

Consumer Response to Increases in the State Cigarette Tax

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## **Summary**

In this paper I look at consumer responsiveness to the cigarette tax. Cigarette taxes are motivated by wanting to raise money for the state and wanting to deter smoking in the state's population. Obviously reducing smoking in the population would reduce the externalities caused by smoking. We know the health effects are completely detrimental to the consumer, and detrimental to those around them. In addition to this we know that tobacco is an addictive substance, meaning that it is inherently extremely inelastic.

To find out how consumers respond to tax increases I conducted a difference in difference analysis of tax revenue before and after a state tax increase and compared them to a state that had a similar level before the tax increase. This showed me how effective the taxes were at raising revenue, but it also allowed me to calculate consumption in the state. I hypothesized that there would be very large increases in the revenue gained after the tax increases and that consumption would remain stable through the tax increases. What I found was that there were rather large increases in revenue, but even more significant decreases in the packs sold in the state. The decrease in packs sold however cannot be considered a decrease in consumption since we know there is an extremely high level of tax avoidance that occurs with cigarettes. According to studies, the decrease in packs sold just points to avoidance by cross border shopping and smuggling, meaning that consumption on the whole remains relatively constant. Tax increases are effective at increasing revenue, but it cannot be said that they are effective at reducing consumption because of the high level of tax avoidance that occurs.

## **Problem Statement**

Sin taxes often have motivations that are somewhat contradictory. One goal of any tax is to increase revenue for the state, but with sin taxes there is also the motivation to discourage a certain type of behavior. In most cases the behavior, or consumption, is deemed to have some negative externalities for the rest of society. To control these externalities, the government must implement a tax that is sufficiently high to actually change behavior.

What I want to look at in particular is the responsiveness consumers have to sin taxes, and in particular the cigarette tax. Tobacco is a highly addictive substance and therefore is presumably highly inelastic. Even though this is the case the taxes on it are relatively low considering the fact that it is an addictive substance. The specific tax I am looking at is the cigarette tax. The tax on cigarettes seems too low efficiently raise revenue and address the externalities of smoking.

The motivations for setting or increasing a cigarette tax is to raise revenue for the state, and to deter smoking in the population. Since it is an addictive substance, the tax needed to deter consumption would have to be rather high, otherwise consumers will just accept the tax and keep their consumption about the same.

Another aspect of cigarettes being an addictive substance is that it has the opportunity to raise a rather large amount of revenue if the tax rate is set sufficiently high. If consumers are completely unresponsive, any increase to the tax per pack would lead to a proportionally similar increase in tax revenue from cigarettes.

In this paper I want to look at consumers' responsiveness to state level increases to the cigarette tax by examining the state level tobacco revenue before and after changes are made to

the tax rate. I am hoping that this analysis will allow me to suggest a policy regarding cigarette taxes that would be sensible for states to adopt if they wanted to address the seeming unresponsiveness of consumers.

## **Literature**

A large amount of the literature on the tobacco tax is on its ability to reduce tobacco consumption in the area covered by the tax and how responsive consumers are to the increased burden. The primary motivation for implementing the tobacco tax was to reduce consumption, so the majority of what is written reflects that and assesses how well the policy achieves this goal. The reason the motivation of the tax is to reduce consumption is the costs to healthcare experienced by the state when the rate is high (Chaloupka 2011).

As the base of the arguments, we see that smokers (it may be worth noting that every article looks exclusively at smokers, as they are the overwhelming majority of tobacco consumers) are responsive to the increased price of a pack of cigarettes. A raise to the tax rate on tobacco products causes (Chaloupka 2011). Because of this, states may impose high taxes with the hope of curbing tobacco consumption in their state (Lewit and Coate 1982).

A study done in Massachusetts looking at the increased rate the state adopted verified that smokers respond to the increased price (Biener, Lois, et al 1998). In 1993 the state of Massachusetts implemented a 25 cent increase to the excise tax on tobacco products, which was met with a slight reduction in costs by manufacturers (Biener, Lois, et al 1998). Despite the reduction made by the manufacturers, an increase in the price on cigarettes was seen statewide. Due to the increased cost of smoking, a 12.5% reduction in sales was seen across the state, as opposed to the national average of 3% (Biener, Lois, et al 1998).

A reaction to the increased price was only seen in half of smokers in the state of Massachusetts, the other half absorbing the extra cost ( Biener, Lois, et at 1998). Those who did respond mainly did by cutting costs by either buying cheaper brands or by reducing the amount of cigarettes they consumed.

Responses also varied across age group in this study as younger smokers were less likely to consider quitting than adult smokers and more likely to simply reduce their daily consumption (Biener, Lois, et at 1998). This also has been of particular interest to researchers as preventing new smokers is another motivation of the increased rate.

The increased price, while somewhat ignored by many young smokers (Biener, Lois, et at 1998) the increased price does seem to detract new smokers from starting ( Chaloupka 2011), which is expected since the taxing of an addictive product is likely to be looked at more rationally by someone who is not addicted. Smokers, on the other hand, when faced with the increased price opted to cut costs in some manner to minimize the burden (Biener, Lois, et at 1998).

A caveat for the generalizability of the Massachusetts study is that responsive to excise taxes on tobacco products varies geographically and there is a very large bootleg industry that transports truckloads of cigarettes to New England (Lewit and Coate 1982). A study in Chicago studied this in particular in the city of Chicago and found an exceptionally large amount of packs from outside of the state littered throughout the city implying the reported loss in sales in any given state with a high tax is partially exaggerated (Slemrod).

This suggests that the elasticity is somewhat low, which again is to be expected by an addictive substance, but is high enough for a sufficiently high tax to cause distortion to the sales in the state of the tax.

Similar to the study of the Massachusetts increase, a study was done of a tax increase of California. The tobacco tax in California was raised by the same amount as the tax in Massachusetts, 25 cents. What they found was an immediate price elasticity of around .3, and estimated this to grow to .5-.7 in the long run (I don't necessarily agree with this increase and will likely use .3 as my elasticity for a moderate tax). Unlike Massachusetts, Distributors did less to minimize the burden of the tax and packs increased by 23 cents, almost the full cost of the tax (Flewling et al 1998).

The estimated effect of the tax was that if the elasticity to the tax increased to the .7 mark, that would lead to reduction in consumption of about 10-12%, also similar to the reduction seen in Massachusetts (Flewling et al 1998).

Another study of the California tax increase found the elasticity to be .3, and resisted every raising it above that level. California also adopted non-tax reforms that had minimal effect on consumption compared to the effect of the increase in price (Keeler et al).

With the intent to reduce consumption the tax may be set arbitrarily high, sacrificing revenue and causing undue burden on consumers (Borren, Pimm, Sutton 1992). Since the good is an addictive substance, though not technically a need, there is concern that those more vulnerable will be affected by the increased costs more (Borren et al 1992). Smoking rates are higher among lower-class people who will be impacted by the increased costs more, making the tax a regressive one. This in particular becomes a problem if the taxes are set at a rate that is designed to cause a

reduction in consumption as a highly regressive tax may cause concerns in terms of equity. The argument against this being the increased costs of having a very unhealthy lower class has on society in terms of healthcare.

## **Theory**

My hypothesis is that consumers will be highly unresponsive to relatively small increases in the cigarette tax. Even though consumption of tobacco is going down in the U.S, I don't believe that the level consumption will be affected by changes in the tax code that are not severe. I expect that there may be minor changes year to year, and an overall downward trend in consumption, but that the consumption level will remain about steady through a tax increase.

The California study found a low elasticity for the purchasing of cigarettes, 0.3. I think this is likely generalizable to the rest of the country and would suggest on a whole the consumers are quite unresponsive to tax increases. My reason for thinking that this is generalizable to the rest of the country is that the Massachusetts study produced an elasticity that was similar to the one calculated for California.

Like I said above, the caveat for this elasticity is that there is a significant smuggling industry which accounts for a great deal of tax evasion. The elasticity for tax evasion seems to be rather high, which would suggest that the actual consumption elasticity for cigarettes would be even lower than .3 which would suggest that consumers will be unresponsive to tax increases, particularly in states where evasion is difficult.

Support for this hypothesis would be a state passing a tax increase and then seeing an increase in revenue that is similar in proportion to the increase in the tax rate. This would support

the hypothesis because it would suggest that consumers are not changing their behavior following the tax change.

The null to my hypothesis would be that consumers are responsive to cigarette tax increases. If consumers were responsive to a tax increase, then the revenue for the state would either be stagnant, decrease, or at least only show a small increase in revenue.

## **Methodology**

The excise tax on tobacco varies widely across the country due to the somewhat contradictory motivations behind sin taxes, raising revenue and reducing consumption. This leads to an inefficient tax rate in terms of raising revenue and minimizing the distortion caused by the tax, both of which in this case are significant. The Cigarette tax can be a significant source of revenue, with states like South Carolina increasing the rate citing that they needed the revenue to pay for services, while New York raised the rate much more aggressively citing public health as the motivation. The most significant distortion is cross border shopping and a significant smuggling industry.

For this study I looked at changes states made to their cigarette tax from 2004 to 2014 and compare it to the state level tobacco revenue before and after the tax increase. To isolate the effects of the tax changes I chose to do a difference in difference analysis. To do this I took a state that increased their tax rate per pack in the years I specified and compared them to a state that did not.

In this comparison the revenue before the increase is subtracted from the revenue after the increase was implemented. The control state is also analyzed in this way. In addition to this, the revenues are subtracted between states for the years being looked at. The differences



produced by each of these subtractions are then differenced again, and the resulting number should show what the isolated effect of the tax increase was.

When choosing states to compare, I tried to make sure there were not significant differences in the states that would undermine the legitimacy of the analysis. I looked at states that had tax rates that were very similar, trying not to compare states that had radically different rates. In addition to wanting to keep the rates between states similar, I also tried to make sure there was not a large disparity between the revenues of the states. I thought that keeping these factors steady was more important than other possible ones, such as geographic location or population.

The final difference produced by the analysis should show the revenue produced by the cigarette increase. If these differences are sufficiently large, it would suggest that cigarettes are particularly inelastic. If this is the case it would tell me that consumers are not responding to the increased price per pack produced by the tax increase, which in turn would suggest that the tax is not set at a rate that is deterring behavior and possibly not even maximizing the revenue that could be obtained. If the difference in difference analysis produces a final difference that is negative, then consumers are clearly responding to the tax change. Finally, if the analysis produces either a small change, or no change, it would also suggest that consumers are somewhat responsive to the tax increase.

I think the difference in difference method is a good approach for this problem because it allows me to control for factors that could contribute to a change in tobacco revenue. By comparing states we can assume that what is happening politically or otherwise in one state does not directly affect another state. This assumption is rather important for the analysis and I suppose that it is possible to argue that these is not the case, and that a state government's actions

within the state influence other states. This is clearly the case in some policy problems, but I do not think it applies to the setting of cigarette tax rates. It could come into the analysis with the fact that there is a significant smuggling industry and cross-border shopping. In my case, if consumers are engaging in evasion, it would reduce the size of the state's revenue. As I said, a smaller revenue gain suggests that there is some responsiveness to the tax increase. If any distortion arises because of this it would skew toward the null hypothesis.

Using the difference in difference analysis I will also calculate the number of packs of cigarettes sold in the state increasing their tax rate. This should tell me how consumers are responding to the tax increase and if the tax increases are effective in deterring smoking in the population.

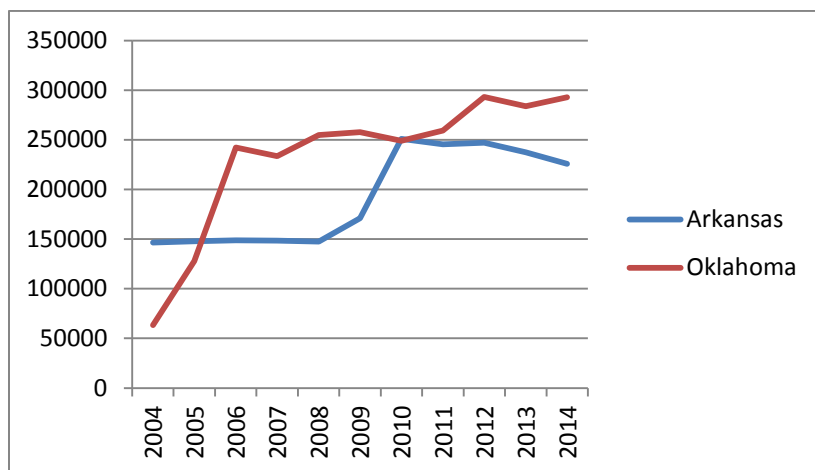
## **Results**

The majority of the tax increases I looked at produced rather large increases in revenue, suggesting that in general consumers are not responding in a significant way. There was only a loss in revenue in one instance, and that was directly after both the federal increase to the cigarette tax and the beginning of the recession. I would argue that these factors were more relevant to the decrease in revenue than the increase in price was since it is only one instance of a tax increase leading to a loss in revenue that I saw.

Figure 1 shows a tax increase in Oklahoma of 80 cents per pack taking effect by 2006 compared to the prior year against Arkansas during those years. Oklahoma's state tax rate increased from 23 cents to \$1.03 and Arkansas's rate stayed at 59 cents per pack. Values on all tables are in thousands of dollars.

Figure 1:

	2006	2005	Difference
Oklahoma	242231	127750	114481
Arkansas	148879	147932	947
Difference	93352	-20182	113534

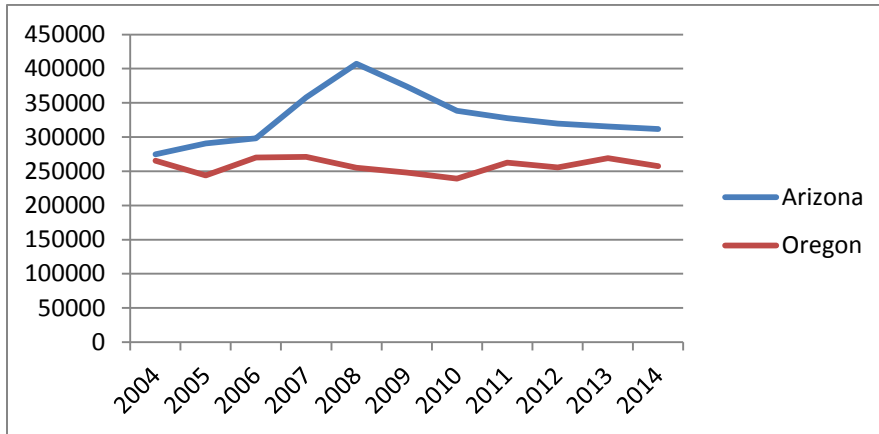


The table shows a difference of \$113,534,000 between the states' increases in revenue the year the tax increase was enacted. This would suggest that the tax was beneficial in raising revenue, and if that is true it should show up repeatedly in similar analyses of tax changes in different states and years. The difference in packs purchased between the two years is also significant. Arkansas sold slightly more packs of cigarettes in 2006 than 2005 while Oklahoma sold less than half in 2006 than they did in 2005. A decrease from 555,434,782 packs to 235,175,782 packs. This would suggest that the tax increase was relatively effective in reducing consumption as well as increasing revenue for the state.

In 2006 Arizona passed a cigarette tax increase that would be fully enacted by 2007. The increase was 82 cents from \$1.28 to \$2.00. During this increase, the state of Oregon kept a rate of \$1.18; interestingly Oregon had recently decreased the rate from \$1.28 a few years before. The following table shows the effects of the increase

Figure 2:

	2007	2006	Difference
Arizona	358113	298001	60112
Oregon	271101	269922	1179
Difference	87012	28079	58933

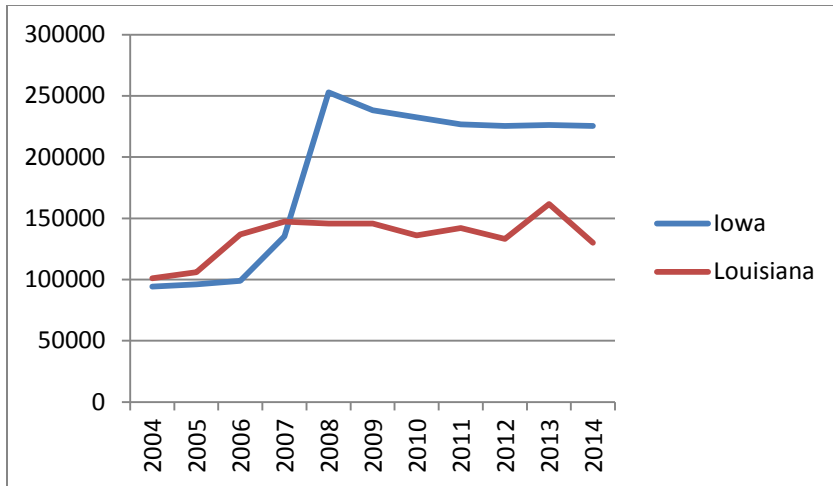


The table shows an increase of \$58,933,000 in the year of the tax increase. This follows the trend of the last table, but the increase is only about half of the size of the previous table's result. The starting tax for both states was much higher than in the previous table. If this trend continues along with the increases, it would suggest a diminishing return as the tax reaches a certain level. Like in the table before, the packs sold in Oregon increased slightly, while the packs sold in Arizona decreased significantly from 232,813,000 packs to 179,056,000 packs in 2007.

In 2008, Iowa increased its tax rate by \$1.00 to \$1.36, while Louisiana kept their rate at 36 cents per pack.

Figure 3:

	2008	2007	Difference
Iowa	252857	135207	117650
Louisiana	145578	147262	-1684
Difference	107279	-12055	119334



Similar to Figure 1 the tax increase was from a rather low rate to over \$1.00 and the difference between the states was \$119,334,000. This follows the trend of the first table with a significant increase in revenue.

The first series of tables seem to confirm that an increase in the tax leads to increase in revenue that is similar in proportion to the size of the tax increase. This would mean that as the price per pack rises, the size of the increase will have to increase with it in order to be effective.

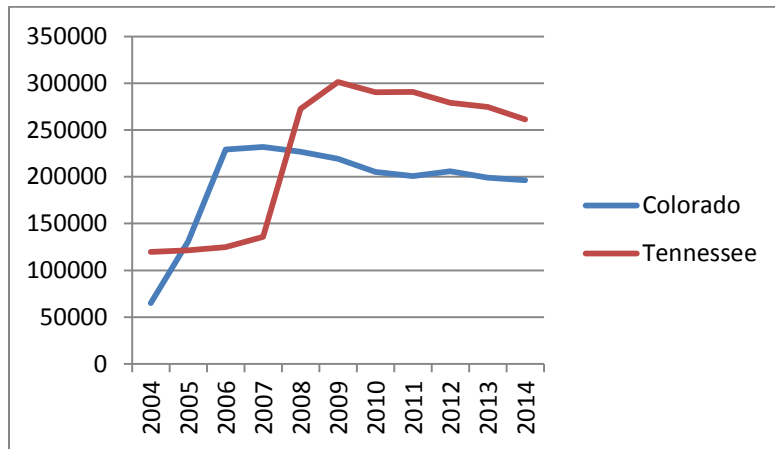
A state with an exceptionally low rate such could increase the price per pack by a relatively low amount to see large changes in the revenue brought in by the tax.

Colorado and Tennessee had a rate of only 20 cents in 2004. By the following year, Colorado implemented a 64 cent tax increase, which was 420% tax increase. Tennessee kept its rate static during this time.

Figure: 5

	2005	2004	Difference
Colorado	131045	65144	65901
Tennessee	121268	119538	1730

Difference	9777	-54394	64171
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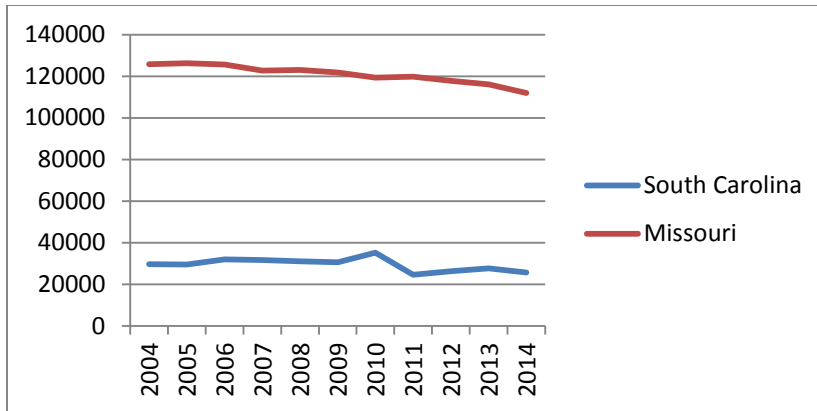
Colorado benefited from the tax increase, doubling the revenue brought in by the tax.

While the table shows that this was beneficial, and showed a \$64,171,000 increase compared to Tennessee, it is worth noting that the increase in revenue was around 1/4<sup>th</sup> the magnitude of the tax increase, suggesting that even though the good being taxed is an addictive substance, it is not completely inelastic. Packs of cigarettes sold in Colorado was reduced by about 50% from 325,720,000 packs to 156,005,000 after that tax was implemented, Tennessee sold slightly more packs in that same time.

South Carolina proposed a 50 cent increase to the tax that was implemented by 2011. The rate prior to the increase was only 7 cents per pack, which was the same as Missouri, which has never increased the tax.

Figure: 6

	2011	2010	Difference
South Carolina	24692	35257	-10565
Missouri	119720	119388	332
Difference	-95028	-84131	-10897

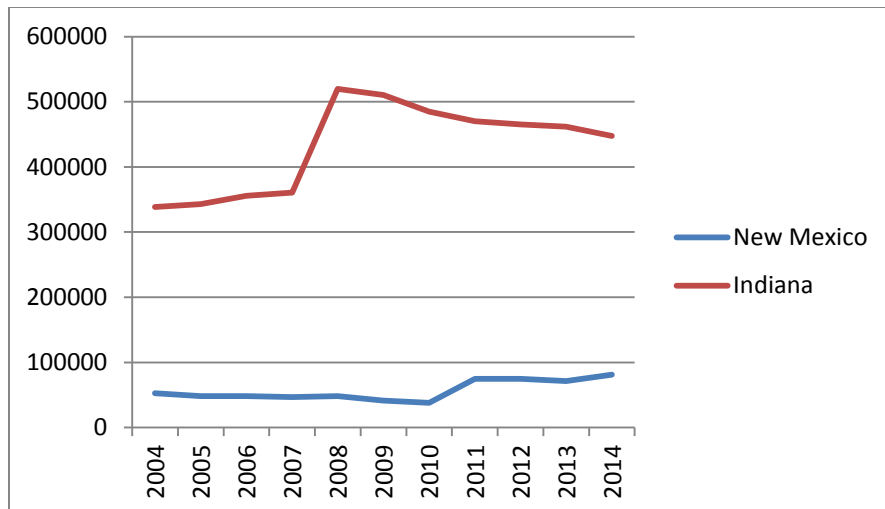


This is the only analysis that I did that produced a negative result for a state that adopted a tax compared to one that kept the rate static. The tax increase was a 714% tax increase that resulted in a 30% loss in revenue. There could be a couple reasons for this including the fact that this the first tax increase I looked at after the federal tax increase, this is the first tax looked at after the 2009 recession, and this is the largest tax increase ( in terms of percentage of the original tax) observed so far.

During the same time period New Mexico increased its tax from 91 cents to \$1.66, an 82% increase in the rate per pack. Indiana during this time kept its rate at 99.5 cents. Like the table above, this took place in the years following the federal tax increase and the 2009 recession.

Figure: 7

	2011	2010	Difference
New Mexico	74612	37926	36686
Indiana	470248	484686	-14438
Difference	-395636	-446760	51124



New Mexico's revenue increased by \$36,686,000 an increase of 97%. Compared to Indiana, which kept the rate static, the difference was \$51,124,000. This seems to contradict the idea that the loss in South Carolina was due completely to either the tax increase or the recession. Indiana did however lose a considerable amount of money during this year, which would likely be due to the recession. Interestingly, packs of cigarettes sold in New Mexico actually increased slightly after that tax increase, from 41,676,000 to 44,946,000 while Indiana saw a decrease in the number of packs it sold. This doesn't make much sense, but it is worth noting that these states are maybe not comparable due to the difference in size.

## Critiques

Possible critiques of my analysis could be that I am calculating packs sold instead of using sales data. That data is hard to come by, and it shouldn't be any different than my calculation. I cannot capture evasion doing this, but I'm not sure how this could be done at all. We know there is a significant bootleg industry as well as cross border shopping, but I do not think it is significant enough to influence my analysis in regards to determining how responsive consumers are to the tax increases.



Another critique could be with the states I chose to compare. I chose to compare states that had similar tax rates as opposed to states with similar populations or geographic location. I wanted to make sure cross border shopping wasn't distorting the final numbers.

## **Conclusion**

Even though most of the tax increases produced rather large increases in revenue, it was paired with simultaneous decreases in the amount of cigarettes being sold in the states. From the data I gathered it is not possible say the decrease in packs sold is entirely representative of consumption in the state. We know that there is a significant smuggling industry, for instance in New York, half of the packs were from North Carolina, the state with the lowest tax rate in the country. This implies that the decrease in packs sold could just be smokers in the state buying they're cigarettes from lower tax areas. If this is the case the state would be forfeiting the revenue that is being lost by out of state shopping or some other type of avoidance.

In general the effects of the tax increase seem to raise the most revenue when the starting rate was very low, and rates between \$1.00 - \$2.00 seem to be the most effective since they are not too large of shocks in sticker price. As for decreasing consumption, I cannot say that the tax increases were effective at actually convincing smokers to quit. The decrease in packs sold in a state is often significant, but studies suggest that this is just avoidance as opposed to an actual change in behavior. That avoidance would be the driving the decrease in packs sold makes sense because the object of the tax is an addictive substance.

## **Policy Suggestions**

States with low tax rates would benefit from moderate increases to the cigarette tax. The benefit would only be revenue however, as real consumption will stay the same, which is what

we should expect from an addictive substance. Since I did not do a regression I cannot recommend a specific rate for states to adopt if they want to raise revenue. I can recommend that states with rates below \$1.00 per pack increase their rates to somewhere between \$1.00 to \$2.00. For states with rather high tax rates, the benefit of further increasing the tax rate would be negligible, and the decrease in packs sold in the state could just be potential revenue going to a lower tax state.

If a state is motivated by wanting to reduce consumption, there seems to be little they can accomplish with a tax increase. Drastic increases will just motivated tax avoidance while likely keeping consumption static, or maybe reducing it slightly. Deterring behavior with a sin tax does not seem to work with addictive goods, which is what I think should be expected.

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