more than 135,000 comments about the proposed deeming rule during the public comment period, which ended in August 2014. FDA announced its intent to issue the final rule in June 2015 in the spring 2015 semiannual regulatory agenda.<sup>18</sup> The final rule had not been issued as of August 2015.

The Tobacco Control Act aimed to, among other things, promote cessation to decrease health risks and social costs associated with tobacco-related diseases.<sup>19</sup> According to the act, FDA can, by regulation, require restrictions on the sale, distribution, advertising, and promotion of a tobacco product if the agency determines that the proposed regulation is appropriate for the protection of public health, based on a consideration of the risks and benefits to the population as a whole, including users and nonusers of tobacco products. In the act, Congress recognized that virtually all new users of tobacco products are under the age of 18.

In the proposed deeming rule, FDA stated that it was researching the effect of e-cigarette use on public health. FDA noted that e-cigarettes could have a positive net impact if using them resulted in minimal initiation by children and adolescents and in significant numbers of smokers' quitting. The FDA also noted that e-cigarette use could have a negative net impact if it resulted in significant initiation by young people, minimal quitting, or significant dual use of combustible products, such as cigarettes, and noncombustible products, such as e-cigarettes.

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<sup>17</sup>79 Fed. Reg. 23,142. In addition to e-cigarettes, products that FDA proposed to deem include pipe tobacco, cigars, certain dissolvable products, and hookah tobacco. For a discussion of FDA's 2010 and 2011 plans to issue the proposed rule, see GAO, *Tobacco Taxes: Large Disparities in Rates for Smoking Products Trigger Significant Market Shifts to Avoid Higher Taxes*, [GAO-12-475](#) (Washington, D.C.: April 18, 2012).

<sup>18</sup>The semiannual regulatory agenda of the U.S. government, also known as the unified agenda, summarizes the rules and proposed rules that each federal agency expects to issue.

<sup>19</sup>Pub. L. No. 111-31, § 3(9).

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## Taxation of E-cigarettes

The IRC, which defines tobacco products subject to FET and sets rates of tax, does not specifically define or list a tax rate for e-cigarettes.<sup>20</sup>

However, two states—Minnesota and North Carolina—have imposed an excise tax on e-cigarettes or vapor products containing nicotine. The Minnesota Department of Revenue issued a notice in 2012 stating its position that e-cigarettes are subject to the tobacco products tax; the current tax rate is 95 percent of the wholesale price of the nicotine-containing liquid or, if the liquid cannot be sold separately, of the complete e-cigarette. North Carolina has taxed vapor products at 5 cents per milliliter of nicotine-containing liquid or other material since June 2015.<sup>21</sup> In addition, at least 18 states and the District of Columbia have proposed legislation to tax e-cigarettes, vapor products, nicotine vapor products, or e-cigarette cartridges since 2013. For example, a bill in Maine proposed to include e-cigarettes in its definition of cigarettes and to apply the same tax rate to cigarettes and e-cigarettes, and a bill in Montana proposed a tax on vapor products, such as e-cigarettes, that would be partially based on the weight in milligrams of the nicotine present in the product.<sup>22</sup>

As of January 2015, three countries—Italy, Portugal, and South Korea—imposed national-level taxes on e-cigarettes that contain nicotine, and each of these countries applies its tax to nicotine-containing e-cigarette liquid, according to an industry expert.<sup>23</sup> In addition, according to research by the Law Library of Congress, Serbia recently enacted legislation to introduce an excise tax on e-cigarette liquid, which went into effect in August 2015.

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<sup>20</sup>26 U.S.C. §§ 5701-02.

<sup>21</sup>N.C. Gen. Stat. § 105-113.35 (2015).

<sup>22</sup>Maine's proposed legislation introduced in 2015 specifies that for the purposes of taxation an amount of liquid containing 18 milligrams of nicotine equals one cigarette.

<sup>23</sup>According to this expert, Italy's tax rate for nicotine-containing e-cigarette liquid is 50 percent of the tax on the equivalent quantity of cigarettes, whereas Portugal's and South Korea's tax rates are per milliliter of nicotine-containing e-cigarette liquid.

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## Effect of E-cigarette Use on Cigarette Federal Excise Tax Revenue Is Not Currently Evident

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### No Current Evidence That E-cigarette Use Has Affected Cigarette FET Revenue

Our analysis of Treasury data on cigarette FET revenue found no current evidence that e-cigarette use has affected the historical decreasing trend in FET collections over the past 6 years. We used a time series regression to determine the change in cigarette FET revenue from April 2009, when the last increase in FET on cigarettes and other tobacco products became effective, through December 2014. Variables in the model control for (1) historical decreases in cigarette FET revenue over the last 6 years; (2) quantities of cigars, pipe tobacco, and roll-your-own tobacco removed from domestic factories or released from customs custody for distribution in the United States; and (3) monthly seasonality effect. Our model tests for the inclusion of e-cigarettes at different points in time and tests for any significant changes from the historical trend.<sup>24</sup> We found no significant evidence that e-cigarettes have decreased the collection of FET revenue from cigarettes at a rate greater than the 6-year historical trend.

Specifically, we found that, when other variables in the model are held constant, the 6-year historical trend of cigarette FET revenue decreased at a rate between \$4.4 million and \$5.5 million per month (see fig. 3). However, we found no significant evidence of a decrease in FET revenue from cigarettes at a rate greater than the 6-year historical trend during the time frame when e-cigarettes have been on the U.S. market.<sup>25</sup> We estimate that cigarette FET revenue would need to decrease by an

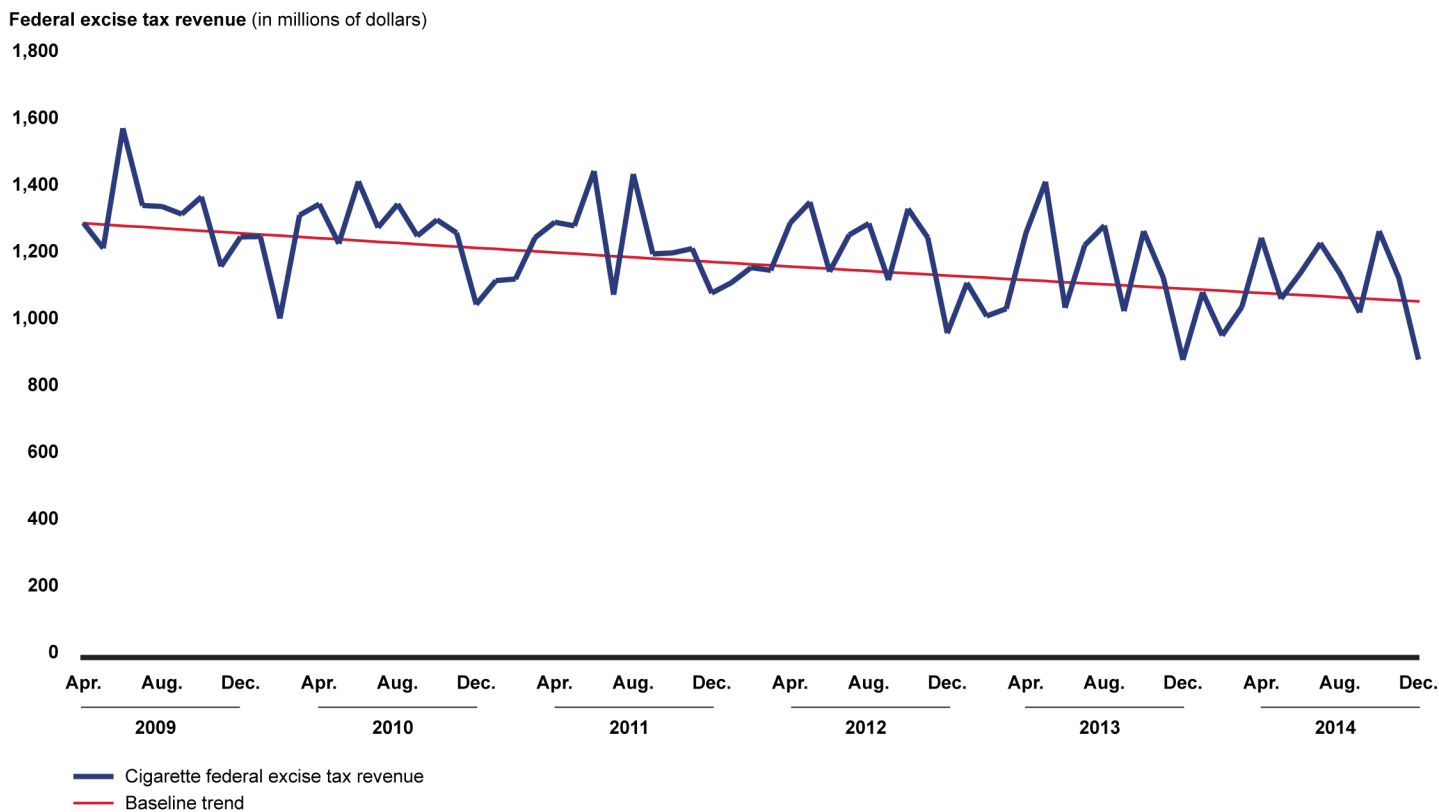
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<sup>24</sup>We tested for the inclusion of e-cigarettes at five different dates in 2012 through 2014. See appendix I and appendix II for more information about our methodology.

<sup>25</sup>Officials from agencies that monitor federal revenue—including the Congressional Budget Office and Treasury's Office of Tax Analysis—also told us that they have not yet observed a significant effect of e-cigarette use on cigarette FET revenue.

additional \$2 million to \$3 million per month to signal a significant effect from e-cigarettes.<sup>26</sup>

**Figure 3: Cigarette Federal Excise Tax Revenue Collected and 6-Year Historical Trend Line, April 2009 through December 2014**



Source: GAO analysis of Department of the Treasury data. | GAO-15-771

Several factors may explain why our analysis did not detect an effect of e-cigarette use on cigarette FET revenue. First, the e-cigarette market—estimated at \$2.5 billion in sales in 2014—is relatively small compared with the cigarette market, which had \$80 billion in sales in the same year. As a result, without a substantial increase in the e-cigarette market, any

<sup>26</sup>In the absence of additional regulation or other factors, like smoking cessation, this additional decrease from the 6-year historical trend could be attributed to increased use of other products such as e-cigarettes or hookahs.



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effect on the cigarette market would be too minor to significantly affect cigarette FET revenue. Second, comprehensive and reliable data on e-cigarette sales and prices—which would enable us to corroborate the size of the e-cigarette market and accurately identify when it became significant—are not available. Third, comprehensive and reliable data about the extent to which e-cigarettes are used as substitutes for cigarettes are also not available. Without such data and information, estimating the effect of e-cigarette use on cigarette FET revenue will be difficult, even if the e-cigarette market continues to grow.

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**Relationship between Use of E-cigarettes and Cigarettes Could Determine E-cigarettes' Effect on Cigarette FET Revenue**

How consumers' use of e-cigarettes relates to their use of cigarettes—whether e-cigarettes are substitutes, complements, or unrelated—may determine any effect of e-cigarette use on cigarette FET revenue.<sup>27</sup> The relationship between the use of e-cigarettes and cigarettes is currently unknown, according to public health officials. Table 1 describes these three possible relationships and summarizes their potential revenue effects.

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<sup>27</sup>Each of these potential relationships also has implications for public health, as discussed in FDA's preliminary economic impact analysis accompanying the April 2014 proposed deeming rule.

**Table 1: Three Possible Relationships between Use of E-cigarettes and Cigarettes and the Corresponding Potential Effects on Cigarette Federal Excise Tax (FET) Revenue**

Relationship	Description of relationship and market effect	Potential effect on cigarette FET revenue as e-cigarette use increases
Substitute	<ul style="list-style-type: none"> <li>If e-cigarettes are substitutes for cigarettes, users consume e-cigarettes instead of cigarettes. If all other factors remain unchanged, fewer cigarettes will be consumed as more e-cigarettes are consumed.</li> <li>Market cross-price elasticity of demand is greater than zero.<sup>a</sup></li> </ul>	Decrease
Complement	<ul style="list-style-type: none"> <li>If e-cigarettes are complementary to cigarettes, more cigarettes will be consumed as more e-cigarettes are consumed.</li> <li>Market cross-price elasticity of demand is less than zero.<sup>a</sup></li> </ul>	Increase
Not related	<ul style="list-style-type: none"> <li>If e-cigarettes are not related to cigarettes, e-cigarette use will have no effect on use of cigarettes and vice versa. E-cigarette use and cigarette use—and possibly users—are independent.</li> <li>Market cross-price elasticity of demand is zero.<sup>a</sup></li> </ul>	No effect

Source: GAO analysis and information from the Food and Drug Administration. | GAO-15-771.

<sup>a</sup>Market cross-price elasticity of demand refers to the percentage change in quantity demanded for one good that results from a 1 percent increase in the price of another good.

The most recent data from the National Youth Tobacco Survey by CDC and FDA showing high school students' increasing use of e-cigarettes and decreasing use of cigarettes (see fig. 2), suggest that cigarette FET revenue could decline further if these trends continue.<sup>28</sup> If the percentage of high school students using cigarettes continues to decline, and if other factors such as current levels of regulation remain constant, the number of cigarette smokers could dwindle further in the coming years as the current cohort of high school students ages. A continued decline in cigarette smoking among high school students—which could be due, in part, to increased use of e-cigarettes—would reduce cigarette FET revenue at a greater rate than the average historical trend.

FDA and CDC are undertaking efforts that, over time, may enable them to better understand e-cigarettes' relationship to cigarettes and other tobacco products, according to agency officials. For example, FDA and CDC are refining survey instruments that they use to measure adults' and youths' use of e-cigarettes, cigarettes, and other tobacco products, such as the National Health Interview Survey and the National Youth Tobacco Survey. In addition, FDA, in collaboration with the National Institutes of

<sup>28</sup>The National Youth Tobacco Survey data show that high school students' use of hookahs also increased between 2011 and 2014.

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Health, is funding a longitudinal cohort study, the Population Assessment of Tobacco and Health, which asks detailed questions about adults' and youths' use of e-cigarettes, cigarettes, and other tobacco products. FDA officials said that they expect to receive the data from the first year of the study in the summer of 2015. Further, according to FDA and CDC officials, other national surveys, state-level surveys, results of National Institutes of Health and other studies currently under way, and, if available, e-cigarette quantity data could help researchers analyze trends and observe statistical relationships.

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**Comprehensive Data  
on E-cigarette  
Quantities and Prices  
Are Not Available  
from Federal  
Agencies**

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## Treasury and FDA Do Not Collect Data on E-cigarette Quantities Comparable to Data Collected for Cigarettes and Other Tobacco Products

Treasury and FDA do not collect data on quantities of e-cigarettes on the U.S. market, and we did not identify any other federal agencies that do so.<sup>29</sup> However, Treasury collects data on quantities of domestically manufactured tobacco products that are subject to FET to ensure that the proper FET amount is paid. FDA collects data on quantities of tobacco products that it regulates under its tobacco product authorities to calculate user fees that fund FDA's tobacco regulation activities.<sup>30</sup>

Treasury and FDA collect data on quantities for different sets of tobacco products because their authorities to regulate tobacco products stem from different statutes:

- Treasury's authorities stem from the IRC.<sup>31</sup> The IRC defines "tobacco products" as cigarettes, roll-your-own tobacco, smokeless tobacco, cigars, and pipe tobacco and sets FET rates for these products.<sup>32</sup> The IRC defines each of these products as containing or consisting of tobacco.<sup>33</sup>
- FDA's tobacco product authorities stem from the Federal Food, Drug, and Cosmetic Act as amended by the Tobacco Control Act.<sup>34</sup> The Tobacco Control Act defines "tobacco product," in part, as any product

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<sup>29</sup>In a previous report, we found that although U.S. Customs and Border Protection collects data on imported goods, the agency's officials said that e-cigarette import quantities are unknown because the agency cannot distinguish the data specific to e-cigarettes, parts, and liquid from the data for larger categories of imported goods. See [GAO-15-491R](#).

<sup>30</sup>The Tobacco Control Act authorized FDA to assess and collect user fees from each tobacco manufacturer and importer subject to FDA's regulation. The act established the Center for Tobacco Products within FDA as the entity responsible for implementing the act. Pub. L. No. 111-31, § 101(b)(3), 123 Stat. 1776, 1787, 1826. The Center for Tobacco Products was formed in 2009 and the user fees collected are the sole source of funding for the center's activities. See GAO, *Tobacco Product Regulation: Most FDA Spending Funded Public Education, Regulatory Science, and Compliance and Enforcement Activities*, [GAO-14-561](#) (Washington, D.C.: June 20, 2014).

<sup>31</sup>26 U.S.C. Chapter 52.

<sup>32</sup>26 U.S.C. §§ 5701-02.

<sup>33</sup>The IRC definitions do not mention nicotine.

<sup>34</sup>21 U.S.C. §§ 387-387u.

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made or derived from tobacco.<sup>35</sup> The act granted FDA immediate authority over cigarettes, cigarette tobacco, roll-your-own tobacco, and smokeless tobacco. The act also gave FDA authority to deem by regulation any other product meeting the Tobacco Control Act's definition of tobacco product to be subject to FDA's tobacco product authorities.<sup>36</sup> Under this authority, in April 2014 FDA proposed to deem additional products, including e-cigarettes, to be subject to its tobacco product regulation.<sup>37</sup>

Treasury collects data on quantities of cigarettes and other federally taxed tobacco products from domestic manufacturers of these products, but does not collect such data for e-cigarettes, because the IRC does not define or list a tax rate for e-cigarettes. According to Treasury officials, on the basis of definitions of the tobacco products enumerated in the IRC, Treasury's ability to tax e-cigarettes—and collect data for them—depends on whether e-cigarettes contain tobacco. Treasury officials said that for e-cigarettes that do not contain tobacco, Treasury could not assert federal taxation and any related data collection by regulation; instead, such authority would require an act of Congress. As of August 2015, Treasury had not collected any FET or data associated with e-cigarettes, according to Treasury officials.<sup>38</sup>

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<sup>35</sup>In full, the Tobacco Control Act defines "tobacco product" as "any product made or derived from tobacco that is intended for human consumption, including any component, part, or accessory of a tobacco product (except for raw materials other than tobacco used in manufacturing a component, part, or accessory of a tobacco product)" that is not a drug, device, or combination product under the Federal Food, Drug, and Cosmetic Act. Pub. L. No. 111-31, § 101(a) (codified, as amended, at 21 U.S.C. § 321 (rr)).

<sup>36</sup>Pub. L. No. 111-31, § 101(b)(3) (codified, as amended, at 21 U.S.C. § 387a).

<sup>37</sup>79 Fed. Reg. 23,142.

<sup>38</sup>If Treasury were to determine that some e-cigarettes on the U.S. market contained tobacco, Treasury would evaluate whether they met any of the IRC definitions of the enumerated tobacco products by examining those e-cigarettes and their packaging and labeling to determine the appropriate tax classification, according to Treasury officials. The officials further explained that e-cigarettes that met the IRC definition of an enumerated tobacco product would be subject to the appropriate FET rate, and the manufacturers of such e-cigarettes would be required to submit data for quantities removed for distribution in the United States from domestic factories to Treasury. However, according to Treasury officials, Treasury would not be able to distinguish data for quantities of such e-cigarettes from data for quantities of tobacco products in the same tax class, because Treasury collects aggregate data by tax class for tobacco products in a manufacturer's inventory when the tobacco products leave the manufacturing facility.

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FDA does not collect data on quantities of e-cigarettes sold on the U.S. market. FDA's preliminary economic impact analysis accompanying the proposed deeming rule states that when the deemed products become subject to FDA's tobacco product authorities, the agency can begin collecting data to determine the number of regulated entities and to monitor the number and type of unique products sold to the public.

At present, FDA collects data on quantities of four tobacco products (cigarettes, cigarette tobacco, roll-your-own tobacco, and smokeless tobacco) that it regulates under its tobacco product authorities to apply the legally mandated method for allocating user fees among the domestic manufacturers and importers of those products.<sup>39</sup> In July 2014, FDA stated that if additional products are deemed subject to its tobacco regulation, the agency would conduct a new rulemaking to make appropriate changes to the user fee regulation. FDA also stated that it recognized that the issue of whether it had authority to assess user fees on some deemed products was controversial and that it intended to solicit public comment to further explore issues related to user fee assessments on tobacco products that may be deemed subject to FDA's tobacco product authorities.<sup>40</sup> According to FDA officials, if e-cigarettes become subject to user fees, FDA would likely need data on quantities of e-cigarettes sold on the U.S. market, comparable to data that the agency collects for the four products currently subject to user fees.

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<sup>39</sup>Under the Tobacco Control Act, FDA is required to use a specific method set in the Fair and Equitable Tobacco Reform Act of 2004 to allocate user fees. See Pub. L. No. 111-31, § 101(b)(3) and Pub. L. No. 108-357, § 625(c), 118 Stat. 1418, 1529-32. This method mandated assessing fees, based on quantity and FET data, on six classes of tobacco products—cigarettes, roll-your-own tobacco, snuff, chewing tobacco, cigars, and pipe tobacco—to fund a federal program, known as the Tobacco Transition Payment Program, which ended in fiscal year 2014. However, the Tobacco Control Act specified that no user fees shall be assessed on a class of tobacco products unless it is listed as subject, or deemed to be subject to FDA's regulatory authority over tobacco products as established by the act. Because cigars and pipe tobacco are currently not subject to FDA's tobacco product authorities, these two products are not subject to tobacco user fees. In implementing the legally mandated methodology to assess user fees on the four tobacco products subject to those fees, FDA does not collect data from domestic manufacturers and importers of cigars and pipe tobacco. Instead, FDA uses publicly available FET data for cigars and pipe tobacco and reallocates the share that would have been paid by domestic manufacturers and importers of cigars and pipe tobacco among the four products that it currently regulates under its tobacco product authorities.

<sup>40</sup>See "Tobacco Products, User Fees, Requirements for the Submission of Data Needed To Calculate User Fees for Domestic Manufacturers and Importers of Tobacco Products," 79 Fed. Reg. 39,302 (July 10, 2014).

Table 2 summarizes information about Treasury’s and FDA’s collection of data on quantities of cigarettes, other tobacco products, and e-cigarettes.

**Table 2: Data on the Quantities of Cigarettes, Other Tobacco Products, and E-cigarettes on the U.S. Market Collected by the Department of the Treasury and FDA as of August 2015**

Product	Data collected by Treasury (for federal excise tax purposes)	Data collected by FDA (for user fee purposes)
Cigarettes	√	√
Cigarette tobacco	Not applicable <sup>a</sup>	√
Roll-your-own tobacco	√	√
Smokeless tobacco (snuff and chewing tobacco)	√	√
Cigars	√	— <sup>b</sup>
Pipe tobacco (including hookah tobacco)	√	— <sup>b</sup>
E-cigarettes	—	—

Source: GAO analysis of information from the Department of the Treasury (Treasury) and the Food and Drug Administration (FDA). | GAO-15-771.

Notes: Although the statutory definitions of the products in the table are not identical for federal excise tax and FDA tobacco regulation purposes, Treasury and FDA receive the same data for the tobacco products as defined and enumerated in the Internal Revenue Code of 1986, as amended—cigarettes, roll-your-own tobacco, and smokeless tobacco (snuff and chewing tobacco) from the manufacturers of these products. Treasury collects these data to ensure that the proper amount of federal excise tax (FET) is paid. FDA collects these data to calculate user fees.

<sup>a</sup>The Family Smoking Prevention and Tobacco Control Act defines cigarette tobacco as any product consisting of loose tobacco that is intended for use by consumers in a cigarette (Pub. L. No. 111-31, § 101(b)(3)). The Internal Revenue Code of 1986, as amended, does not define or set a rate of tax for cigarette tobacco. According to Treasury officials, a product that meets the Family Smoking Prevention and Tobacco Control Act’s definition of cigarette tobacco may meet the Internal Revenue Code’s definition of roll-your-own tobacco or processed tobacco.

<sup>b</sup>Because cigars and pipe tobacco are not subject to FDA’s tobacco product authorities, these two products are not subject to tobacco user fees. In implementing the legally mandated methodology to assess user fees on the four tobacco products subject to those fees, FDA does not collect data from domestic manufacturers and importers of cigars and pipe tobacco. Instead, FDA uses publicly available FET data and reallocates the share that would have been paid by domestic manufacturers and importers of cigars and pipe tobacco among the four products that FDA currently regulates under its tobacco product authorities.

## Bureau of Labor Statistics Has Begun to Collect Limited E-cigarette Price Data

The Department of Labor’s Bureau of Labor Statistics (BLS) began collecting limited e-cigarette price information in September 2014 as part of its ongoing data collection for the Consumer Price Index. The Consumer Price Index provides monthly data on changes in the prices paid by urban consumers for a representative “basket” of goods and services. The index is divided into more than 200 categories representing the goods and services that an urban consumer might typically buy. BLS

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collects e-cigarette price information, under the category “tobacco products other than cigarettes,” for disposable e-cigarettes, starter kits, liquid refills, and e-cigarette replacement cartridges. These items may or may not contain nicotine and may have any flavor.

According to BLS officials, the number of observations on e-cigarette prices is too small to calculate a reliable national average price or reliable state-level prices.<sup>41</sup> According to the officials, U.S. consumers’ e-cigarette expenditures, while increasing, represent a small share of total expenditures in the representative basket of goods and services. Additionally, BLS officials explained that the Consumer Price Index sample for “tobacco products other than cigarettes” is refreshed over a 4-year cycle; the length of time it takes to fully replace samples causes Consumer Price Index sample shares (the percentage of the sample composed of the prices of a given product) to lag real-world percentages for items for which consumers’ expenditures are changing rapidly. The Consumer Price Index sample included 10 e-cigarette price observations as of June 2015 and, according to the BLS officials, will increase to 14 e-cigarette price observations by October 2015. BLS would require more resources in order to collect substantially more data on e-cigarettes, according to BLS officials.

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## Concluding Observations

Our analysis shows no current effect of the growing e-cigarette market on FET revenue from cigarettes. Given the limited information about the e-cigarette market, it is difficult to accurately estimate this market’s size or analyze its potential effect on FET revenue from cigarettes and other tobacco products. The increased regulation of tobacco products at the federal and state level, among other things, has contributed to a decline in cigarette use and FET revenue. Recent CDC studies show that e-cigarette use has significantly increased among high school students, while cigarette use has significantly declined. As the regulation of e-cigarettes unfolds and the market develops, e-cigarette use patterns may change. Federal agencies’ efforts to develop a better understanding of the relationship between e-cigarette and cigarette use will help analysts

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<sup>41</sup>An observation is the price of a product at the same store tracked over time. For example, for one e-cigarette price observation, BLS collects information about the price of the same e-cigarette product (such as an e-cigarette replacement cartridge of a particular brand, flavor, and nicotine strength) at the same store every month.



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and government officials develop a more complete understanding of the e-cigarette market and its effect on cigarette FET revenue.

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## Agency Comments

We provided a draft of this report to DOL, HHS, and Treasury. We also provided relevant portions to U.S. Customs and Border Protection and USPTO. We received technical comments from DOL, HHS, and Treasury and incorporated the comments as appropriate.

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We are sending copies of this report to the appropriate congressional committees; the Secretaries of Health and Human Services, Labor, and the Treasury; and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3149 or [gootnickd@gao.gov](mailto:gootnickd@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.



David Gootnick  
Director, International Affairs and Trade

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# Appendix I: Objectives, Scope, and Methodology

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This report examines the extent to which (1) use of electronic cigarettes (also known as e-cigarettes) affects federal excise tax (FET) revenue from cigarettes and (2) data on quantities and prices of e-cigarettes on the U.S. market are available from federal agencies.

To address these objectives, we reviewed documents and interviewed officials from the Department of the Treasury's (Treasury) Alcohol and Tobacco Tax and Trade Bureau and Treasury's Office of Tax Analysis, the Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), the U.S. Bureau of Labor Statistics (BLS), and the U.S. Patent and Trademark Office (USPTO) to obtain information and views about e-cigarette and tobacco sales and revenue trends and regulation. We determined the reliability of USPTO e-cigarette trademark registration data by interviewing cognizant USPTO officials. We also interviewed industry experts, including e-cigarette industry members, tobacco industry members, financial analysts, researchers, and representatives of public health organizations. We interviewed organizations and companies that represent a range of perspectives. We spoke with industry associations that represent small and midsized e-cigarette companies; we also spoke with representatives of leading companies that produce e-cigarettes, as measured by dollar share from available data, including an independent e-cigarette company and tobacco companies. The views expressed by these representatives are not generalizable and do not represent the views of the entire e-cigarette industry. We also attended an e-cigarette industry conference as well as three FDA public workshops featuring current research on e-cigarette product science and implications of e-cigarette use for individual health and population health.

To determine whether e-cigarette use affects cigarette FET revenue, we examined cigarette FET revenue from April 2009 through December 2014.<sup>1</sup> For this analysis, we used monthly data obtained from Treasury on

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<sup>1</sup>The last increase in the FET rate on cigarettes took effect in April 2009. The increase was enacted by Congress in the Children's Health Insurance Program Reauthorization Act of 2009 (Pub. L. No. 111-3, 123 Stat. 8), which amended the Internal Revenue Code of 1986 by raising FET rates on cigarettes and other tobacco products. In previous reports, we examined market shifts among smoking tobacco products since the act's passage; see GAO, *Tobacco Taxes: Large Disparities in Rates for Smoking Products Trigger Significant Market Shifts to Avoid Higher Taxes*, [GAO-12-475](#) (Washington, D.C.: Apr. 18, 2012), and *Tobacco Taxes: Disparities in Rates for Similar Smoking Products Continue to Drive Market Shifts to Lower-Taxed Options*, [GAO-14-811T](#) (Washington, D.C.: July 29, 2014).

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FET revenue from cigarettes removed from domestic factories or released from customs custody for distribution in the United States. In addition, using these removals data and testimonial evidence, we constructed a multivariate model that estimates the effect of e-cigarette use on cigarette FET revenue. In particular, we regressed cigarette FET revenue on a number of variables, including other tobacco products, a trend, presence of e-cigarettes on the market, and seasonality. We assessed the reliability of the data by checking the data for inconsistency errors and for completeness. We determined that the cigarette removals data were sufficiently reliable for the purposes of this report. See appendix II for more explanation of our analysis.

To examine the extent to which data on quantities and prices for e-cigarettes on the U.S. market are available from federal agencies, we interviewed cognizant officials from Treasury, FDA, CDC, BLS, and the Congressional Budget Office, as well as industry experts. To describe Treasury's collection of data on quantities of federally taxed tobacco products, we reviewed documents and interviewed officials from Treasury's Alcohol and Tobacco Tax and Trade Bureau.<sup>2</sup> To describe FDA's collection of data on quantities of tobacco products regulated by the agency, we examined FDA's regulatory actions, including its April 2014 proposed rule to deem additional products, including e-cigarettes, to be subject to the agency's tobacco product authorities, and the July 2014 final user fee rule, and we interviewed cognizant FDA officials. To describe BLS's collection of data on e-cigarette prices, we reviewed documents and interviewed BLS officials.

We conducted this performance audit from September 2014 to September 2015 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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<sup>2</sup>The Secretary of the Treasury delegated responsibility to U.S. Customs and Border Protection to collect FET on imported tobacco products.

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# Appendix II: Results of Regression Analysis Testing the Effect of Electronic Cigarette Use on Federal Excise Tax Revenue from Traditional Cigarettes

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We constructed a multivariate model to estimate the effect of electronic cigarette (e-cigarette) use on federal excise tax (FET) revenue from traditional cigarettes. The model uses monthly data obtained from the Department of the Treasury's (Treasury) Alcohol and Tobacco Tax and Trade Bureau and controls for a 6-year historical trend in cigarette FET revenue, from April 2009 through December 2014;<sup>1</sup> the presence of other tobacco products (cigars, roll-your-own tobacco, and pipe tobacco); and seasonality effects. The model also includes a time variable that tests for the presence of e-cigarettes. We used five different dates during the period January 2012 to October 2013 for the time variable, and we estimated regressions for each date. In particular, the model uses the following equation:

$$Cig\_rev_t = \alpha + \beta cigars_t + \gamma ryo\_pipe_t + \delta trend_t + \theta ecig\_slope_t + \lambda monthly\_indicators_t + \mu_t$$

where

$Cig\_rev_t$  = the amount of FET revenue, in nominal dollars, from domestic and imported cigarettes collected in period t;

$\alpha$  = an intercept;

$cigars_t$  = the sum of small and large cigar removals<sup>2</sup> in number of sticks in period t;

$ryo\_pipe_t$  = the sum of roll-your-own and pipe tobacco removals in pounds in period t;

$trend_t$  = a monthly trend that controls for the historical changes in cigarette revenue at period t;

$ecig\_slope_t$  = a dummy variable that equals one for each month on or after the date that indicates the presence of e-cigarettes in the market (because there is no clear indicator of this presence, we selected five different dates to indicate the beginning of this presence);

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<sup>1</sup>The Secretary of the Treasury delegated responsibility to U.S. Customs and Border Protection to collect FET on imported tobacco products.

<sup>2</sup>Removals are the quantity of tobacco products removed from domestic factories or released from customs custody for distribution in the United States.

**Appendix II: Results of Regression Analysis  
Testing the Effect of Electronic Cigarette Use  
on Federal Excise Tax Revenue from  
Traditional Cigarettes**

$monthly\_indicators_t$  = a set of eleven dummy variables controlling for monthly seasonality, with June as the reference month; and

$\mu_t$  = an error term assumed to be heteroskedastic and possibly autocorrelated.

**Table 3: Regression Results for the Multivariate Model Used to Estimate Effect of E-cigarette Use on Federal Excise Tax Revenue from Traditional Cigarettes**

Variable	Jan. 12	Jan. 13	Oct. 11	Oct. 12	Oct. 13
Cigars	0.180 (0.0974)	0.177 (0.102)	0.169 (0.0950)	0.236 <sup>a</sup> (0.101)	0.174 (0.0913)
Roll-your-own and pipe tobacco	23.73 (21.17)	26.94 (22.30)	25.19 (22.19)	29.15 (23.61)	33.32 (23.19)
Time trend	-4.672 <sup>c</sup> (1.107)	-4.428 <sup>c</sup> (1.229)	-4.177 <sup>c</sup> (1.007)	-5.459 <sup>c</sup> (1.212)	-4.767 <sup>c</sup> (1.106)
E-cigarette slope	0.176 (0.239)	0.0738 (0.241)	0.0102 (0.232)	0.370 (0.218)	0.153 (0.181)
January	-107.6 (76.71)	-108.0 (78.32)	-109.4 (76.41)	-97.01 (78.06)	-109.1 (75.37)
February	-216.9 <sup>b</sup> (77.61)	-216.9 <sup>b</sup> (78.40)	-217.6 <sup>b</sup> (77.52)	-210.1 <sup>a</sup> (78.68)	-217.7 <sup>b</sup> (76.30)
March	-138.6 <sup>a</sup> (67.38)	-138.4 <sup>a</sup> (65.52)	-137.9 <sup>a</sup> (66.13)	-141.2 <sup>a</sup> (64.97)	-138.8 <sup>a</sup> (64.05)
April	14.51 (69.72)	14.75 (69.79)	14.18 (69.86)	17.95 (68.49)	15.40 (68.53)
May	-28.98 (105.0)	-28.64 (105.0)	-28.86 (105.3)	-27.04 (103.4)	-28.52 (104.5)
July	-55.44 (88.17)	-56.63 (88.83)	-56.61 (88.01)	-54.45 (88.33)	-58.18 (88.08)
August	1.184 (70.71)	-0.110 (70.02)	0.588 (69.49)	-3.159 (70.20)	-1.523 (70.11)
September	-127.4 (66.02)	-128.2 (65.86)	-128.6 (65.49)	-126.3 (65.92)	-127.7 (64.32)
October	7.182 (70.83)	5.633 (71.25)	5.015 (72.15)	0.159 (70.06)	1.621 (71.04)
November	-56.96 (74.11)	-58.15 (74.60)	-60.56 (75.08)	-54.11 (74.59)	-60.33 (73.26)
December	-212.0 <sup>a</sup>	-213.7 <sup>a</sup>	-216.9 <sup>a</sup>	-204.4 <sup>a</sup>	-215.9 <sup>b</sup>

**Appendix II: Results of Regression Analysis  
Testing the Effect of Electronic Cigarette Use  
on Federal Excise Tax Revenue from  
Traditional Cigarettes**

<b>Variable</b>	<b>Jan. 12</b>	<b>Jan. 13</b>	<b>Oct. 11</b>	<b>Oct. 12</b>	<b>Oct. 13</b>
	(81.16)	(84.99)	(81.76)	(83.66)	(80.54)
Intercept	3908.4 <sup>c</sup>	3758.0 <sup>c</sup>	3619.0 <sup>c</sup>	4310.0 <sup>c</sup>	3950.3 <sup>c</sup>
	(672.1)	(711.4)	(625.0)	(699.4)	(656.5)

Source: GAO analysis of Department of the Treasury data. | GAO-15-771.

Notes: R-squared in all regressions was higher than 70 percent. Newey-West Standard errors are shown in parentheses.

<sup>a</sup>Significance at 10 percent level.

<sup>b</sup>Significance at 5 percent level.

<sup>c</sup>Significance at 1 percent level.

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

David Gootnick, (202) 512-3149 or [gootnickd@gao.gov](mailto:gootnickd@gao.gov).

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## Staff Acknowledgments

In addition to the contact named above, Christine Broderick (Assistant Director), Christina Werth, Sada Aksartova, Pedro Almoguera, Grace Lui, and Srinidhi Vijaykumar made key contributions to this report. In addition, Tina Cheng and Reid Lowe provided technical assistance.

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