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Meaningful Reform or Wasted Effort:

The Effect of Taxes on Cigarette Consumption 1985-1995

The use of statistics can tell us a lot about the world around us. Detailed information on various topics abound, and we can use those data to infer whether actions are helpful or harmful, whether or not government policies are reaching their goals or falling short. The consumption, price, tax levels, and broad usage of tobacco products in the form of cigarettes is one valuable set of data that can be used to see whether increased government taxes are actually doing their job and lowering the consumption of cigarettes on average across the 48 lower United States. This is the task upon us now with data collected from 1985-1995 to see what effect the prices and taxes had on cigarette consumption in the US. Using some basic econometric tools, we can delve deeper into the data here, doing everything possible to pull out the best possible explanations given the data we have at our disposal. Using ordinary least squares regression analysis, we can see if these policies had their intended effect or if they were an effort wasted.

In this data set, we have a few variables from the years spanning 1985-1995, including the price per pack of cigarettes, the average level of consumption of cigarettes, the consumer price index level for that year, the average level of sales tax and excise tax on each pack of cigarettes, income levels for each year, and the average excise tax on packs of cigarettes without sales tax. This last measure will give us a good idea of how much government wanted to raise in terms of a so-called “sin tax.” This excise tax will be put onto cigarettes, usually for the purpose of enticing people, with higher payments on their particular brand of “sin” to stop using the product or to cut down on their use of cigarettes. We should, obviously, expect to see that higher levels of excise taxes will lead to higher price per packs of cigarettes, which would then lead to a reduction in average cigarette consumption. This is precisely what the data shows—as each year passes, excise taxes increase the price of cigarettes, and we see a reduction in the average consumption in nearly every state. The graph with the various colored lines showing a marked decrease for nearly every curve on the graph is measuring this effect in each of the lower 48 states. Our significant R squared values show that the price per pack is a significant variable in determining the average consumption of cigarettes.

Looking to the data itself, there is a large span in terms of every state’s population, so we used a weighted average level using population as the weight. That gives us a better idea of

average consumption erasing the discrepancies in population. Prices over the ten year span ranged from \$1.50 to \$2.40, while yearly consumption averages ranged from slightly above 100 packs to slightly under 200 packs per year. It would be interesting to rerun these models with current, updated data sets, as state excise taxes on tobacco products have skyrocketed in recent years, per pack prices reaching over an average of \$12 per pack in states like New York City, as state governments look to new sources of revenue while looking to tamp down on the number of new smokers, cutting the consumption of existing smokers, passing smoking bans in public places (an idea almost unheard of in the time span of 1985-1995), even going so far, in some cities, as to ban smoking in outdoor areas.

There has clearly got to be some omitted variable bias built into our models here, and they will inherently remain without further data points explaining cultural and religious factors. For example, one might easily conclude that religious values will play a large part of a person's decision to smoke or not to smoke, especially in certain states. Take Utah, for example, where there is a large population of religious Mormons, who are forbidden by their religion to take up smoking at all. That is clearly why we see significant explanatory power in our current variables with R square near 40%, but it also tells us why, even using instruments in the form of log excise tax and log excise plus sales tax, we don't get anywhere near 100% in explaining the variation among the states. Some states, in the data, most notable in the graph that shows all 48 states together, see an uptick in the average consumption of cigarettes at the end of our data set in 1995. There is a convergence seen between price per pack, average excise tax level, and the consumption levels- the first two rise to the center, as the latter variable drops to the center, so we know that these items are correlated, but how strongly is the question, and what further variables could be added into the mix to give us a more robust explanation as to the decrease in cigarette consumption (even when we use each state's population as a weight), while seeing a steady increase in average US income over all the states in our data. The figures outlining these points of convergence can be found at the end of this paper.

In my attempts to recreate the data set of 1985-1995 cigarette prices and consumption levels, running a regression using the natural log differences between prices per pack, consumption, and income on average, I was unable to replicate the log functions of each variable. I separated variables by year, renamed them as natural log versions of their previous values, then ran multiple S2LS regressions, but SAS kept throwing up numerous errors. I was

unable to fully utilize this approach, but I did use the log of sales tax and the log of excise tax as instruments in a 2SLS regression model, and the results are as telling as the basic means procedures, in that it is clear, with a high level of statistical significance, that excise taxes restrain a smoker's elasticity for cigarette products. In fact, previous studies have found the same to be true using this data set and others. In looking at other term papers using this same dataset, the authors were able, at least in the term paper by Brandt and his co-authors, that a rise in income levels actually corresponds with an increased level of cigarette consumption, though not a very large increase, showing that tobacco in this form is a normal good but not, as they term it, a "luxury good (Brandt, Hjert and von Bremen)".

Earlier, larger studies, especially that from Frank J. Chaloupka at UIC in Chicago show the same results. Though some have argued that tobacco usage in the form of cigarette consumption violates the basic rule of a downward sloping demand curve, detailed econometric analysis proves that this is not the case, that tobacco usage does, in fact, decrease with added sales taxes and excise taxes. The government, looking to use an excise tax in order to slow down the rate of growth in cigarette usage is following a successful path. My own regression shows a marked 50 unit decrease of consumption per unit increase of excise tax added to each pack of cigarettes. This makes sense in the light of basic economics, even for a product as addictive as tobacco. I ran multiple tests, many of which did not successfully finish because of data issues with using logs of figures, but the results that did work show that excise taxes and sales taxes being at least 40% of the statistical reason why consumption moves in one direction or the other. That's not a small portion of the reason in the movement, as I mentioned earlier, cultural effects, religious effects, and education levels, if given in the data set, could easily explain a large portion of the 55-60% left.

Looking to the actual regression and the code run in SAS, I took the natural log of excise tax and then that same log of sales and excise tax on a per pack basis and then ran as the independent variable the level of consumption. The tax and excise tax are both reasonable instruments, and without them, only using basic OLS regression techniques, you leave out a lot of the explanation as to why consumption drops. The problem here is the data, it's too sparse, and there are too many important variables missing. Again, if religious and cultural effects were added, we would, I have little doubt, see a much more robust statistical explanation on the lowering of consumption levels. One could easily fault me in the same way for neglecting to

mention government and private programs to stop smoking, and though I did no research into this area, this time span might also coincide with some of the larger tobacco lawsuits, one of the results being a demand for educational programs that were set up to stop younger people from smoking as well as barring advertisements of tobacco products. A loss of advertising would surely mean a lower level of consumption, even with a product as addictive as tobacco.

One of the anomalies from my research is price elasticities, and it's something few, in my readings on the topic, expected to find. Chaloupka found, in his data, that the price elasticity is quite different for various subgroups of the US population. In fact, his data shows that the elasticity for younger smokers, especially those in the teenage range, are much higher than those in higher age ranges. This would make sense in terms of basic elasticity, as much of their consumption is being fueled and literally paid for by someone else (parents, relatives, part time jobs with no other major outlays except perhaps gas money and some spending cash). Their particular elasticity for tobacco is, in itself, much larger than that of say an adult age 25-39 (Chaloupka).

The author also finds elasticity differences among various races of people. Blacks and Hispanics have a smaller range in which they are willing or able to travel in terms of per pack prices. Their tobacco elasticities are much tighter than those of white Americans, across all age ranges. This would mean that government programs might be directed toward certain ethnic populations, particular races, or age groups in the US. This argument and the underlying data give reason to perhaps support those that say cigarette taxes are regressive in nature, do little to ultimately stop smoking in any significant way, and mostly hurt the poor, especially the lower end of the spectrum amongst blacks and Hispanics, all at a time in history when we see that the lower end of the spectrum are those same people who are more likely to start smoking and remain smokers, even when their price elasticities to tobacco price surges are much smaller than their richer, whiter counterparts. The data, as I have compiled and ran them, would suggest otherwise, but again, we are missing so many valuable data points that it's hard to fully grasp the topic and the effects here without tossing in some other variables that make sense inherently from a common sense perspective.

One thing is clear, however, and that is that excise taxes and sales+excise taxes on prices per pack of cigarettes is a large portion of explaining why people cut back on their cigarette consumption. A basic OLS regression shows this, but running the 2SLS regression and using

these two instruments shows us this even more clearly and with more robust measures. The government is, in an attempt to improve the health of all Americans, helping all of us cut back on our consumption of tobacco products, despite state government's near universal reliance on using excise taxes just like this in order to bridge the gaps in state budgets. There is clearly a dichotomy. Get fewer people to pay the excise tax, but rely on those that do pay it to fund various important government programs. In the end, people will continue to use tobacco, and though levels might decrease, the data from this ten year span alone shows that it's hardly a small number of people consuming what is a deadly product, and for many of them no level of excise tax is going to stop them.

Bibliography

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