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Economic Research Informing Tobacco Control Policy

The Economic Effects of Cigarette Sales and Flavor Bans on Tobacco Retail Businesses

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Abstract:

This paper uses trend analyses to examine the relationship between cigarette sales and various measures of convenience store and tobacco store business in the United States, including cigarette sales revenue, number of convenience stores, and profits. It also examines trends in employment, wages, and number of stores following the implementation of tobacco product flavor bans.

Key findings:

- **Declines in cigarette sales do not adversely impact retailers:**
  - While cigarette sales have been declining in the United States, the number of convenience stores, inside total store sales revenues, cigarette sale revenues and profits have all generally increased. In fact, the total number of convenience stores and convenience store sales revenue was substantially higher in 2021 compared to 2006. Likewise, as cigarette sales have declined, the number of tobacco stores and tobacco-store sales revenues have increased.
  - Compared to other product categories we examined, cigarettes have the lowest profit margin for convenience stores, whereas food services have the highest profit margin.
  - Over time, cigarettes represent a declining share of convenience store revenues.
- **Bans on the sale of flavored tobacco products do not adversely impact retailers:**
  - Several states have banned the sale of flavored tobacco products. Massachusetts was the first state in the US to ban the sale of all flavored tobacco products - flavored e-cigarettes in 2019 and menthol cigarettes and other flavored tobacco products in 2020. New York and Rhode Island banned the sale of flavored e-cigarettes in 2020. Data demonstrate that these flavor bans did not lead to any meaningful reduction in the number of convenience stores, tobacco stores or convenience store employees, nor did they reduce convenience store wages.

Summary:

Taken together, the data demonstrate that tobacco retail businesses have successfully adapted to changes in market conditions, including the implementation of tobacco product flavor bans. Claims of significant negative impact of tobacco control policies that reduce demand for tobacco products are exaggerated.

Introduction

The federal government, numerous states, and many localities have implemented policies banning the sale of flavored tobacco products. The most comprehensive policies ban the sale of all flavored tobacco products without exemptions for certain flavors, products or retailers.

In 2009, as part of the Family Smoking Prevention and Tobacco Control Act, Congress banned characterizing flavors in cigarettes except for menthol. In February 2020, the United States Food and Drug Administration (FDA) prioritized enforcement against flavored cartridge/pod-based e-cigarette products, except for menthol and tobacco flavor.

Massachusetts became the first state in the US to ban the sale of all flavored tobacco products - including menthol cigarettes and flavored e-cigarettes in 2019.[1] The only exception to the Massachusetts law is that flavored tobacco products can still be sold at licensed smoking bars where consumption must occur on-site. Moreover, in 2020, New Jersey, New York, and Rhode Island enacted bans on the sale of flavored e-cigarettes. In January 2021, California banned nearly all flavored tobacco products; the only exemptions from the policy are loose leaf tobacco, premium cigars, and hookah tobacco. Other state flavor bans have been limited to specific products.

There have been significant local level efforts to ban flavors in tobacco products. According to The Campaign for Tobacco-Free Kids, more than 365 localities had enacted laws restricting flavored tobacco sales in some manner, with more than 125

[1] Massachusetts' flavor ban became effective 11/27/2019 for e-cigarettes and 06/01/2020 for all other products.

localities prohibiting the sales of all flavored tobacco products, including menthol, without exception (CTFK, 2023).

A common argument against implementing these laws includes concerns that these policies harm retailers who sell tobacco/vaping products. This argument is not new. Claims of adverse economic impacts to businesses, job losses, and reduced economic activity have been made about a variety of measures that affect the demand for tobacco products including tobacco taxes, smoke-free air laws, tobacco product display bans, tobacco product plain packaging policies, point-of-sale corrective statements, and others. A review of the literature from methodologically sound studies contradicts this claim, concluding that measures that affect the demand for tobacco products have either no negative economic impact or, in many cases, have positive economic effects (NCI/WHO, 2016).

This report examines the relationship between cigarettes sales and several measures of convenience store and tobacco store business and the effects of tobacco product flavor bans on various types of businesses.

Trends in Cigarettes Sales and Measures of Convenience Store Business

Using trend analyses, we first investigate the relationship between cigarette sales and several measures of convenience store and tobacco store business in the United States. Figures 1-8 investigate the relationship between cigarette sales and various measures of convenience store business. Data on cigarette sales are from the Federal Trade Commission and data on convenience stores come from yearly industry reports from Convenience Store News. Figures illustrating trends are presented and discussed below. Figures 9-10 investigate the relationship between cigarette sales and various

measures of tobacco store business. Data on cigarette sales are from the Federal Trade Commission and data on tobacco stores come from the United States Census Bureau's Economic Census.

Figure 1 shows data on overall cigarette sales (total number of cigarettes sold) and the total number of convenience stores in the United States. Cigarette sales have been declining steadily over time for a variety of reasons, including various policy measures aimed at reducing the demand for cigarettes. At the same time, the number of convenience stores has been generally rising over time, however, the number of stores declined slightly for the last few years of data (2018-2021). The recent decline in stores is likely a result of the COVID-19 pandemic. The pandemic had a significant effect on convenience stores as there was a significant increase in the number of people working from home or switching to hybrid schedules, a sharp decline in leisure and business travel, a sharp decline in fuel demand as consumers stopped driving, an increase in costs as convenience stores needed to adhere to health and safety protocols and adopt new strategies and technologies such as contactless payments and curbside pickup. All of these COVID-19 related changes took their toll on many convenience stores. Total cigarette sales and the number of convenience stores per million population shows a similar trend, see Appendix, Figure 15.

Figure 1

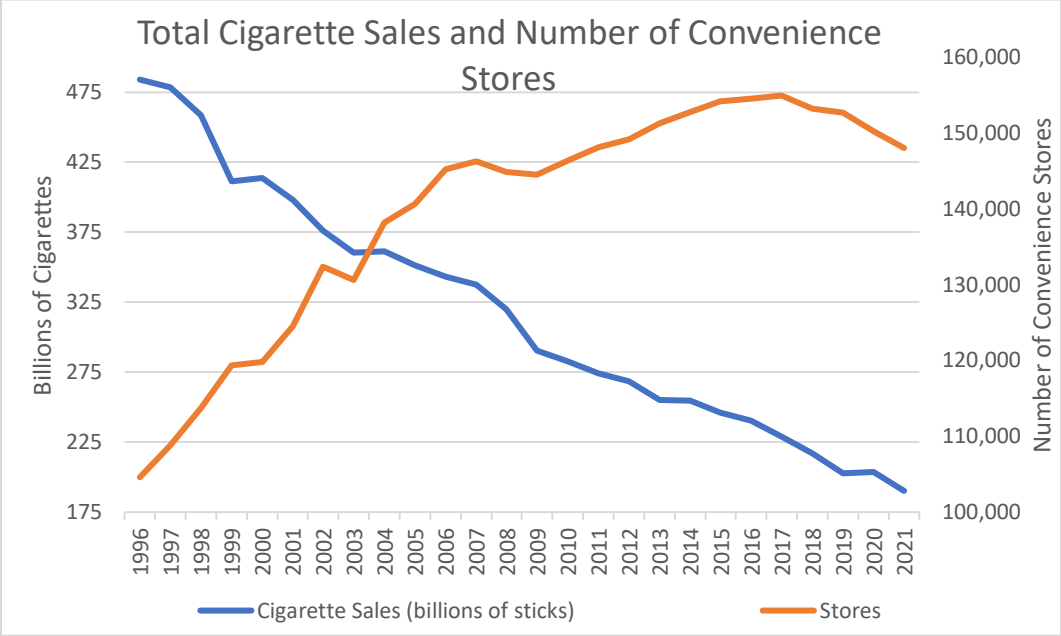


Figure 2 shows trends in cigarette sales and inflation-adjusted total sales revenue of convenience stores from 1996 through 2021. Convenience store sales revenue rose steadily while cigarette sales declined from 1996-2008. After 2008, there is considerable variability from year to year in revenues. This variability is not correlated with cigarette sales, but is instead likely to reflect a variety of other factors, particularly in overall changing economic activity, and of course, the COVID-19 pandemic. While there is some variability, total convenience store sales revenue is significantly higher in 2021 compared to 2006, despite the large decline in cigarettes sales over this period. Total cigarette sales and the inflation-adjusted total sales revenue per convenience store from 1996 through 2021 shows a similar trend, see Appendix, Figure 16.

Figure 2

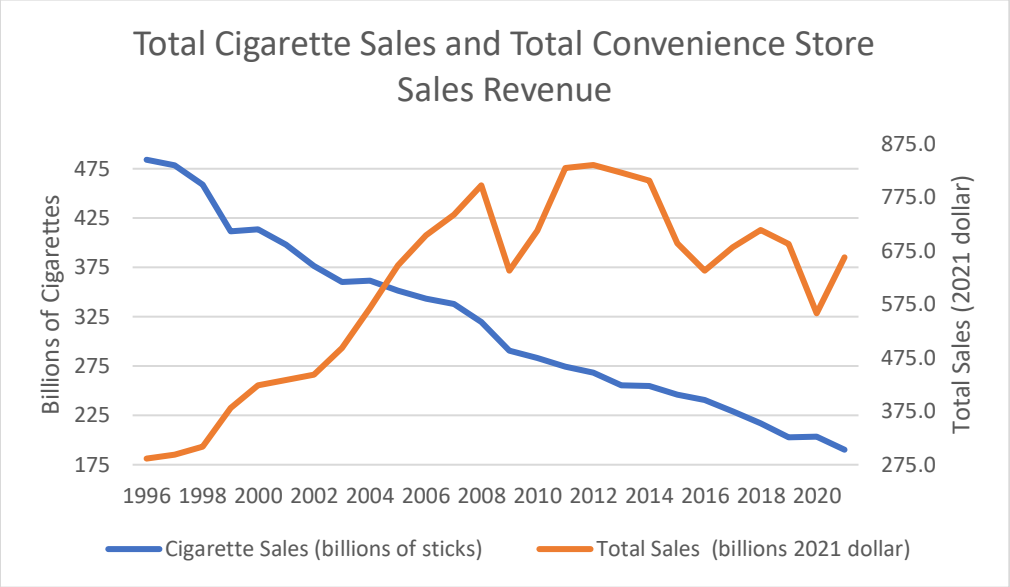


Figure 3 shows trends in cigarette sales and inflation-adjusted inside-store sales revenue. Inside-store sales revenue excludes revenue from convenience store fuel sales. Given that motor vehicle fuel sales account for a significant share of overall convenience store sales revenue, inside-store sales revenue provides a better indicator for trends over time because they exclude more volatile fuel sales revenue. Inside-store sales revenues are rising over time while at the same time cigarette sales are declining steadily. Total cigarette sales and inflation-adjusted inside-sales revenue per convenience store show a similar trend, see Appendix, Figure 17.

Figure 3

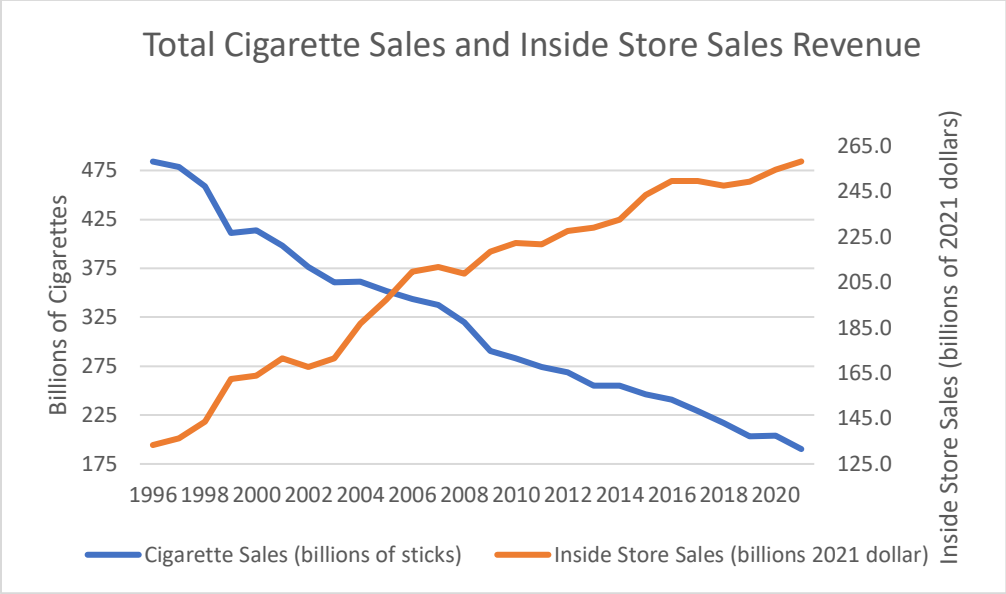
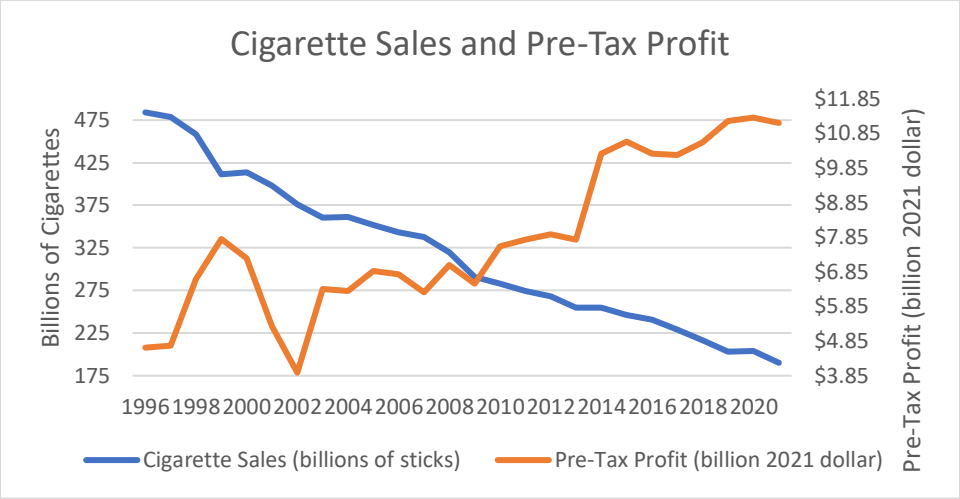


Figure 4 shows trends in cigarette sales and a measure of convenience store profitability (inflation-adjusted pre-tax income) over time. Pre-tax income is defined as total revenues, less expenses, and so is more representative of convenience store profits than sales revenue. From 1996-2009, pre-tax income is highly variable while overall cigarette sales are declining. The variability in pre-tax income over this time is likely tied to variability in overall economic activity, with income rising during economic upswings and falling during economic downturns. From 2009-2021, pre-tax income is generally rising while at the same time overall cigarette sales are declining. Total cigarette sales and inflation-adjusted pre-tax income per store show a similar trend, see Appendix, Figure 18.

Figure 4



Figures 5 and 6 show sales revenue and profit margins for various convenience store products. Sales revenue is defined as the number of products sold multiplied by the price per unit sold. Sales revenue does not take into account the cost of goods sold (COGS). Profit margins, on the other hand, do take into consideration COGS. In particular, profit margins are defined as: (sales revenue – COGS)/sales revenue*100. Therefore, profit margins can be thought of as the fraction of the sales revenue a store retains for each product. Convenience stores are profit-maximizing organizations and have an incentive to sell higher margin products. The higher the profit margin, the greater the fraction of sales revenue the store retains from the sale of each product.

Figure 5 shows inflation-adjusted sales revenues for products sold inside convenience stores from 2000-2021. Despite a steady decline in the number of cigarettes sold between 2000-2021, sales revenues from cigarettes over this time period are variable with general increases from 2000 to 2010, relative stability from 2010-2017, and slight declines 2017-2021. Sales of other tobacco products, wine and liquor, and food services are generally increasing over time while beer/malt beverage sales revenues are more constant over time with only a slight increase from 2000-2021.

Figure 5

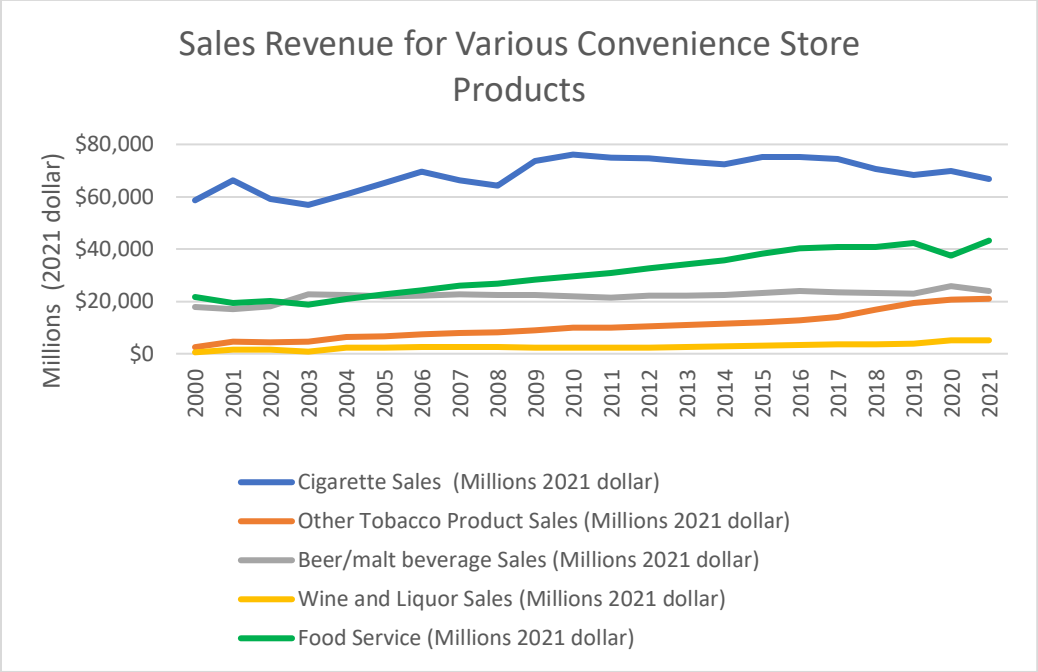


Figure 6 shows profit margins for various products sold by convenience stores over time. Food services have the largest profit margin among the products that are graphed, consistently higher than 40% from 2000-2017 (data for 2018-2021 are not available). Cigarettes, on the other hand, have the lowest profit margins among the other convenience store products that are graphed including beer/malt liquor, wine and liquor, other tobacco products, and food service. Among the products that are graphed in Figure 6, the least profitable product sold by convenience stores is cigarettes, consistently generating the smallest fraction of revenue that a convenience store retains since year 2000.

Figure 6

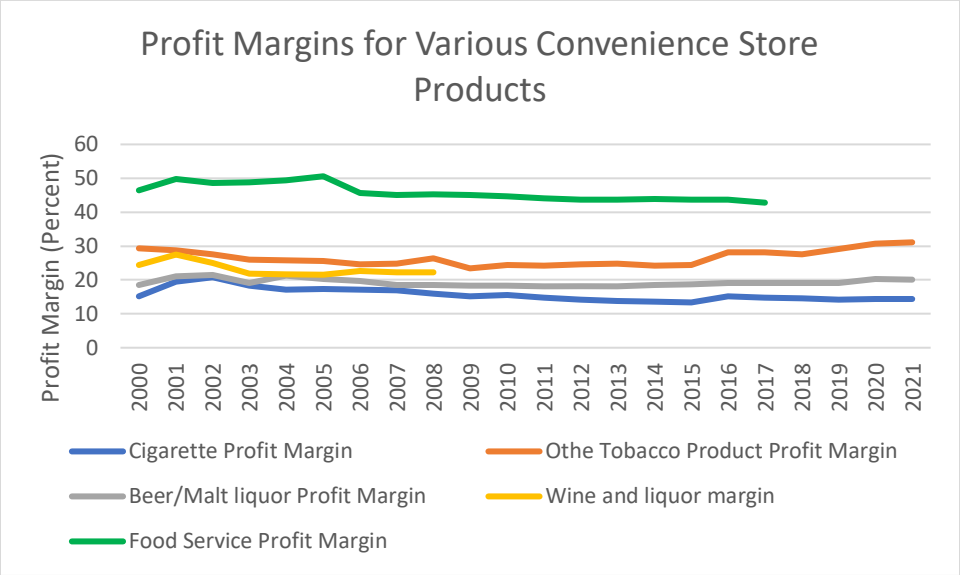


Figure 7 shows the fraction of total sales revenue that cigarettes, other tobacco products, and all other non-tobacco products generate in convenience stores. The fraction of total sales revenue generated by cigarettes decreased from 15.3% in 2001 to approximately 10% in 2006. While the fraction of total sales revenue generated by cigarettes was quite variable between 2006-2021, by 2021 it was virtually identical to the 2006 value. On the other hand, the fraction of total sales revenue that other tobacco products generate has generally increased from 0.6% in 2000 to 3.7% in 2020 before declining to 3.2% in 2021. The fraction of total sales revenue that non-tobacco products generate for convenience stores increased from 83.7% in 2000 to 90.9% in 2008 and then declined slightly to 86.8% by 2021.

Figure 7

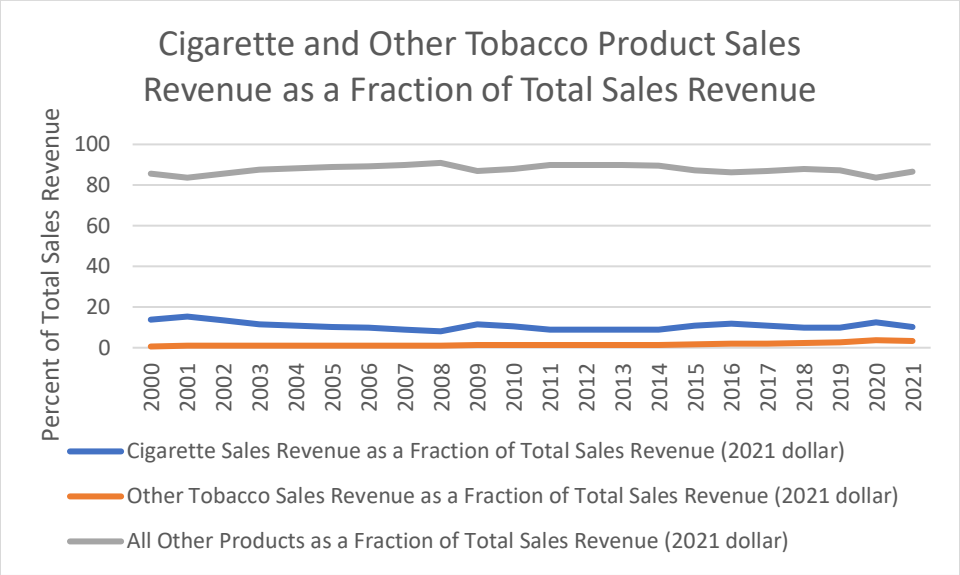
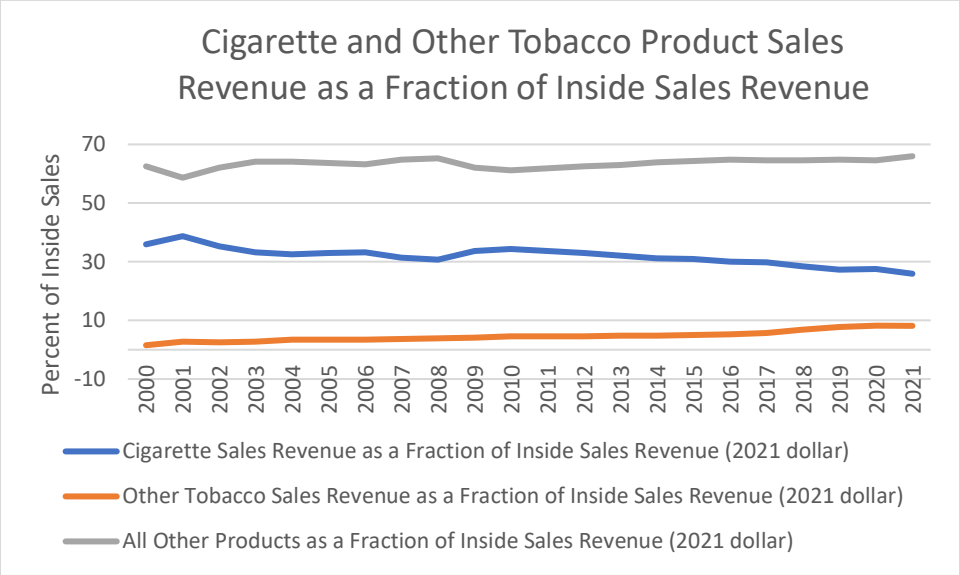


Figure 8 shows the fraction of inside-sales revenue that cigarettes, other tobacco products, and all other non-tobacco products generate. Given that motor vehicle fuel sales account for a significant share of overall convenience store sales revenue, inside-store sales revenue provides a better indicator for trends over time because they exclude more volatile fuel sales revenues. A more consistent downward pattern is found for the fraction of inside-sales revenues that cigarettes generate. The fraction of inside-sales revenue generated by cigarettes has decreased from 38.7% in 2001 to approximately 25.9% in 2021. A consistent upward pattern is found for the fraction of inside-sales revenues that other tobacco products generate. The fraction of inside-sales revenue generated by other tobacco products has increased from 1.5% in 2001 to 8.1% in 2021. The fraction of inside-sales revenue that non-tobacco products generate for convenience stores increased from 58.64% in 2000 to 65.97% in 2021.

Figure 8



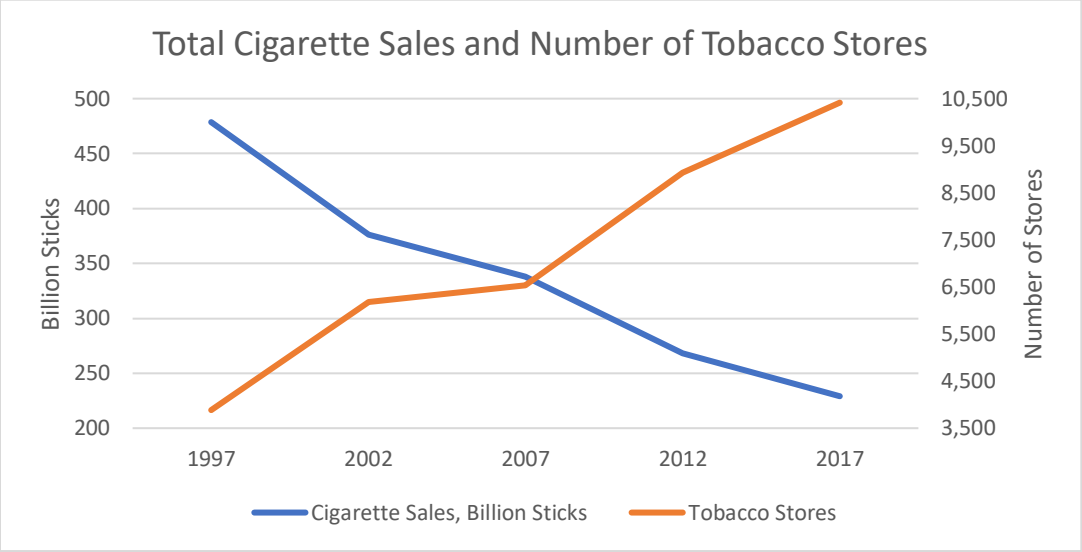
While the simple trend analyses presented above are not definitive, they are consistent with the findings that public policies that decrease cigarette sales do not adversely impact convenience stores. These trend data suggest that convenience stores successfully adapt to changes in market conditions, including the implementation of measures that affect the demand for tobacco products.

Trends in Cigarettes Sales and Measures of Tobacco Store Business

As discussed above, given a larger reliance on tobacco sales, tobacco stores could be more impacted by policies that affect the demand for tobacco than convenience stores. We use data from the Census Bureau's Economic Census to examine the relationship between tobacco sales and several measures of tobacco store business. Tobacco stores are defined as establishments primarily engaged in retailing cigarettes, cigars, tobacco, pipes, and other smokers' supplies. Tobacco stores do not include vape shops. In Figure 9 we show data on overall cigarette sales and the total number of

tobacco stores from the five most recent Economic Censuses (from 1997 through 2017).[2] As we reported above, cigarette sales have been declining steadily over this time period, while at the same time the recent Economic Census data show that the number of tobacco stores has been rising. Total cigarette sales and the number of tobacco stores per million population shows a similar trend, see Appendix, Figure 19.

Figure 9

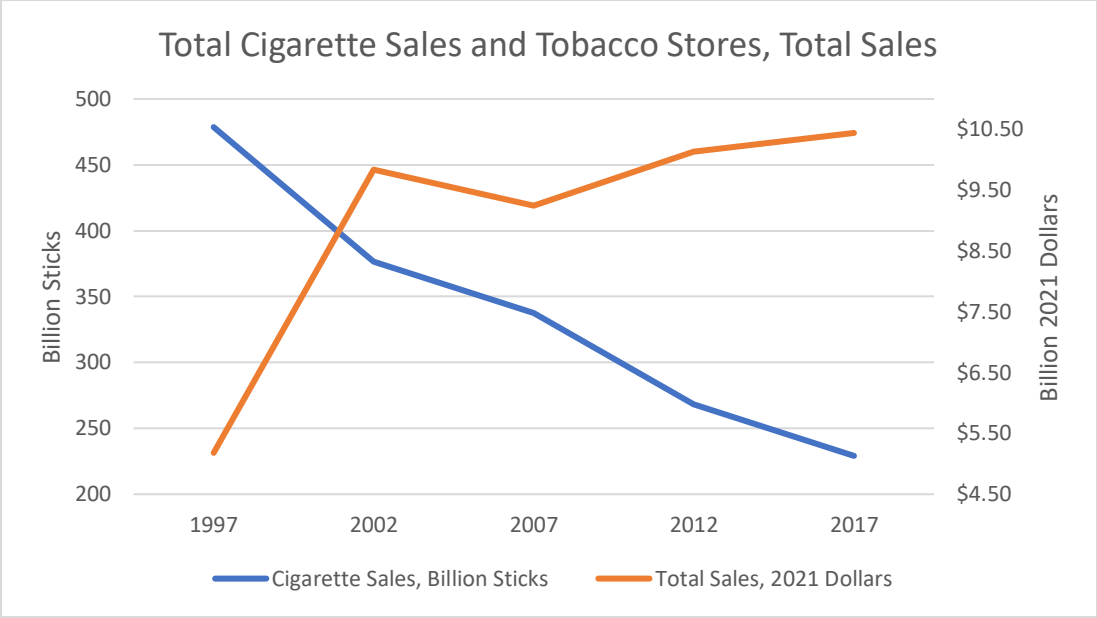


Using data from the five most recent Economic Censuses, Figure 10 shows trends in cigarette sales and inflation-adjusted total dollar sales revenue of tobacco stores (in 2021 dollars). Overall tobacco store sales revenues have been rising over time, despite the steady decline in overall cigarette sales. During the same time period, sales revenue per store has generally declined over time, paralleling the decline in overall cigarette sales. See Appendix, Figure 20. The downward trend in sales per tobacco store likely reflects the increased saturation of the market, with the number of stores rising overall and in per-capita terms, despite the long-term downward trend in smoking in the US. The increase in the number of tobacco stores over time, even as sales revenue per store

[2] Data from the 2022 Economic Census will not be available until March 2024.

has fallen, suggests that tobacco stores are still generally profitable, despite reductions in overall cigarette demand.

Figure 10



Impact of Flavored Tobacco Product Bans on the Tobacco Retail Industry

Despite claims that tobacco flavor bans will cause companies to go out of business and employees to lose their jobs, there is very little scientific evidence on this topic. A report by the Johns Hopkins University summarizes the economic arguments as to why a ban on flavored tobacco products would have a very limited impact on businesses (Institute for Global Tobacco Control, 2020). First, a majority of retailers selling flavored tobacco products do not rely on these products as their only or primary source of their revenue. Second, consumers are likely to spend money previously spent on flavored tobacco products on other purchases, including other non-flavored tobacco products and other goods and services. Finally, workers and other resources that were once used in the supply and sale of flavored products will likely be redirected to other sectors or other jobs. The report suggests that adult-only vape shops might be more

impacted by a vaping flavor ban than other businesses but suggested that these types of specialized retailers could likely modify their product offerings to drop flavors products and add other products such that there would be little to no impact on the number of businesses and workers they employ.

Tobacco flavor bans have been found to decrease tobacco demand through increased tobacco cessation and decreased tobacco initiation (Chaloupka 2020; USDHHS 2020). As noted previously, research has demonstrated that measures that affect the demand for tobacco products have either no negative economic impact or, in many cases, have positive economic effects (NCI/WHO, 2016). We graphically examine trends in employment, wages, and number of establishments in Massachusetts and all neighboring states for the period first quarter 2018 through the fourth quarter 2021. Massachusetts and its surrounding states are ideal states to investigate the effects of flavor bans as Massachusetts' flavor ban on e-cigarettes went into effect on 11/27/2019 and its ban on other flavored tobacco products (including menthol cigarettes) went into effect on 6/1/2020. Moreover, New York's flavor ban on e-cigarettes went into effect on 5/18/2020 and Rhode Island's flavor ban on e-cigarettes went into effect on 3/26/2020. Finally, Connecticut, New Hampshire, and Vermont did not enact a flavor ban on tobacco during this time period. In our analyses, we investigate trends in establishments, employment, and wages for the following types of businesses: convenience stores; gas stations with convenience stores; tobacco stores; tobacco product and electronic cigarette merchandise wholesalers. These analyses do not isolate the impact of the COVID-19 impact, which as previously described, significantly impacted convenience stores.

Figure 11 shows the number of convenience stores in each state from the first quarter 2018 through the fourth quarter 2021. Overall, in states that had some sort of

flavor restriction, the number of convenience stores increased immediately after the policy went into effect, while in the states without a flavor policy, there were minimal changes. Specifically, following the ban on flavored e-cigarettes during the fourth quarter of 2019, the number of convenience stores in Massachusetts increased for four straight quarters and after the ban on flavored cigarettes during the second quarter 2020 the number of convenience stores continued to increase for an additional two quarters before declining slightly through the third quarter 2021 and then rising slightly again in the fourth quarter 2021. Similarly, in New York, following the ban on flavored e-cigarettes during the second quarter of 2020, the number of convenience stores increased for six straight quarters. By the fourth quarter 2021, New York had the highest number of convenience stores over the entire time period we examined. Following the ban on flavored e-cigarettes in Rhode Island, the number of convenience stores increased as well, from the first quarter 2020 (when the ban went into effect) to the fourth quarter 2021. Comparing these results to states that did not enact a flavor ban during this time period: Vermont experienced a decline in the number of convenience stores from the fourth quarter 2019 to the fourth quarter 2021 while New Hampshire and Connecticut experience slight increases in the number of convenience stores.

The number of gas stations with convenience stores remained steady in both the states that enacted flavor bans and those that did not for the period 2018-2021. See Appendix, Figure 21.

Figure 11

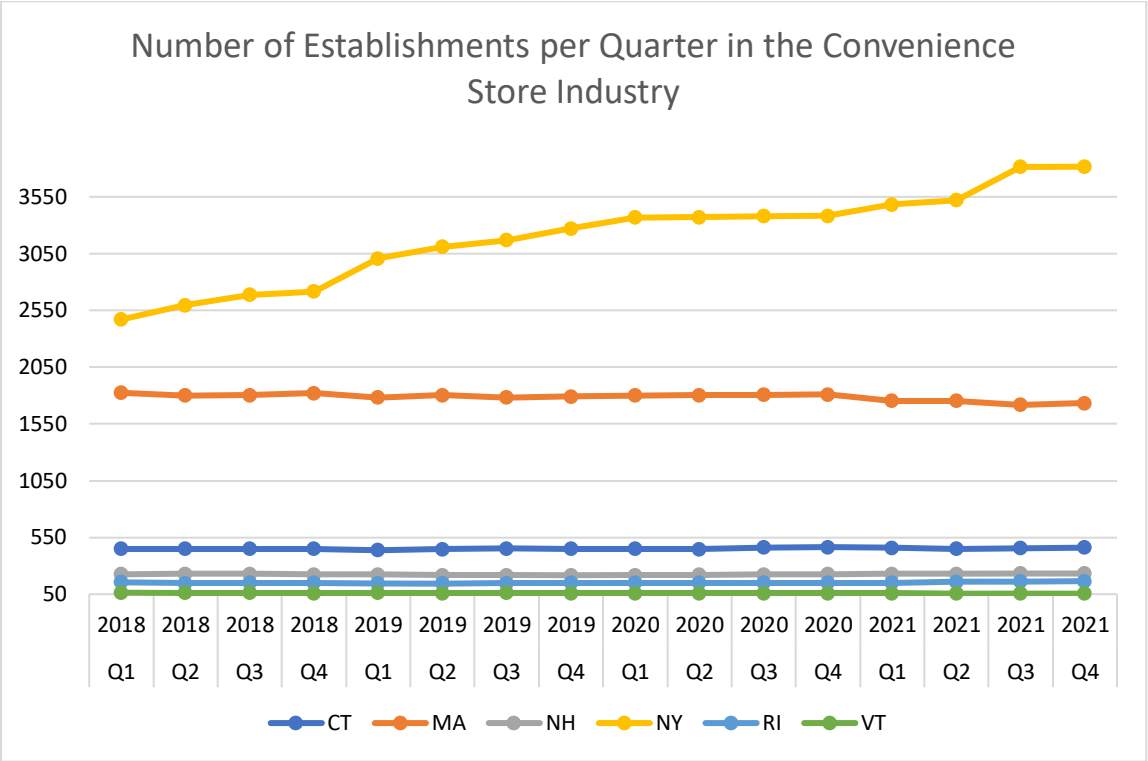


Figure 12 shows the number of tobacco retail stores in each state from the first quarter 2018 through the fourth quarter 2021. The number of tobacco retail stores in Massachusetts and New York slightly declined following policy implementation, while in Rhode Island and in states without a policy, the number of tobacco retail stores increased slightly. Massachusetts experienced a slight decline in the number of tobacco stores in the two quarters following the fourth quarter 2019 when they enacted the ban on flavored e-cigarettes, but they experienced a slight increase in the number of tobacco stores in the two quarters following the second quarter 2020 when they enacted the ban on flavored cigarettes. Overall, the number of tobacco stores decreased between the fourth quarter 2019 when the first ban went into effect and the fourth quarter 2021. Similarly, New York experienced a slight decline in tobacco stores from the second quarter 2020 when the e-cigarette flavor ban went into effect to the fourth quarter 2021.

Rhode Island experienced a gain in tobacco stores from the first quarter 2020 when the e-cigarette flavor ban went into effect to the fourth quarter 2021. Comparing these results to states that did not enact a flavor ban during this time period: Vermont, New Hampshire, and Connecticut experienced slight increases in the number of tobacco stores between the fourth quarter 2019 and the fourth quarter 2021.

The number of tobacco product and electronic cigarette merchandise wholesalers remained relatively steady in both states that enacted flavor bans and those that did not. See Appendix, Figure 22.

Figure 12

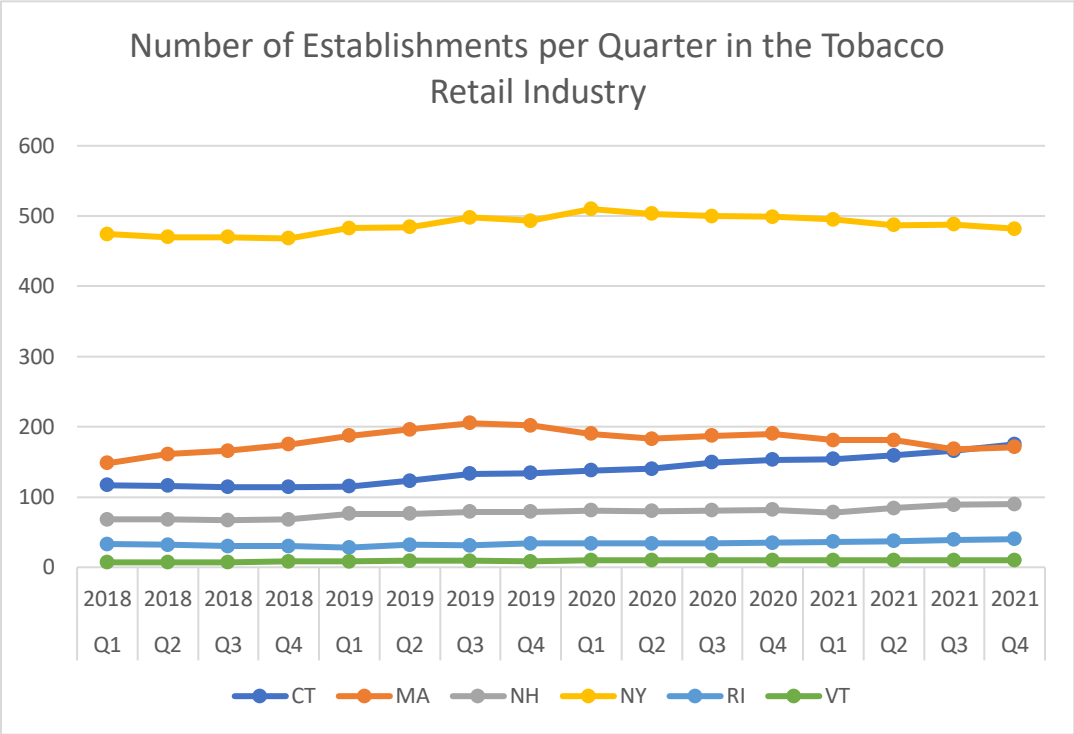
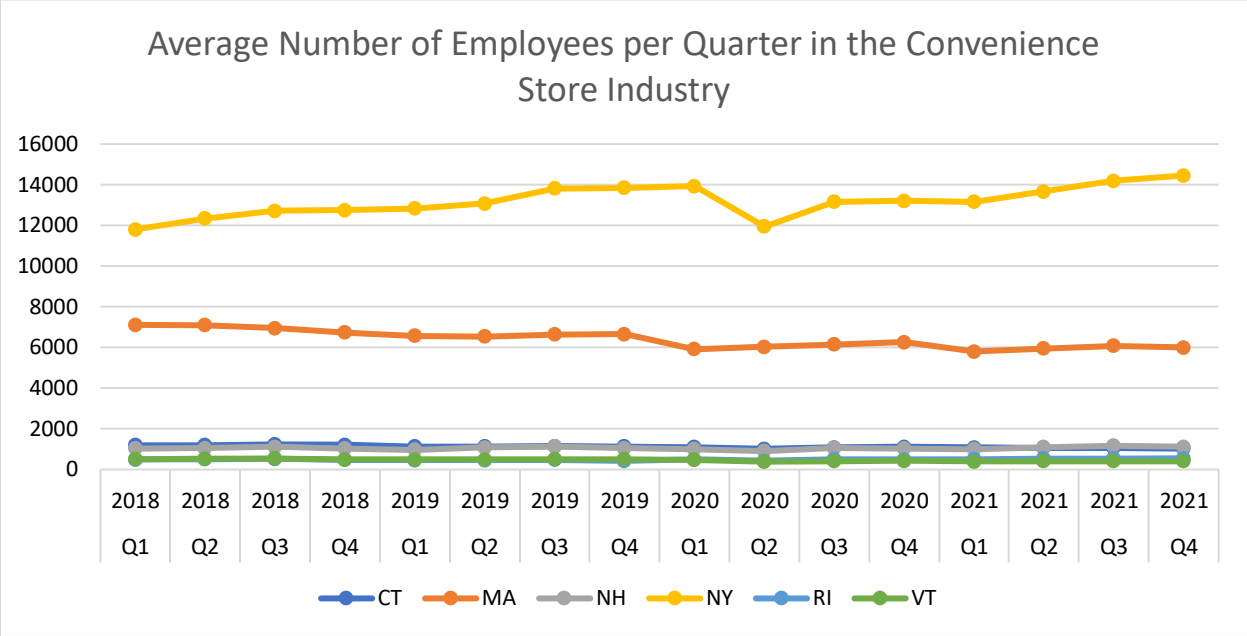


Figure 13 shows the number of employees working in convenience stores in each state from the first quarter 2018 through the fourth quarter 2021. Employment trends were also mixed, with a slight decline in Massachusetts, slight increase in Rhode Island, and a massive increase in New York after their policies went into effect. In states that did not enact a policy change, employment declined in Connecticut and Vermont and

increased in New Hampshire. In Massachusetts, the number employees working in convenience stores decreased for one quarter following the e-cigarette flavor ban, but then increased over two quarters after the ban on flavored cigarettes went into effect. Overall, the number of employees working in convenience stores in Massachusetts declined slightly between the fourth quarter 2019 and the fourth quarter 2021, but it is difficult to isolate the impact of the COVID-19 impact from these findings. Unlike the decline in Massachusetts, New York experienced large gains in convenience store employees following the flavor ban on e-cigarettes. The number of employees increased from 11,945 during the second quarter 2020 to 14,453 by the fourth quarter 2021. There was also a slight increase in the number of employees working in convenience stores in Rhode Island from 1,105 during the first quarter 2020 (when the ban went into effect) to 1,122 by the fourth quarter 2021. Comparing these results to states that did not enact a flavor ban during this time period: Connecticut and Vermont both experienced declines in the number of employees working in convenience stores between the fourth quarter 2019 as the fourth quarter 2021, whereas New Hampshire experienced a slight gain in employment.

Figure 13



The trends in number of employees working in gas stations with convenience stores in each state for the first quarter 2018 through the fourth quarter 2021 is very similar to the trends in the number of employees working in convenience stores, except there is a slight decrease (not increase) in the number of employees working in gas stations with convenience stores in New Hampshire between the fourth quarter 2019 and the fourth quarter 2021. The trends can be seen in Figure 23 of the Appendix.

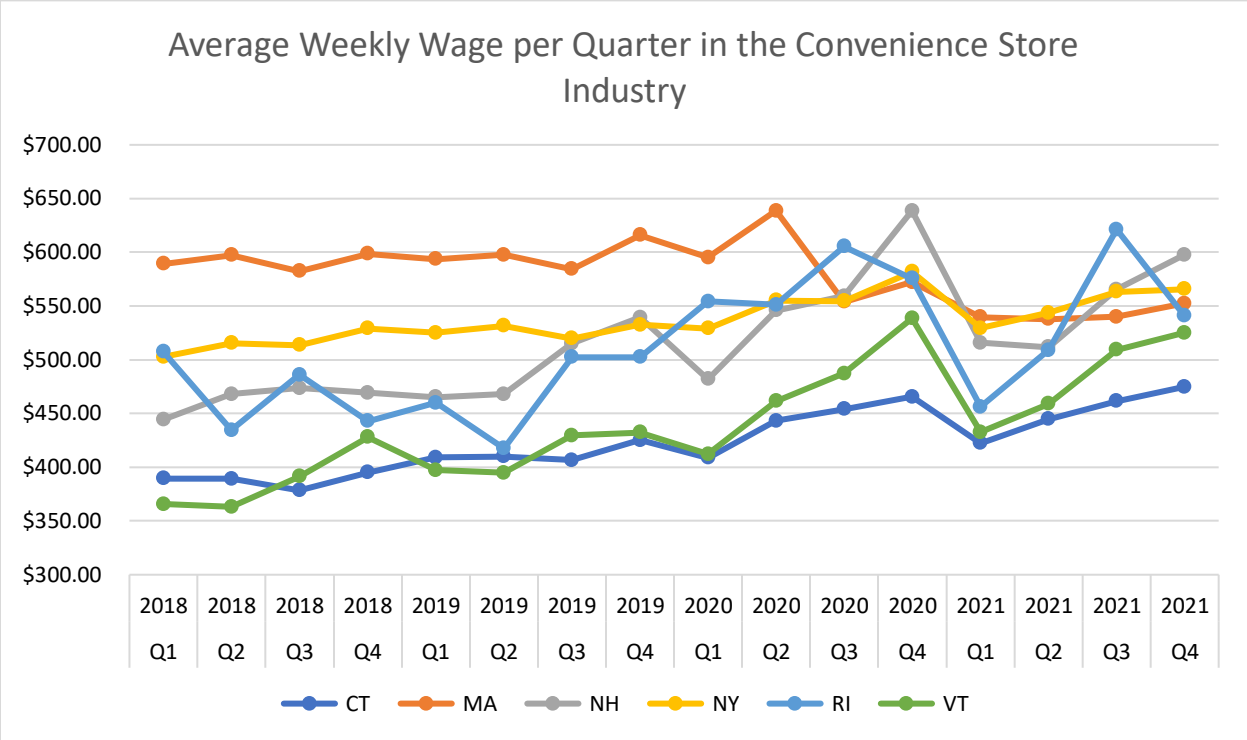
In states that enacted flavor bans (MA, NY, and RI), the number of employees working in tobacco stores was higher in the fourth quarter 2021 than in the quarter that the flavor ban was enacted. Comparing these results to states that did not enact a flavor ban during this time period: Connecticut and New Hampshire experienced slight increases in the number of tobacco store employees between the fourth quarter 2019 and the fourth quarter 2021, whereas Vermont experienced a slight decline in employees over this time period. See Appendix, Figure 24.

In states that enacted flavor bans (MA, NY, and RI), there was a small decrease in the number of employees working for tobacco wholesalers from the quarter that the flavor ban was enacted to the fourth quarter 2021. This pattern is consistent with tobacco wholesaler employment in states that did not enact flavor bans with the exception of Connecticut which saw an increase of five employees between the fourth quarter 2019 and the fourth quarter 2021. See Appendix, Figure 25.

Figure 14 shows the real weekly wages (in 2022 3Q dollars) for convenience store employees in each state from the first quarter 2018 through the fourth quarter 2021. The estimated wages for each state are more variable than the number of establishments or employees. In Massachusetts, the average real weekly wage of convenience store workers increased from $584.45 in the third quarter 2019 (before the e-cigarette flavor ban) to a high of $638.74 in the second quarter of 2020 (the quarter the cigarette flavor ban was enacted). There was a subsequent decline in average weekly wages through the second quarter 2021 before increasing slightly in the third and fourth quarter 2021. In New York, the average real weekly wage increased after the enactment of the e-cigarette flavor ban. The weekly wages in New York between the second quarter 2020 (when the ban went into effect) and the fourth quarter of 2021 increased from $551.04 to $565.56. Rhode Island saw among the most variability in real weekly wages. The average real weekly wage among convenience store employees in Rhode Island increased for two straight quarters following the enactment of the e-cigarette flavor ban and then large fluctuations in wages ensued. In the end, the real wages Rhode Island convenience store workers earned in the fourth quarter 2021 were larger than the real wages they earned before the enactment of the ban. Comparing these results to states that did not enact a flavor ban during this time period, the real weekly wage rate generally increased for

employees working in convenience stores in Connecticut, Vermont, and New Hampshire between the fourth quarter 2019 and the fourth quarter 2021.

Figure 14



Following the enactment of flavor bans in Massachusetts, New York, and Rhode Island, the real weekly wages for employees of gas stations with convenience stores increased. A similar pattern of real wage growth between the fourth quarter 2019 and the fourth quarter 2021 in Vermont, New Hampshire, and Connecticut – states that did not enact a flavor ban. See Appendix, Figure 26.

In Massachusetts and Rhode Island, there was a substantial increase in real wages for tobacco store employees following the enactment of flavor bans, but New York experienced a small decrease in real wages for tobacco store employees following the enactment of the e-cigarette flavor ban. The real weekly wages in states that did not enact a ban generally rose over this time period. See Appendix, Figure 27.

Finally, in Massachusetts and New York, real wages for tobacco wholesale employees were higher in the fourth quarter 2021 than the quarter when e-cigarette flavor bans went into effect in each state. However, the real weekly wage in Rhode Island decreased slightly between the first quarter 2020 (when ban became effective) to the fourth quarter 2021. The real weekly wages for employees working for tobacco product and electronic cigarette merchandise wholesalers in New Hampshire, Vermont, and Connecticut generally rose from the fourth quarter 2019 to the fourth quarter 2021. See Appendix, Figure 28.

To summarize, the trend analyses presented above are consistent with the findings that tobacco flavor bans do not adversely impact convenience store, gas station with convenient store, tobacco store, and tobacco wholesaler's businesses. The trend data suggest that convenience stores, gas stations with convenience stores, tobacco stores, and tobacco wholesalers successfully adapt to changes in market conditions, including the implementation of flavor bans on tobacco products.

Conclusion

This report seeks to understand the actual impact of reduced demand for cigarettes and flavored tobacco products on key measures of the tobacco retail business. Empirical evidence from peer-reviewed journals and various measures of retail business trends demonstrate that measures that reduce demand for cigarettes and reduce cigarette consumption do not adversely impact convenience store and other tobacco retail business. Claims that tobacco control measures that reduce cigarette consumption will have a devastating economic impact are greatly overstated.

More specifically, data show that any proclaimed negative economic impact resulting from tobacco flavor bans are also exaggerated. In this report, we graphically

examined trends in employment, wages, and number of establishments in Massachusetts and all neighboring states for the period first quarter 2018 through the fourth quarter 2021. The trend analyses presented above are consistent with the finding that tobacco flavor bans do not adversely impact convenience stores, gas stations with convenient stores, tobacco stores, and tobacco wholesaler's businesses. The trend data suggest that these businesses successfully adapt to changes in market conditions, including the implementation of flavor bans on tobacco products.

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Appendix

Figure 15

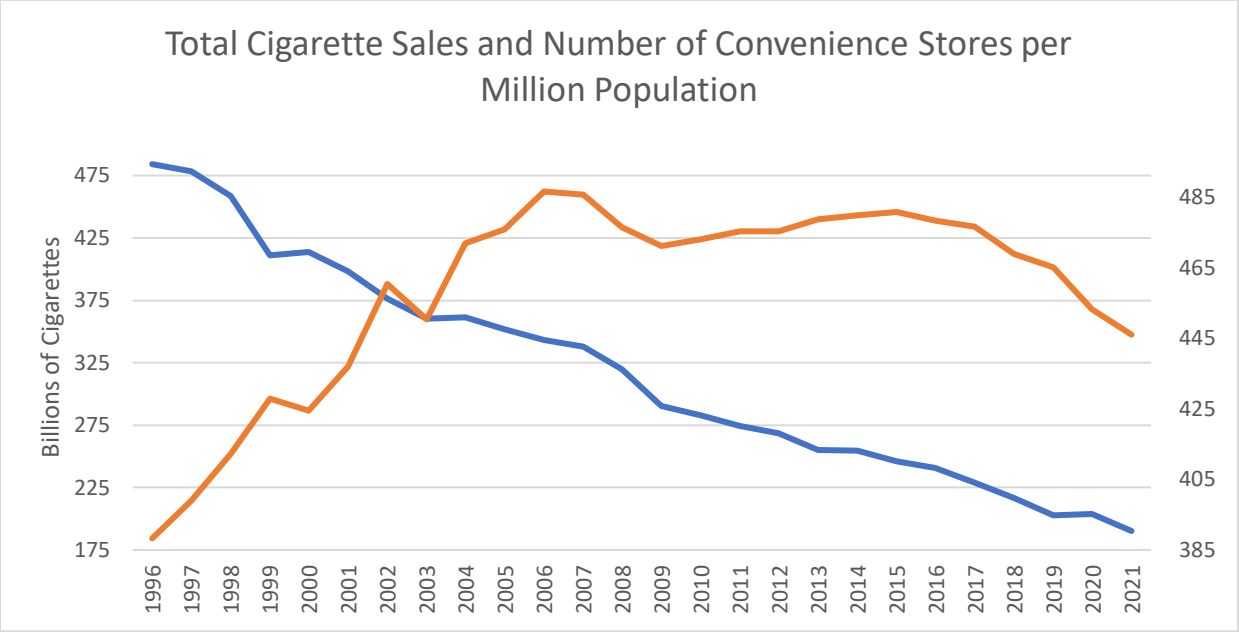


Figure 16

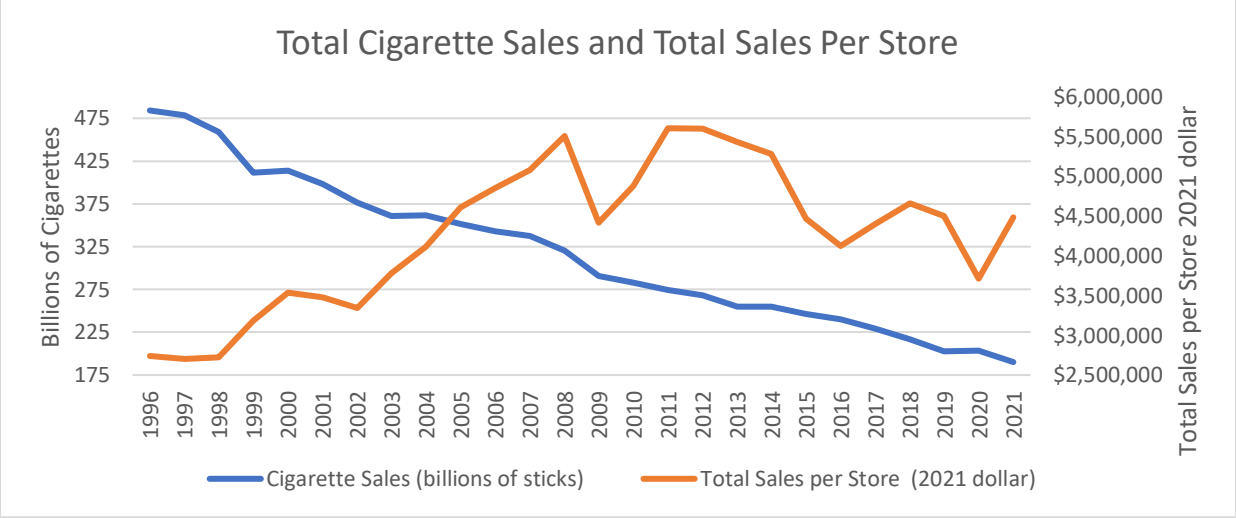


Figure 17

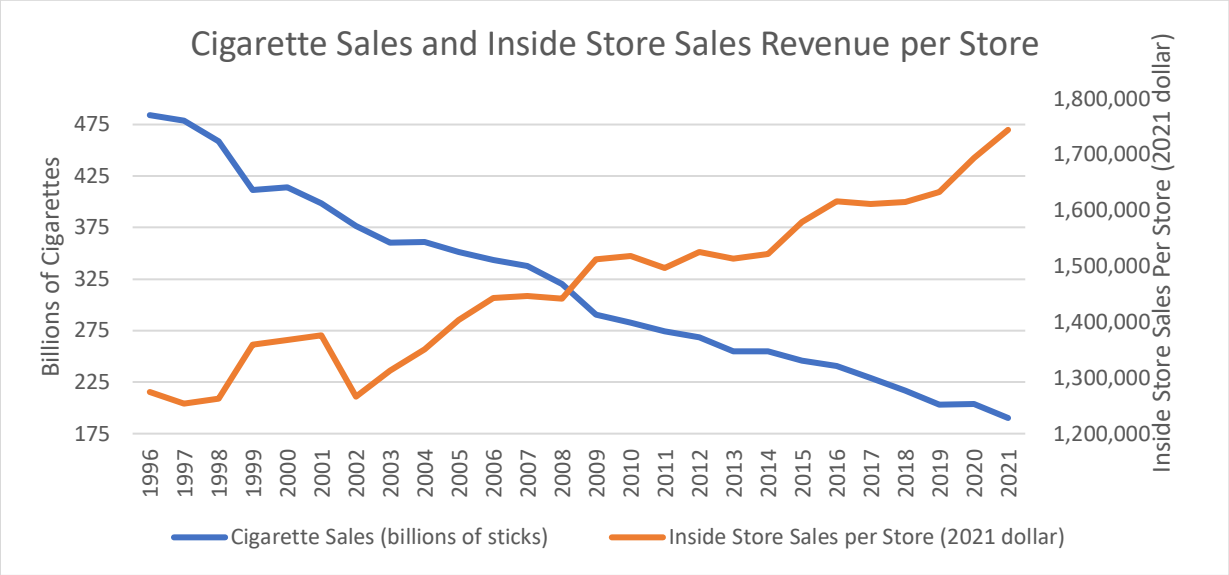


Figure 18

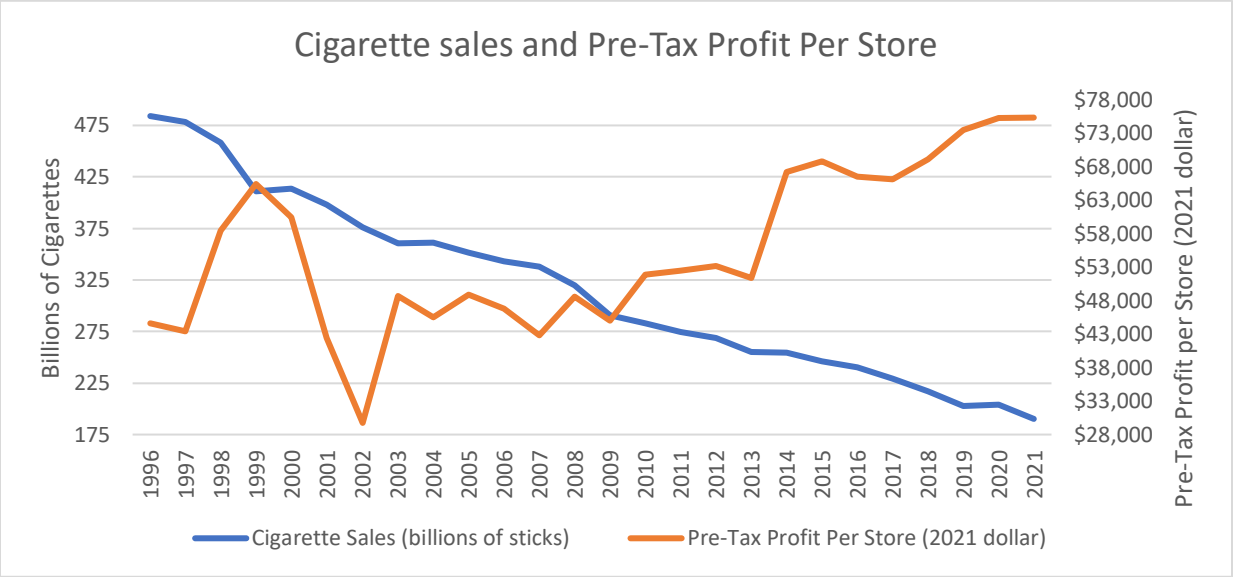


Figure 19

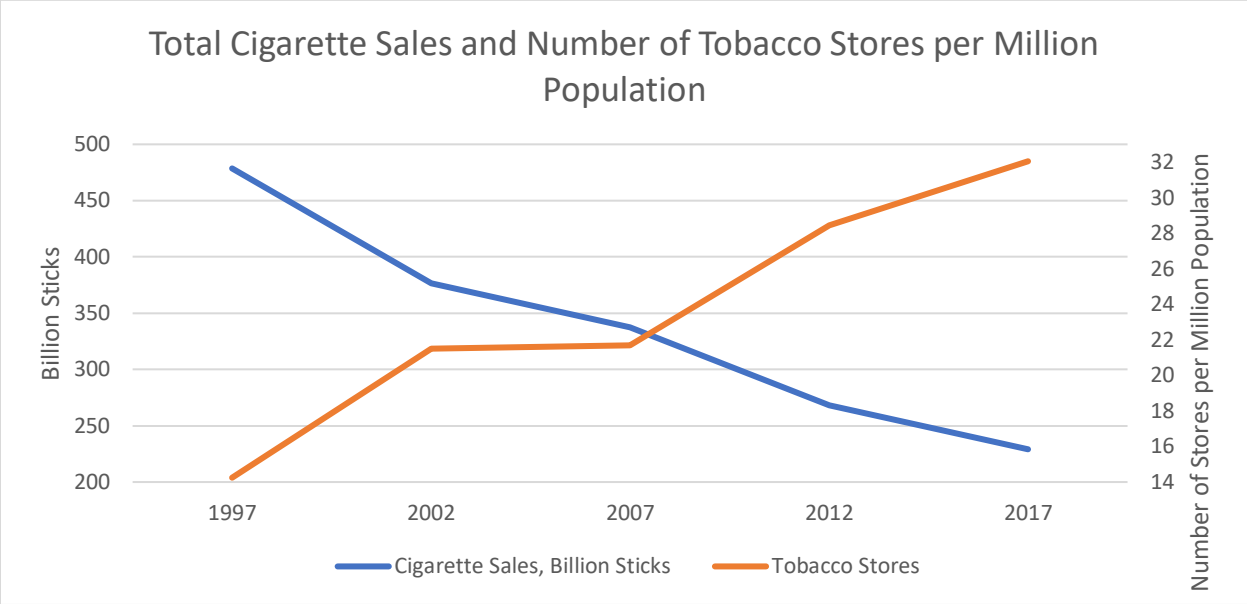


Figure 20

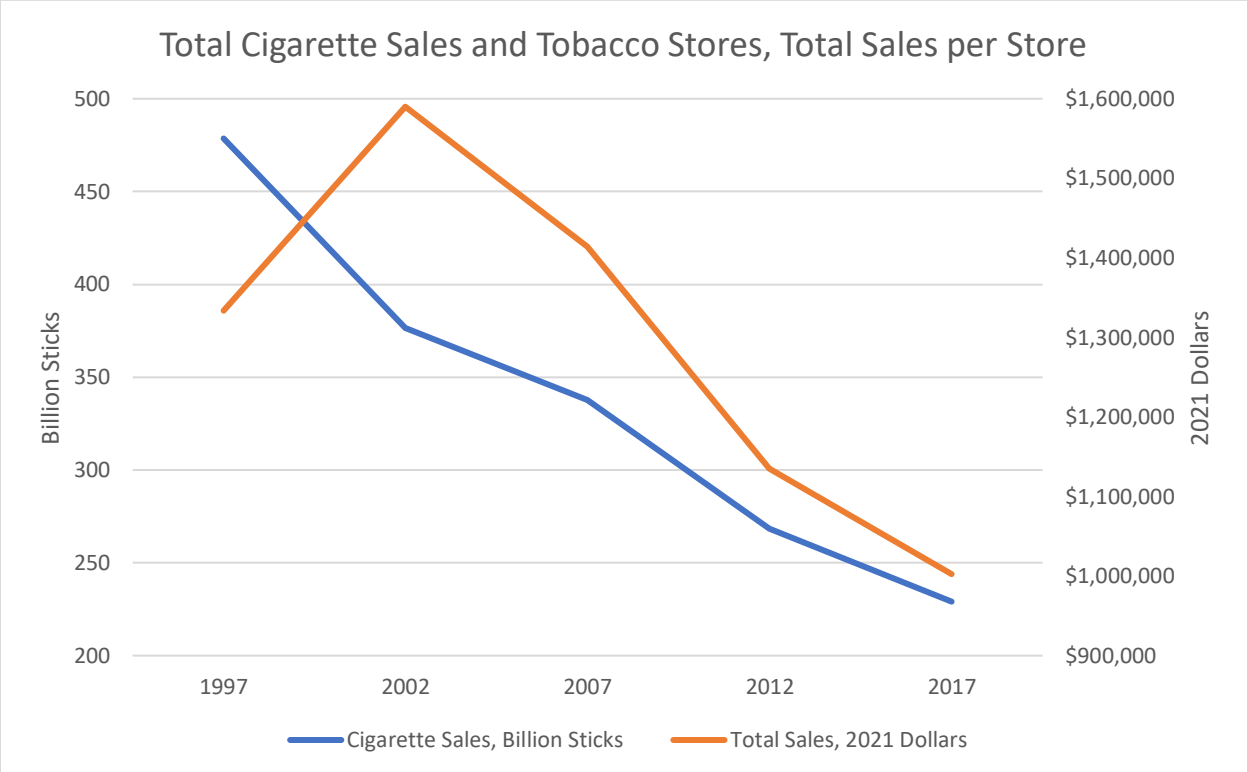


Figure 21

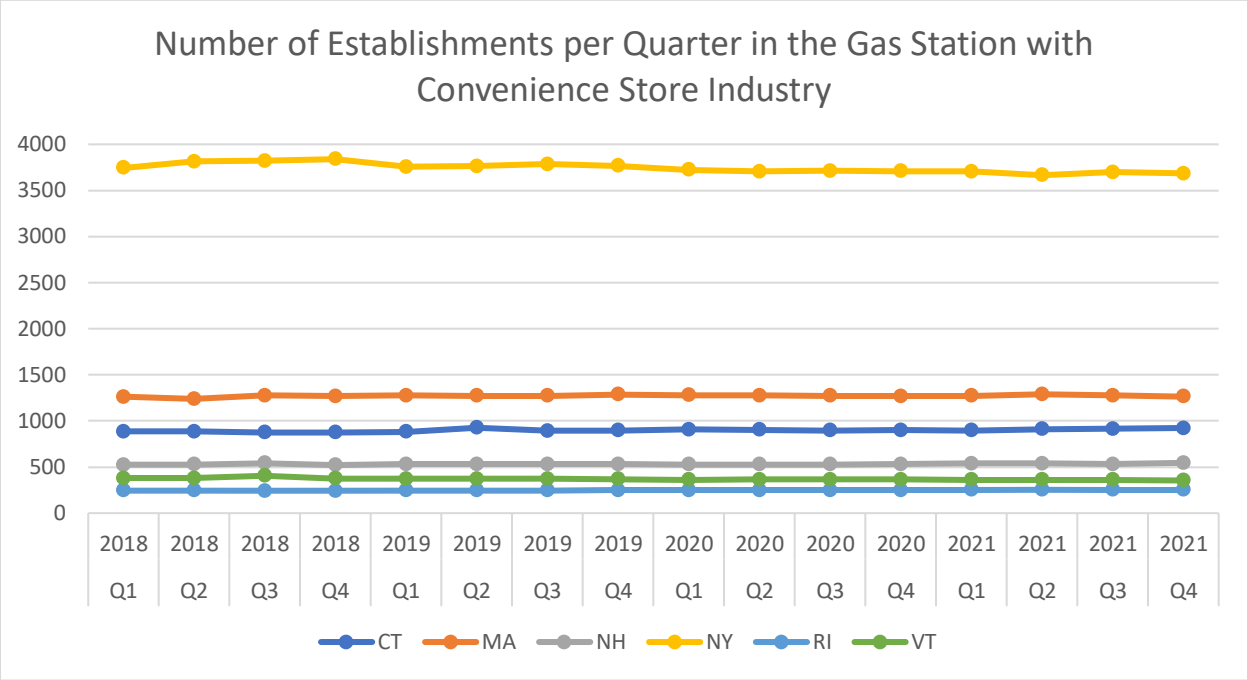


Figure 22

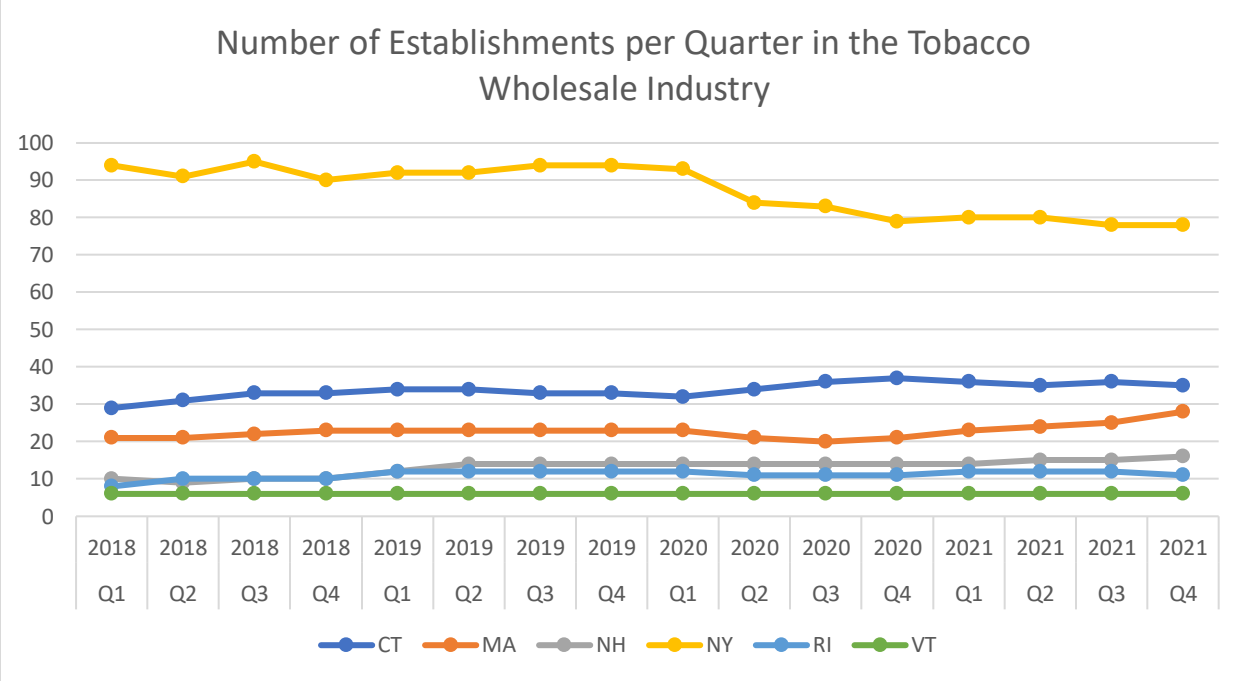
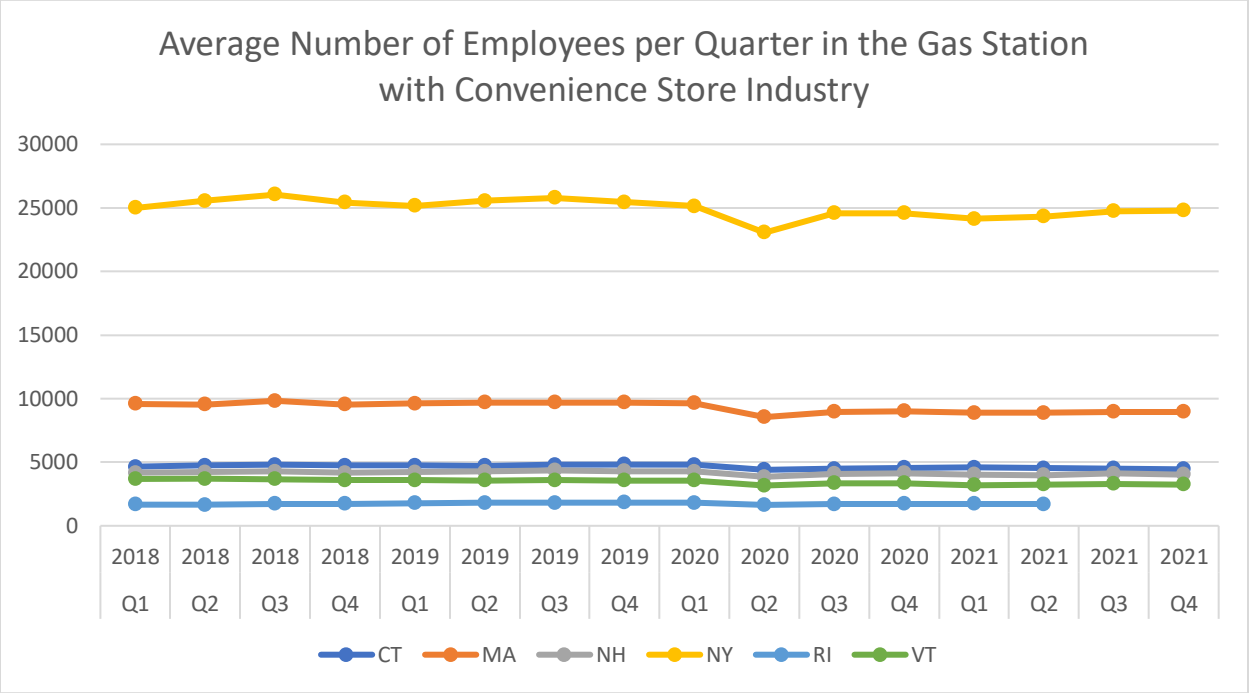


Figure 23



*The Bureau of Labor Statistics withheld employment data for gas stations with convenience stores in Rhode Island for the third and fourth quarter 2021 to protect the identity of employers.

Figure 24

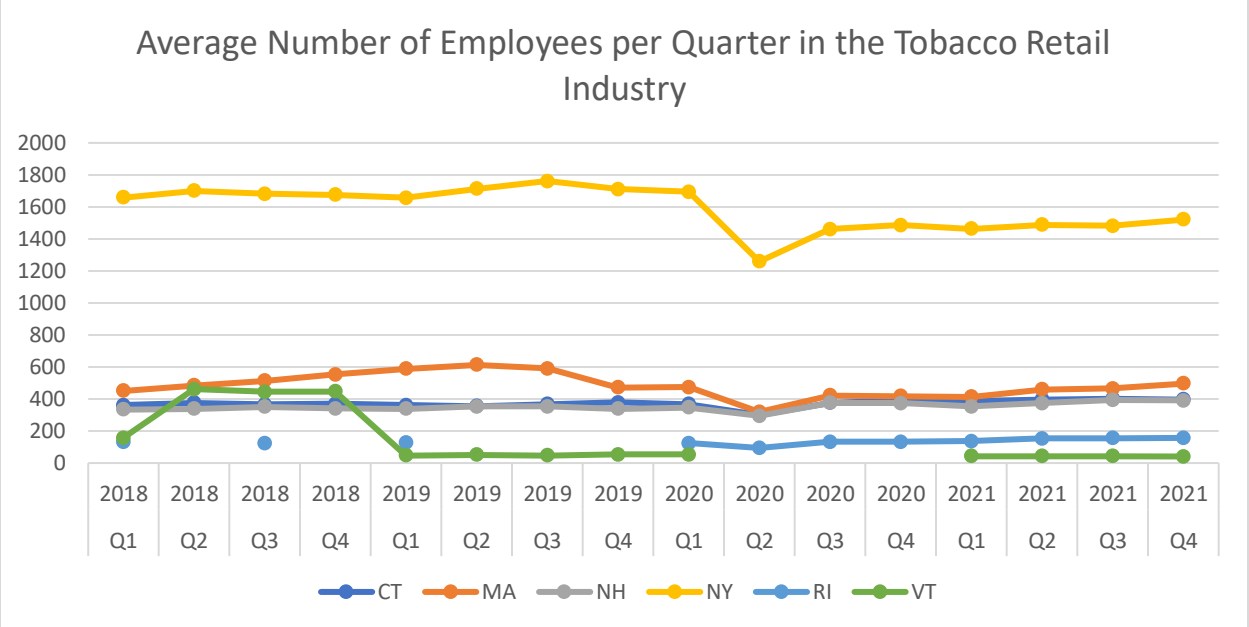


Figure 25

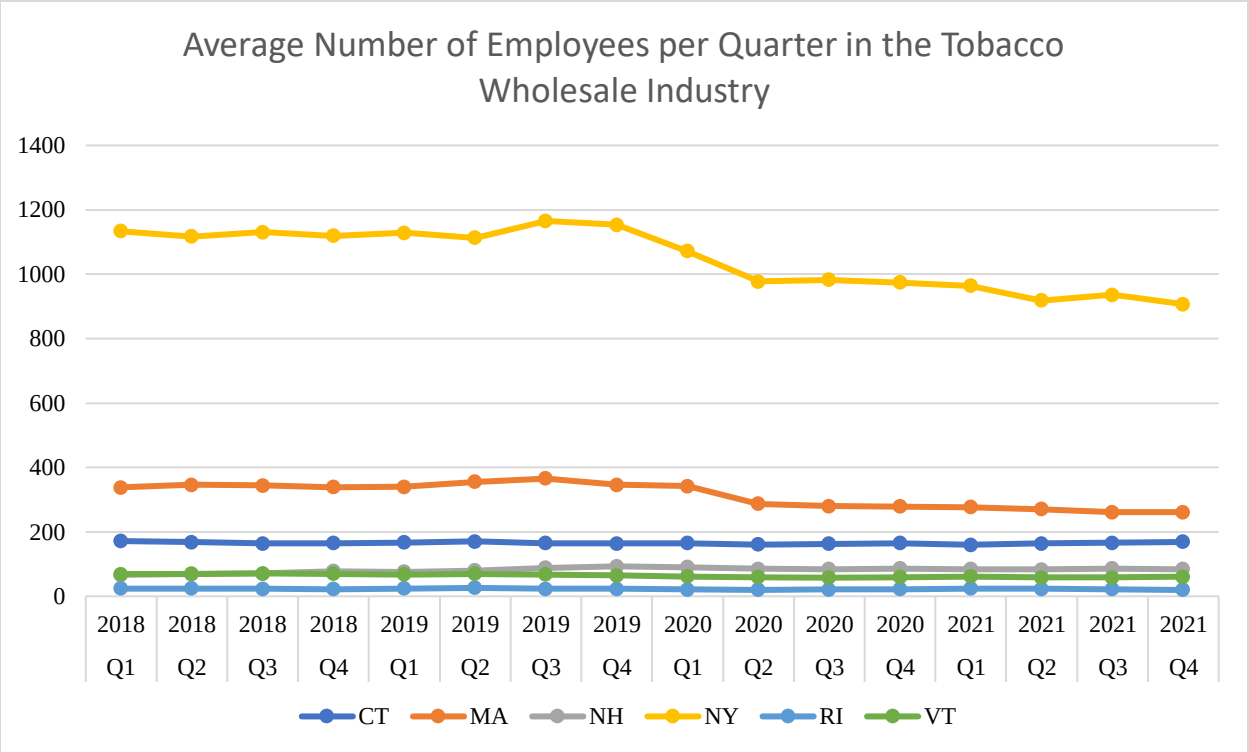


Figure 26

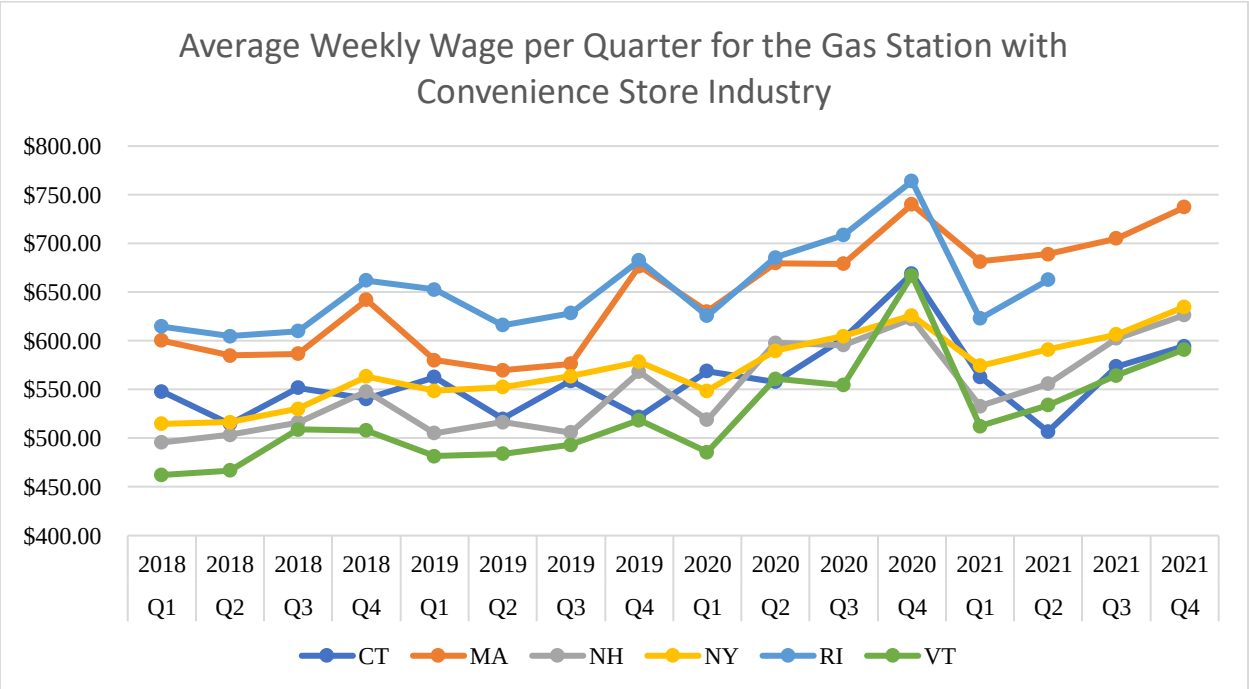


Figure 27

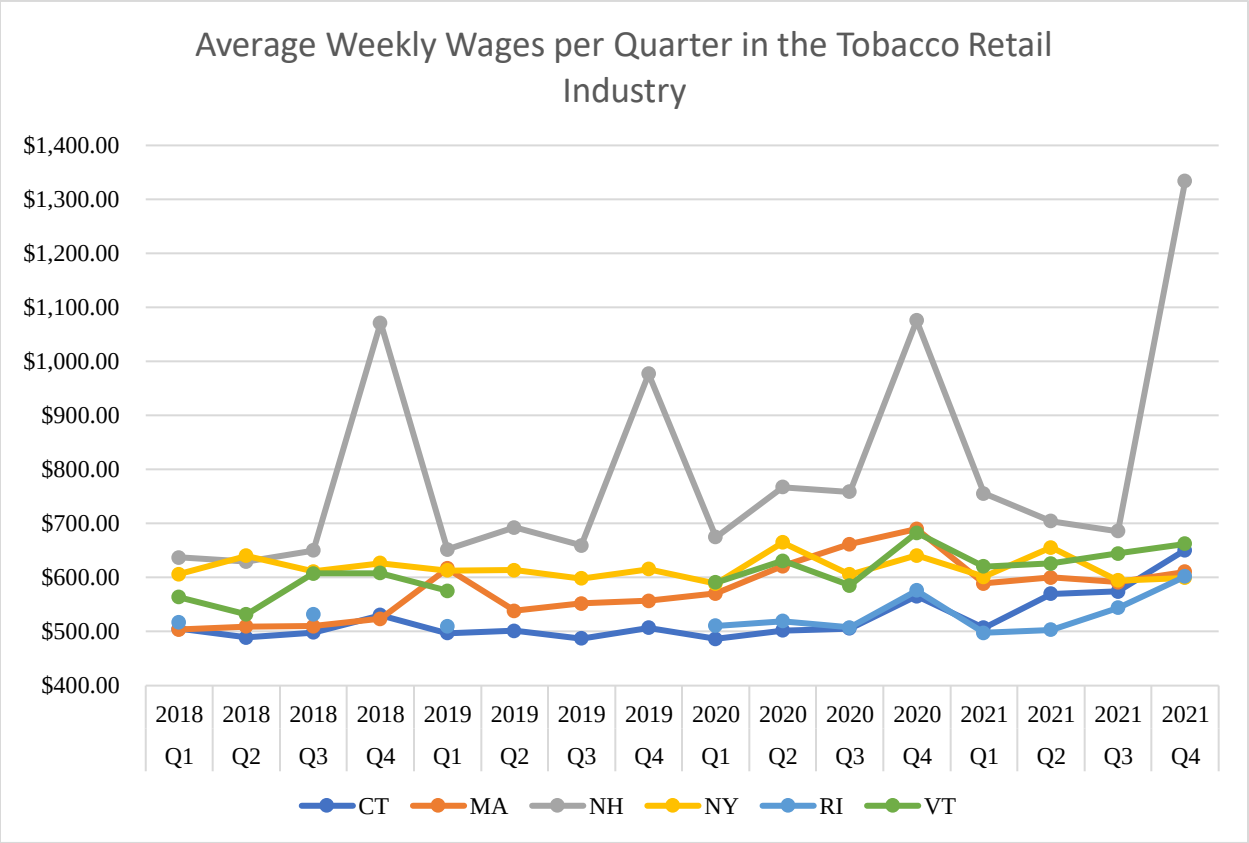


Figure 28